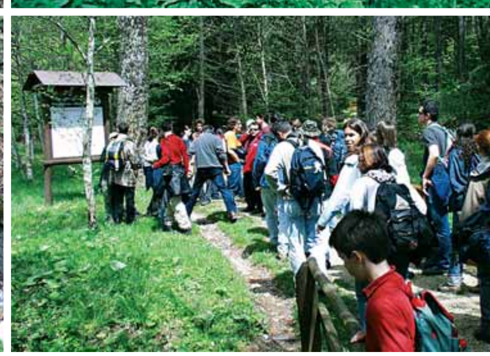
Stated preferences for conservation programmes : evidence from a forest in Corsica

Francois Bonnieux, Alain Carpentier, Jean Christophe Paoli

L. Cesaro
P. Gatto
D. Pettenella
(eds.)

The Multifunctional Role of Forests – Policies, Methods and Case Studies



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To the Memory of Maurizio Merlo

'There is a social profitability if forest management is such to produce not only timber but also other social services of unpriced values, such as protection of the environment, watershed regulation, recreation .....'

Maurizio Merlo wrote this in 1986, as the concluding remarks to a Seminar of the European Association of Agricultural Economists on 'Multipurpose Agriculture and Forestry' held in Motta di Livenza, Italy. A few words reminding us how the concept of multifunctionality was even then animating the meetings of the Society of Forest Economists, of which Maurizio was a distinguished member. After twenty years, we – Maurizio's colleagues and friends who also participated in those discussions – met again in Padova to commemorate his work and retrace our steps and progress along the path of forest multifunctionality.

Maurizio died at the end of August 2003 at the age of fifty-nine, leaving a sudden void in our scientific community. Those who had the pleasure of meeting Maurizio and working with him had always acknowledged his special gifts as a researcher and an academic. He had the intuition of a forerunner, always pioneering innovative research paths; he was endowed with a sensitive grasp of the real world problems and an innate problem-solving capacity; he had valuable communication talent. He deeply and sincerely loved his work and pursued it with constant and tireless day-by-day commitment.

Of all the issues underpinning the discussion on multifunctionality in this book, Maurizio's scientific work was mostly focused on three main questions: the economic evaluation of non-market outputs and services, production relationships and the related optimisation of the multifunctional use of forest resources and, lastly, the design of appropriate policy instruments to pursue multifunctionality.

Today that multifunctionality has become one of the key-concepts in rural development, we take pleasure in dedicating this book to the memory of Maurizio Merlo, in the belief that it contributes to the debate on the role of multifunctional and sustainable forest management to which he devoted such a large part of his research effort.

Ottone Ferro, Francesco Lechi, Vasco Boatto, Edi Defrancesco, Giuseppe Stellin,
Luca Cesaro, Paola Gatto, Davide Pettenella, Giovanna Toffanin

Padova, May 2008

Executive Summary

This book focuses on forest multifunctionality in its different economic connotations. The fact that multifunctionality is deeply embedded in the nature of forests seems never to have been questioned. However, several definitions of multifunctionality have been proposed over the years from various perspectives: biological, ecological, functional and managerial. Forest economists themselves have been discussing the economic nature of multifunctionality and its consequences on resources allocation for a long time, but they all seem to agree that forest multifunctionality can be meant as the capacity of forests to provide a large array of goods and services – private and public, market and non-market – at the same time.

The idea of multifunctionality, which nowadays might appear to some analysts as fully explored and thoroughly understood, gained new political momentum in 1992, when it was placed by the United Nations Conference on Environment and Development at the core of the definition of the Principles of Sustainable Forest Management: '*...policies, methods, and mechanisms adopted to support and develop the multiple ecological, economic, social and cultural roles of trees, forests and forest lands*'. In 1998, when the European Union adopted its Forest Strategy, the attractiveness to policymakers of multifunctionality as the leading principle for forest management was once again stressed.

More recently, the entry in force of the Kyoto Protocol and the consequent emphasis of the role of forests in the mitigation of climate change, has introduced another good reason for reconsidering the role of multifunctionality in forest management. Trees and woodlands are expected to produce a new kind of public good, and the requirement for a 'human-induced' nature of the provision of C-sink services may trigger new and different compositions of the bundle of private and public goods supplied.

The joint provision of goods and services in the forestry sector is also frequently justified on ethical grounds, recalling the necessity to maintain the capacity to satisfy the needs of future generations. However, as stated by the OECD in 2001 and shown by economics research in this field, multifunctionality in forest production can also represent, from a strictly financial point of view, an option that is cheaper than separate, specialised provision of individual commodities and services. Indeed, a high level of technical interdependence exists among inputs as well as outputs – forest production, biodiversity conservation, protection and provision of rural values in general. This close relationship, together with the existence of economies of scope makes the provision of separate products more difficult to achieve and probably less efficient than the joint production of an equal bundle of goods and services.

Even in the light of these few comments, the subject of forest multifunctionality appears far from obsolete. Conversely, some newly-emerged key issues call for further consideration within a perspective of forest economics and management. The Conference held in Padova at the end of April 2005 and these Proceedings try to provide ground for discussion, voice some of the main concerns, and identify the main research paths.

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A first question is the role of policies: multifunctionality implies problems in forest policy implementation and conflicts between stakeholders. These relate to the joint supply of multiple commodity and non-commodity outputs and the fact that some of the non-commodity outputs are public goods or externalities. In addition, the nature of the jointness among forest outputs is rather complex: relationships of complementarity, indifference or, even more complex to deal with, competition, arise. In order to optimise the multifunctional role of the forest sector, public intervention is needed. As a consequence of the different economic structure of the outputs (private, public, common, club goods), the idea has been proposed that a mix of different instruments should be used. Part 1 of this book contributes to the development of this issue, suggesting that multifunctional management of forests is (or should be) the result of a combined use of regulatory, financial and market instruments. In this context, a governance structure based on a wide participation of stakeholders from institutions and civil society appears to be the most appropriate one for the mitigation of existing conflicts, as underlined by the papers presented in Part 2.

Modern governance systems rely not only on institutions, networks and instruments for policy implementation, but also on the availability of information systems. These can be referred to different spatial scales: a forest region, a single forest enterprise and even a single tree. Multifunctionality can therefore be the result of either a joint provision of several outputs from one individual forest enterprise or of a spatial differentiation at local scale based on a mosaic of specialised forest activities. The topic of ‘scale’ is transversal to all the contributions in Part 3, casting light on the issue of additionality of forest multiple outputs and stressing once more the importance of the dimension and the level at which managerial decisions are taken.

Poor or asymmetric information also affects the knowledge of values and public perception of public goods and externalities – and sometimes also of market goods. As the papers in Part 4 show, the scenario of forest products and markets is rapidly changing: new products are emerging, often competing with the traditional ones. Globalisation of timber markets and the consequent entrance of new forces and agents are the cause of market tensions and rapid alterations to the price systems, to which some consumers and institutional procurement policies seem to react with an increasing awareness towards social responsibility in the purchase of wood products.

On the other side, the production of non-market goods and services, described in Part 5, still involves some problems in the definition – and acceptance – of appropriate evaluation methods. The characterisation of forest production as a mixed public/private good and the consequent unclear definition of property rights has clear policy and management implications, both in the way distributional and intergenerational questions are considered, and the different actors that are involved in the decisional process at micro and macro level. The papers in Part 5 thoroughly discuss the methodological and operational gaps still existing in the environmental economics approaches, but also show, within these limits, how the environmental and social values produced by multifunctional forest management can often be far more important than the strictly financial revenues of timber production.

Part 1 – The Policies for Shaping the Rural Environment

Forest Government and Forest Governance within a Europe in Change

Max Krott

Institute for Forest Policy, Forest History and Nature Conservation,
Georg-August-University, Göttingen, Germany

Abstract

After 1990, with the transition towards democracy and market economy in Eastern countries, the integration of Europe became stronger causing both new problems and chances for forestry. There were two types of reaction in forest policy. On the one hand in the emerging democracies the classic instruments of forest government were formulated by rebuilding the rule of law, private ownership and markets for forestry. implementation of the progressive laws is the major problem today. On the other hand, cooperative forest policy-making in self-organizing networks of participants from policy, economy and society was introduced mainly by national forest programmes or by the European Union forest strategy. Based on a theory of policy-making and network analysis and case studies it is shown that this new "forest governance" offers chances for mutual learning but the results are also affected by a power process. By showing the distribution of power, network analysis could provide useful information for the decision on whether to join a specific network. Enhanced forest governance could be a new task for an active state administration. Whether the state forest service could fit into this new role depends on the ability to become a trusted mediator for all interests in forests. In conclusion, it is recommended to rely on the classic government instruments for a strong forest policy but to actively make use of the governance instruments in selected cases only.

Keywords: forest policy, institutions, forest administration

1. Cross-border forces for European forestry

The round about 1000 million ha of forests are an essential component in the lives of Europeans (Ministerial Conference on the Protection of Forests in Europe Liaison Unit Vienna 2003). The forests are multiply-used for wood and non-wood products to supply 500 million inhabitants plus increasing exports. The tasks and the subject of a European forest

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policy would be rather huge and demanding but the reality of Europe shows that the forest is divided into more than 40 national policies based on sovereign states. The political borders cut a single European forest policy into pieces.

Whereas the borders of small national states are still essential for Europe, the project of integrating Europe formulates a vision of an open social and economic space. By widening and deepening the European Union, the breaking down of borders has made reasonable progress in the last decades. In Europe's forests, change is also strongly driven by cross national activities.

On the ecological level, the diffusion of pollutants and nutrients in air and water do not stop at borders. Plants and animals spread all over Europe and the exchange of products by transport technologies have, as well, major border crossing impacts. Adding climate change consequences, it is striking that cross-border effects change the ecological conditions for forests throughout Europe.

Strong and accelerating pressures for change result from opening up markets in Europe. Easy access to cheap wood and labour provides an incentive for the forest based industry to go East. In Central and Western Europe the markets force foresters on the wood supply side to cope with the new competition from eastern forests. In highly-developed national economies the decreasing wood prices and high labour costs have changed the economic parameters for forestry dramatically. A structural innovation of forest production in state and private enterprises is inevitable in order to survive on the markets.

At a social level, the citizens in European nations still think about one another as foreigners who should not have the same rights as residents. If employment or salaries are scarce, conflicts among nationalities are at hand and protection of borders demanded. Whereas, in general, national identity is dominant and hinders foreign impacts on the "national" forests, some environmental values regarding forests gain weight by cross-border activities (Schmithüsen 2004). Under the umbrella of sustainability new demands for environmental and nature conservation standards became visible. These demands for non-wood products shrink the options for economically profitable wood production.

This snapshot shows that key issues of national forests like guaranteeing ecological health, keeping up economically-profitable wood production or serving the new demands for non-wood products are driven by cross-border impacts within the European and global context. If forest policy claims to solve key issues in forestry, the question arises how the pressures to the forest sector crossing the borders can be regulated by policies.

This paper provides an answer by focusing on the changes in forest policy-making at national and international level in Europe during the past two decades. Further, by applying the concepts of governance and government a theoretical basis is identified which is able to explain the new developments. Finally, conclusions are drawn as to how an active forest policy can cope with these challenges. The analysis is based on the literature and two theoretical and empirical studies on networks and state forest institutions recently completed by the author and his team (Hasanagas 2004; Krott, Stevanov 2004).

2. National and international responses of forest policy

In the past two decades forest policy coped with the emerging challenges for forestry in numerous activities on national and international level. In all European countries forest policies reformulated forest law and initiated wide-ranging reforms of the state forest services. Private forest ownership was re-established throughout countries in transition. In addition, sustainable forest management certification spread in European countries and National Forest Programs were initiated (European Commission 1999; Indufor and EFI 2003; Rametsteiner 2000).

Table 1. Forest Government and Forest Governance in Europe.

Level of forest policy	State authority	Type of forest policy *	
		Government	Governance
National forest policies	full	90	10
EU forest-related activities	partly	80	20
International forest activities	none	0	100

* Estimated volume of activities in % 2000–2005

On an international level, the Ministerial Conference for the Protection of Forests in Europe (MCPFE) involving more than 40 countries, including the Russian Federation, was established in 1990. The main task is to develop a common understanding of the protection and sustainable management of European forests. In contrast to this forest-focused international body, the European Union (EU) does not have an explicit forestry mandate but influences forestry strongly by the policies in the domains of agriculture, rural development, nature conservation and environment. In addition, the EU formulated a forestry strategy in 1998. As a follow up of the United Nations Conference on Environment and Development in 1992, forests also became the subject of global initiatives which were strongly reflected by the MCPFE and the EU (Hofmann 2002).

The rather confusing bundle of new national and international forest policy initiatives can be structured along two different types of policy-making (Benz 2004). Important forestry issues are handled by the state in a policy process formulating binding programs and implementing them by partly binding means (Krott 2005). The regulation of conflict is based on the central role of the state and its authority to implement binding solutions for all forest users e.g. formulating and implementing the new forest law. This process is the heart of (traditional) forest government.

An increasing number of forest policy instruments no longer fit into this concept because they go beyond the domain of a single state authority. A National Forest Program is policy-making for sustained forests in a process of broad partnership of government and non-government organizations (Glück et al. 1999). Broad participation is essential, meaning that the state becomes just one partner in the network and solutions must be based on broad bargaining instead of on state power only. Such loss of power of an individual state also happens at international level because there is no "state of Europe" and consensus is needed among the partners, which are sovereign states e.g. within the MCPFF. By the features networks and bargaining among partners from state, economy and society, the new forest policy initiatives follow a policy-making type which can be described by the concept of governance and differs from the state centred government process.

Forest government and forest governance are spread over the different levels of forest policy in different ratios (see Table 1). In forestry at national level traditional forest government dominates, but a few forest governance processes were also initiated – mainly National Forest Programs, certification and integrated rural development. At international level only governance among sovereign nations is possible. A striking exception is the EU. Based on the Treaty between member states, the EU has a mandate to use government instruments which are binding for the member states. However, the power of the EU is rather limited. It therefore introduces a number of governance instruments especially for forestry.

Discrimination between government and governance becomes meaningful in analyzing forest policy because the two types differ significantly in the political dynamics of the instruments. The two concepts help in choosing political theories which are efficient in describing and explaining forest policy and, finally, results in useful recommendations for the practice. the following chapters focus on the theories of administrative policy-making and networks.

3. Forest governments in European countries

3.1 Rebuilding the rule of law, private ownership and markets in forestry

The transition from the communist centrally-planned states into democracies and market economies was the most significant development in forest government. The countries in transition strongly aligned their design of government instruments with the model of western countries. In the annexation of countries to the EU, formal requirements for membership gave a strong added impetus for adapting the policy tools.

The results of the past two decades of policy formulation are forest and forest-related environmental laws in all European countries with quite similar ecological and economic standards of sustained forest. But the unified legal basis has different implications for the government process in old and young democracies. In the old democracies, due to the pluralistic power balanced system, laws had little room to change and implementation by state and private institutions often goes ahead with new trends in ecology and economy. For example, important ecological standards were carried out by state owners and a group of environment-oriented private owners far beyond the requirements of law (Schraml et al. 2003) or, with regard to economic innovation, private owners and some state-owned enterprises have started to shift forest management toward higher profitability much beyond the incentives from policy (Österreichische Bundesforste 2001).

In the new democracies the process is quite different. New legal standards for sustainable forest management and privatization were formulated rapidly during the transition period but implementation lags far behind the program (European Commission 1999, Indufor and EFI 2003). Restitution and re-privatization has produced a large number of small private woodlots, whose owners often lack the skills and capacity for forest management. They can hardly fulfil the role of a private owner being an active partner on markets. Forest policy lacks the strength to provide them with sufficient extension services and financial incentives which could help the private forest owners to become the strong and responsible actors in sustainable forest management necessary for the concept of private ownership.

Hand in hand with weak private partners the overall implementation of the rule of the law lags far behind the legal obligations. “Black” and “grey” markets for wood as well as for labour in timber harvesting and transport are wide-spread problems in the young democracies (Indufor and EFI 2003). The illegal activities mean that the state cannot provide the government framework which is a basic presupposition for the development of strong markets.

Mentioning the wide-spread implementation deficits in the young democracies should not be misunderstood as major failures of the national forest policies. The opposite is true; the deficits are the consequences of a very progressive, innovative and fast formulation of new forest-related laws with high standards. But they show where the challenges for forest government are in the young democracies today. Positive impacts for sustained forests can be achieved mainly if the classic government instruments of monitoring, extension and financial incentives are strengthened in the implementation.

The conclusion for the old democracies is different because there, the law has fallen behind innovative practices. The challenge for forest government is to faster reformulate the binding instruments in order to keep up with the innovations of the sector. For example, the integration of ecology into forest planning and financial incentives is not strong enough to keep the competence in the new issue of biodiversity in the forest fully within forest governance. Another example is climate change and carbon sinks in forests. Specific forest government instruments have not yet been formulated.

International regimes like the MCPFE and international conventions with impact on forests can trigger the national formulation of innovative government instruments, but not more. It would need the joint efforts of the whole forest sector and the skilful use of specific national "windows of opportunities" to renew the legal basis of specific forest policy instruments. The cross-border pressures have not substituted the national forest government process but opened up new challenges for it (Hogl 2000).

3.2 Economic streamlining of forest administration

The state forest administration is the key factor for forest government. The administration plays an important role in the formulation and state-wide implementation of forest policy and is also a major economic actor by managing the state owned forests. The organization of state forest administration differs widely in European countries. Management and policy tasks can be handled by one integrated state institution, as in the majority of countries in transition, or by two or more different state institutions as the economics-driven reform has newly created in some countries.

As a basis for optimizing internal organization, the overall outputs of the state forest administration are important (Krott and Sutter 2003, Krott and Stevanov 2004). In all European states forest policy formulates goals that can be used as a benchmark for the state forest service (see Figure 1). Ecological sustainable management is an accepted principle in all European states which should be supported by the policy activities of the state forest service and the management of public land. There is also a consensus that multiple-forestry should produce marketable products like timber as well as public goods like recreation or biodiversity. Improving the economic strength can be done by higher production cost efficiency, maximizing profits and developing new markets. Politically, there is the alternative for the state forest administration to play the role of speaker for forestry or to act as a mediator, being a fair broker for all interests in the forest from wood production to nature conservation.

With respect to the rather minor economic potential of forestry the state forest services are huge institutions in Europe. In the old democracies the state expanded its administration during the prosperous 1960s and 1970s in order to offer the private forest owners a powerful extension service, and to serve the general population by providing recreation and nature protection facilities. The young democracies inherited a well-developed state forest administration from the centrally-planned communist system, which directly managed all forests.

Today, in contrast to the prosperous past, the driving force of reforming the state forest administration is the lack of financial means for the state institution. In the old democracies, the state fiscal pressure results in diminishing funds to cover deficits in the state forest administration. In the young democracies, the state budgets lack the strength to cover any state forest administration deficit; whereas expectations and political pressure to get financial returns on the general budgets from the state forest management are high. At best the state forest administration gains a more or less autonomous financial status (Krott 2001).

The reform means that state forest administrations switch to a model of "Profit-seeking state forest administration". The market orientation of wood production is increasingly looking for profits. In addition new markets should finance the public services for recreation, nature conservation and environment. The efforts to lower costs lead to a reduction in public goods and

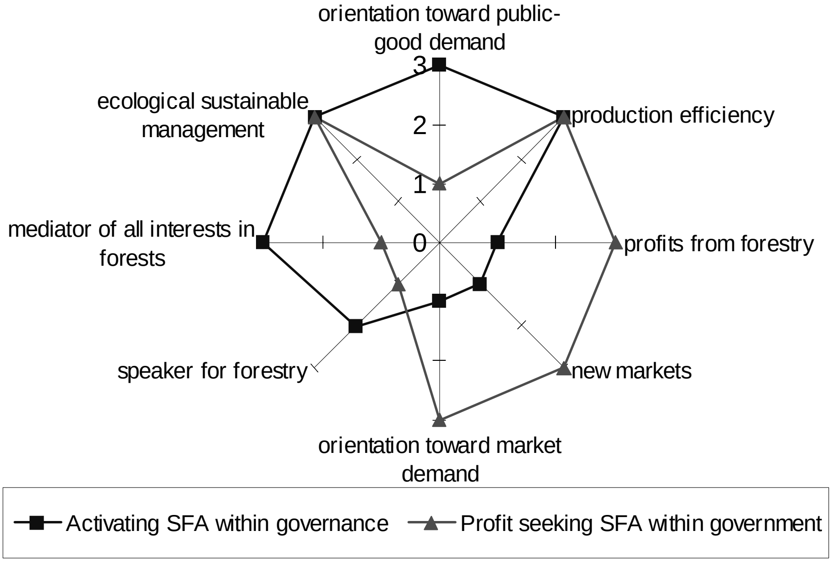

Figure 1. Benchmarking of the State Forest Administration (SFA) Forest policy goals for state and private forest land. Sources: Krott and Stevanov 2004; Krott and Sutter 2003.

services towards a minimum standard. Ecologically sustainable management is still accepted but cost efficiency forces silviculture management towards the “mission impossible” of being efficient in the short-term and simultaneously follow long-term ecological standards.

The reform also has consequences for the policy role of the state forest administration. Public funds are saved by shrinking the state administration, which reduces activities in monitoring, planning and extension. Due to a strong trust in the market, private forest owners and industry acquire more freedom for running forestry driven by their own interests.

The “profit-seeking state forest administration” model fits very well into the overall change in the role of public administration within the government process (Jann 2002). The state seeks to reduce the financial burden of a huge administration by restricting the direct and free public supply of goods and services. A slim state administration should guarantee a minimum, with the promise that additional demands will be served by private economy and society.

The change into a profit-seeking state forest administration has already and will in the future change the way forestry is managed in European countries. By reducing the tasks in which the state plays a leading role, the slim forest government concept leaves forestry more open to the demands of markets. Two consequences are politically important. Firstly, the concept of shrinking forest government gives a rather vague answer on how to serve the demands of the general population, which cannot be easily organized in markets, like many environmental and recreation needs. Secondly, sooner or later the shrinking forest government will reach a point when the state forest service becomes too slim to monitor and guide the implementation of forest policy in a proper way. The standards of forest law will consequently lose their impact on forest practice, or other public administrations will take over the task of guaranteeing sustained forests.

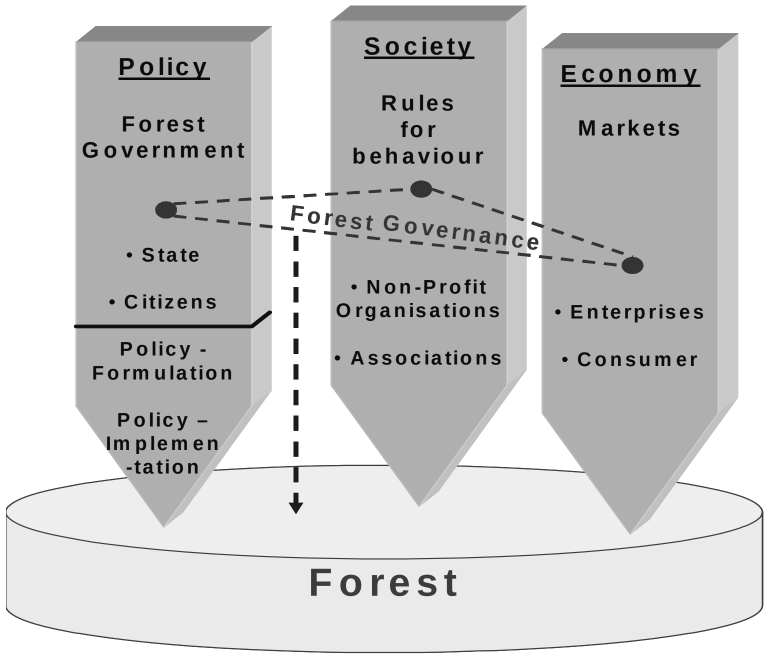

Figure 2. Elements of government and governance in forestry.

4. Forest governance on a national and international level

4.1 Success within forest governance processes

In the past decade, the number of policy activities which follow a rather different concept than forest government has increased (Glück et al. 2005). The key elements of the forest governance concept are shown in Figure 2. Pillar one symbolizes the state-driven government process aimed at formulating and implementing political solutions for the forest (Krott 2005). Besides government, society and economy also produce rules guiding the use of the forest. The dominant stake-holders in society are non-profit organizations and associations. In the economic system the enterprises dominate the markets. Whereas in the government concept all three systems – policy, society and economy – develop autonomous solutions for the forest, in the governance concept the interdependence between policy, society and economy becomes the central process seeking solutions to forestry problems (Rhodes 1996).

Forest governance is forest policy making in a social bargaining process for regulating conflicts of interests in forests within a self-organizing network of public and/or private members without formal state dominance. The promises of governance are that the networks can be built up around specific problems, organizing members from different sectors, with specific resources, competences, interests, responsibilities and means to solve problems of forestry. Open communication would steer policy learning, improving the mutual understanding and triggering new solutions (Shannon and Schmidt 2002). If the willingness to learn is insufficient or win-win solutions are not to hand, the networks offer options for negotiations to pave the way for compromises of interests among the participants.

The National Forest Programmes are a prominent attempt of forest governance strategies in many European countries (Rayner and Howlett 2004). Since 1992, 12 European countries have started the process of National Forest Programmes. The programmes should develop improved solutions for sustained forests based on the principles of broad participation, collaboration and a holistic, intersectoral approach (Humphreys 2004). Creating an institutional platform for a long-term process to develop iterative adaptive solutions for sustained forests is as important as a specific plan of actions (Schanz 2002). Up to now the experiences of the 12 countries are that the National Forest Programmes have been accomplished on the one hand, in a process of state regulated self-regulations, e.g. in the Czech Republic, Finland, Denmark, Belgium or Germany. This means that the state remains most important for guiding the process. On the other hand, there are countries like The Netherlands, Portugal, Sweden and the UK where no specific nominal National Forest Programme was created but where networks of private self-regulation of specific forestry issues like certification were developed. Driving factors were private actors with a high capacity to act.

The diversity in National Forest Programmes demonstrates that forest governance does not only mean optimal networking by communication oriented towards the common goal of sustained forests, but also a process driven by power. The process and the outcome highly depend on the distribution of power and information within the networks. Consequently, for a specific forest institution the challenge of governance is to identify the patterns of power and information which are relevant for a specific governance instrument. Based on this knowledge, active participation can lead to success but in other cases it might also be rational to resist participating and to save the resources for alternative activities.

Alternative strategies for acting within a network were analyzed in a recent case study of 12 networks comprising 234 state and private actors in Finland, Germany, Greece, UK, Sweden, Spain, Ireland and Denmark (Hasanagas 2004). The analysis model explains success within a network by two sets of variables, network conditions on the one hand and actor-related means on the other. The theoretically based explanations are statistically tested by data produced from a telephone survey in the 8 countries. The results can be illustrated by an example focusing on cross-sectorality as a major goal of networking. In principle a specific actor can use information, financial means or pressure for surmounting the borders between sectors (Krott and Hasanagas 2005).

In informal networks, dominated by state agencies and strongly formalized it turned out that information or pressure are rarely sufficient for forging new links between sectors (See Table 2). Within the discourse, new arguments of private actors are selectively used by the state agencies to support their programme. Even scientific proof cannot influence the dominant formal arguments of the state agency. In addition, pressure from private actors is not strong enough to achieve an impact. The only effective means is to use financial incentives. Paradoxically also the opposite setting, namely networks with low state influence and low formalization, do not offer good chances for effective arguments in the discourse. In such issue networks the whole structure is too flexible to pin down arguments for a joint cross-sector project. The floppiness also means that participants easily escape pressure. But again financial incentives can attract partners.

Networks with low state influence and high formalization offer the best setting for building bridges across sectors by information, financial means and pressure. Such networks, described as social corporatism (Jordan and Schubert 1992), enable associational arrangements and spontaneous co-optations. They follow voluntary political and social procedures that involve the participants in cross-sectoral formulation and implementation of joint solutions. The example proves that specific network factors do make a difference to whether and how integrative solutions can be achieved. This underlines the conclusion that in

Table 2. Means for cross – sector linkages.

	Actor related means	Network factors		
Use of information	Use of pressure	Use of incentives	State importance	Formalization degree
👎	👎	👍	High	High
👎	👎	👍	Low	Low
👍	👍	👍	Low	High

Legend: 👎 incompatible; 👍 effective
Source: Krott and Hasanagas 2005

specific settings only forest governance will improve the situation for the forest partners. In other settings, governance instruments will weaken the position of forestry because other participants will dominate the results. The network analysis can help to identify the most promising networks in advance.

4.2 New role for activating state forest administration

The different but still important role of the state within the governance concept also means a new challenge for the state forest administration (Jann and Wegrich 2004). Governance in practice needs someone who supports the build up of a well-balanced network of partners and is able to follow some procedures. In the absence of network rules and mediation, the stronger participants would easily misuse the arrangement to legitimize only their programmes.

The role of mediator basically fits the state. The state forest administration could also assume this position if it leaves the role of speaker for a rather narrow focused wood-producing forest sector and opens up to all stake-holders interested in forest use and protection. The mediator must win the trust of all participants by unbiased acting. The guiding principle is to enable sustainable multiple-use of the forest by organizing a well-balanced governance process of joint search for solutions. The process as such is already a public-good and the results are expected to complement the market driven forest use in cases where deficits from the point of view of public-goods became apparent.

The task of governance needs to activate society and enterprises to participate in joint efforts to support sustained forests. It requires the state forest administration to change from a profit driven to an activating type of public administration. Figure 2 demonstrates the essential differences between the two types. orientation toward market demands will diminish and orientation towards public-good demand and a role as mediator will strengthen. The goal of efficiency remains high because the new role should also be fulfilled with minimum costs. All over Europe the state forest administration has a good chance to be the most efficient in the role of an activating public administration because of its widespread capacities in the area, its competence, and its experience in managing the state-owned forests (Krott 2001). The most difficult task is to become an unbiased and accepted broker for all participants interested in forests. If the state forest administration fails in fulfilling the requirements of governance, another public administration will take the lead in forest related governance. The consequence would be that the competence of forestry will be restricted to market-based wood production and the multiple-use issues of the forest will be taken over by environmental institutions.

5. Forest government and governance in the EU

In 2001 the EU published a White Paper on European Governance. The governance strategy is aimed at healing the paradox that people all over Europe are facing - their problems are increasing and they expect solutions from policy, but simultaneously distrust all political institutions, especially the EU. Involving people and state as well as private institutions in the joint development of solutions should increase acceptance. The governance approach has not yet changed the key elements of EU policy, which is government by binding solutions based on the Treaty, but governance adds elements of communication and decision-making in networks to EU activities (Heritier 2001). Combining governance with government means that the participants from policy, economy and society do have a chance to find joint solutions but if they fail the EU will go ahead with classic government actions. In practice governance is done in the shadow of the state-driven government. Governance often becomes a first stage in a process which continues in traditional legislation, or it should simply support the implementation of existing laws. In both cases classic government remains the stronger element of EU policy-making. The EU is far from becoming a “confederation of learning networks” in the future.

The dominance of government and the specific but limited role of governance are highly relevant to forest policy on EU level. Based on the Treaty, the EU has no mandate for an EU forest policy. This gap in EU policy does not mean freedom for autonomous national forest policies but rather the opposite. national forest policies are highly influenced by numerous EU policies that have side effects on forests and the EU-supported international markets become driving forces for changing the forest sector.

Most important for forestry are the growing demands of the EU environmental policy, e.g. the EU Birds and Habitats Directives, measures for meeting the Kyoto targets by forest related sinks, or the EU Water Directive. Of the same relevance is the EU rural development policy in which forestry is an integral part of rural development (Flies 2004). Most financial incentives for forestry are given by the EU within the framework of regional development, meaning that the specific sectoral forest needs to lose relevance. The forest policy role in EU environmental and rural development policy is weak due to the lack of an EU forest policy which could balance the prominent position of other sectors at EU level.

At the moment, the only means for EU forest policy is by forest governance. The EU focuses on governance in the “Forestry Strategy for European Union” which the member states adopted by a Council Resolution in 1998. A key element of the strategy is better communication in order to improve coordination and cooperation in all policy areas relevant to the forest sector (Flies 2004). The national forest programmes are the most prominent new instrument to organize the implementation of international commitments. As discussed, active forest governance could meet some new chances for strengthening forestry, but governance is by no means a guarantee that forestry interests will keep their position against growing demands from other participants in the new networks. Of greater concern for forest policy is that even if forestry is successful in the communication networks these governance instruments cannot go beyond the limits drawn by EU environmental or rural development policy.

A rather promising strategy for strengthening forest governance is to focus on the international markets. Because EU government is strongly aimed at supporting markets, a market driven governance strategy will find a positive response from EU institutions and policies. The vision 2030 “Innovative and Sustainable Use of Forest Resources” formulated in February 2005 by the Forest-Based Sector Technology Platform wants to enlarge the role of the forest-based sector in Europe. An innovative forest-based sector could contribute significantly more to the sustainable development of a globally competitive EU. The initiative is driven by representatives of the forest industry, private forest owners and scientists. A basic idea is the “transition of the sector from being largely resource driven to being market and knowledge driven" (Forest-Based Sector Technology Platform 2005). Due to the strong participants and the good market fit, the platform could be the seed of a powerful forest governance process.

The platform is a good example of how governance in connection with government can have an impact on forest policy. It opens a window for all stake-holders interested in strengthening market-oriented profitable use of the forests in Europe. This initiative will find support in the strong EU government task of strengthening Europe-wide markets. Within such a framework interest in a market driven forestry will be strong, while interest in public goods from forests as environmental, recreation and cultural benefits remain weak. Such a setting of interests within a governance process has a significant potential to shift the priorities for the multiple-use of European forests under the umbrella of sustainable development.

6. Conclusion: towards a wise use of the forest governance potential

The integration of Europe causes new cross-border problems for national forest policies but at the same time the international policy process initiates governance as a new concept for forest policy. Based on theory and empirical examples, it becomes clear that governance is a new approach to policy-making within self-organizing networks comprising participants from policy, economy and society. The challenge in a changing Europe is to make use of the potential of governance complementing the classic instruments of forest government:

1. Forest government only has the ability to solve problems by binding solutions backed by the power of the state. Within a forest policy driven by real conflicts, this basic function cannot be replaced by a non-binding process like governance. The challenges of forest government differ in young and old democracies in Europe. Whereas the young democracies must improve implementation to have an impact on forestry in the field, the old ones need to speed up the formulation of improved legal programmes to keep up with the innovation in the field by private and state users of the forest.
2. Forest governance processes – as National Forest Programs, Certification or MCPFE – offer stake-holders the chance for mutual learning from policy, economy and society in forestry issues. Forest scientists could use such forums to foster the transfer of knowledge on forests between policy, economy, society and science.
3. Besides information exchange, forest governance processes deal with power as soon as they tackle key forestry issues. Whether specific forest stake-holders will be able to organize support for their interests and needs depends on the distribution of information and power. it is therefore not recommendable to join every forest related network. The most important strategic decision is to select the useful networks. Quantitative scientific network-analysis could provide relevant information on the power and information processes within the networks.
4. The state forest administration – comprising policy tasks and management of state owned forest in different organization models – is the key player in forest government. The Europe-wide attempts to downsize state budgets puts pressure on the state forest administrations to focus more on profit-oriented market activities. A profit seeking state forest administration is then forced to reduce the services of public-goods from the forests.
5. Governance offers the new task of activating state forest administration. The governance processes need a neutral mediator to activate the network. This role could be filled by the state forest administration if it gives up the rather narrow focus of being the speaker for profit-oriented sustainable wood production only. If the state forest administration fails, another state administration will do the job and gain a central role in forests.

6. Governance can gain power if it fits well into specific government programmes. A recent example is the Forest-Based Sector Technology Platform 2005. The platform promotes a shift towards a market-driven forest sector all over Europe. The focus on markets fits well with the key EU policy to strengthen free markets.
7. Governance is rather weak as far as it tries to change the impacts of government programmes. The Forest Strategy for the EU is an example of such frustrating efforts. The non-binding strategy cannot protect forestry from the impacts of other EU forest-related policies, especially environmental or rural development policy. In such cases, governance activities mainly mean, for forest participants, accepting and adapting to a EU government framework already decided by other policies.
8. Governance is an ever-challenging and sometimes risky search for new solutions to forestry issues by networking participants from policy, economy and society. A wise use of governance means keeping in mind the strength and reliability of the classic forest government instruments and only going beyond after checking whether the efforts are worthwhile.

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The Prospects for Evaluating Forestry Policy in the UK

Martin Whitby
University of Newcastle upon Tyne, UK

Abstract

During the last thirty years forestry in Britain has expanded in scale under various policies. Occasionally these policies have been evaluated in economic terms using cost-benefit analysis. The paper compares the first and last of these studies seeking conclusions about the extent of progress in evaluation and the requirements for further improvement.

Keywords: forest policy, Forestry Commission, UK, economics

1. Introduction

The UK was well covered with trees when the first settlers arrived from Europe, some thousands of years ago. According to Best (1981) the share of forest in total land use in Britain declined from 70% in the Neolithic period to 17% in the 11th century. It fell to its lowest point, at about 4% by the 17th century and remained at that level until the1920s, from which date it expanded slowly to pass 10% of the total area of land in the 1990s. These data are not precise partly because of a lack of clear definition of forestry. It remains the case that small woods and hedgerow trees may easily be omitted in the enumeration of the area of forest although they offer significant, mainly public, benefits to society.

The expansion of forestry during the 20th century was brought about through a series of Government policies which began with the establishment of the Forestry Commission in 1919. That event was triggered by the problems of ensuring adequate supplies of timber for vital coal mining activities during World War I. Forestry policy during its first half century concentrated on the provision of timber, in particular on the planting of comparatively fast growing softwoods. The land converted to forestry came mostly from marginal agricultural uses, particularly from beef and sheep cattle rearing in agriculturally poor upland areas. A significant amount of the land planted with softwoods also consisted of long-established native hardwoods. Until recently the debates about land transfer from, agriculture to forestry has focused almost exclusively on the competing attractions of growing trees or rearing livestock.

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The initial plantations tended to be owned by the state and by the end of its first half century of expansion, in 1970, the area of forest had increased from roughly one to two million hectares. Of this a majority was owned by the Forestry Commission but a significant share was in private ownership. The conversion of private land to forestry was encouraged by a mixture of incentives including direct subsidies and tax concessions. The utility of tax concessions as an incentive to private owners depends on the marginal rates of tax they pay and, whilst this rate was high enough to persuade landowners of the desirability planting trees during much of the 1970s and 1980s, the advent of Mrs Thatcher's radical Conservative government (1979–90) introduced a major change in the structure of taxation. In particular she presided over a reduction of the marginal rate of income tax from an (alleged) top rate of 100% down to the modest 40% where it remains today. Her Government also introduced Value Added Tax (in 1979–80), which also had a substantial regressive impact on the distribution of wealth in the UK. The grants which replaced tax concessions on private forest planting where not sufficient to cover this reduction in the tax incentive to plant trees and private planting slowed.

By the 1970s the substantial plantings of previous decades had not yet fully matured and Britain was still supplying only some 10% of its domestic demand for wood and wood products. The situation of private foresters was further undermined by environmental protests about recent ugly plantations, which were then becoming difficult to ignore in the landscape. At around the same time World timber markets began to weaken, which further reduced the commercial incentives for afforestation.

2. Forest policy evaluation

The role of the Forestry Commission and forest policy had not been ignored during this period. However, the economics of forest policy evaluation was a new game in the British public sector which has been developed over a long period. From the 1950s onwards there was some recognition of forest policy issues during debates about public finance (see, for example, Peters 1970). During the last few decades the issues of managing public expenditure have been a recurring political issue and attempts to regulate and systematise its allocation have been important. Over time a system of annual reviews of public expenditure has evolved and this provokes crises of confidence in individual agencies expecting to have their budgets challenged and they may respond at the technical level with economic evaluations which seek to support their case for public investment.

The debates on public expenditure were given a boost in the 1970s when the Conservative government under Edward Heath attempted to adapt the US system of financial management known as PPBS (Public Programme and Budgeting System) to UK conditions. Under this regime particular parts of the public sector might be subjected to in-depth economic analysis prior to policy adjustments and/or budget determination. This contrasts with the way in which CBA was applied on the US, where it was typically applied to sets of projects competing for shares of a given budget. In the UK CBA was used to explore the desirability of individual projects or policies, considering whether to continue or modify them. One such study was carried out for UK forestry and a substantial report was published (HM Treasury 1972). This study was highly controversial with foresters at the time because it concluded that forest expansion was an extremely weak economic proposition.

The study is now of historic interest but provides an instructive example of the problems of evaluating forest policy in Britain and an opportunity to compare with more recent work to

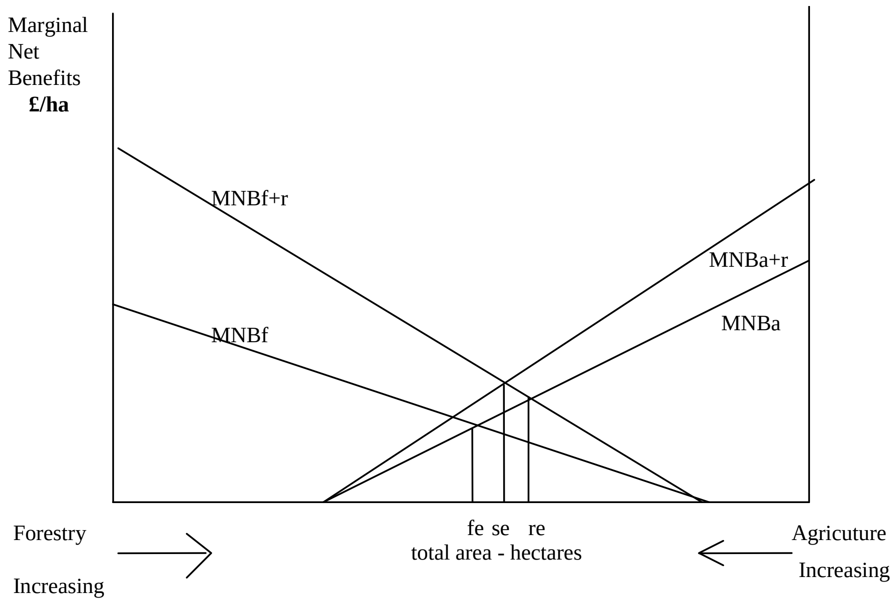

Figure 1. Allocation of a fixed land area between two competing uses.

assess progress in appraisal. The basic model can be summarised in a simple diagram derived from a paper by McInerney (1976). The general case he presents relates to the transfer of land from agriculture to forestry, treating it as a stock resource. A fixed amount of land is seen as allocatable to one of two competing activities and marginal net benefits from each may be shown as declining as the amount of each increases. In the CBA study these activities were characterised as agriculture and forestry and the benefits of each were considered to be declining at the margin. The point at which the net benefits from each activity are equal indicates the optimum level of planting.

This is, of course, a very simple model but it does provide a useful checklist for such evaluations. Reference to Figure 1 shows the variables for consideration. The horizontal axis indicates how the land area is shared between agriculture and forestry, whilst the vertical axes indicate the marginal net benefit of transferring land between the two uses. In general the net direction of transfer has been from agriculture to forestry and that is the policy issue considered here. We should recognise, however, that over many centuries the direction of conversion has been the opposite of that, namely from forestry and native woodland to agriculture.

The diagram crudely represents the situation evaluated in the 1972 study, comparing the possible outcomes of extending the area of forest by planting trees on agricultural land. The initial use is seen to be agriculture, which diminishes as farmland is planted with trees. The marginal net benefit of these changes is recorded on the vertical axis. If a reallocation is considered on the basis of primary products alone, the optimum will be at the point where the marginal net benefits from agricultural and forest production are equal, at *fe* in Figure 1.

However, if the concern is to optimise *social* benefits, including recreation, the optimum indicated by the intersection of benefit curves, MNBa+r and MNBf+r, moves rightwards to

Table 1. Marginal Unit Values of Benefits and Costs from Woodland: GB.

Item Being Valued:	Estimated Annual Marginal Impact £
Recreational visits to forests, per visit	1.66–2.75
Forest View, per household per year	269
Enhanced biodiversity per 1 per cent increase of Sitka Spruce Plantation, per household/year	0.35
Enhanced biodiversity per 1 per cent of new lowland native broadleaved forest, per household/year	0.84
Enhanced biodiversity per cent increase in Ancient Semi-natural Woodland, per household/ year	1.13
Tonnes of carbon Sequestered	6.67
Total deaths avoided in one year, due to absorption of PM10 and SO_2	124,998
11 day hospital visits avoided by improved respiratory health	602
Cost per m^3 of water lost to abstraction due to planting	0.13–1.24

Source: Willis et al. 2003

se. In practice this study compared *public* forestry with *private* agricultural production and ignored the possibility of recreational benefits arising from agricultural land use. This moves the apparent optimum rightwards from *fe* to *re*, rather than its 'correct' position at *se* imputing a substantial advantage to forestry. Perhaps the case for doing that rested on the scarcity of estimates of the value of recreation on open agricultural land. Nevertheless the assumptions of the analysis were potentially biased towards agriculture at thee expense of forestry.

The outcome of this official study found no cases where transferring land from agriculture to forestry could be justified at the 10% discount rate applied to the streams of costs and benefits. Foresters, especially those in the private sector, saw the study as harmful to their cause because no recreation benefits were attributed to private forestry and a high discount rate was applied. The use of land by upland farmers was also underestimated to the extent that they provided recreational and other social benefits from their land.

The study does show that forestry is very difficult to justify using a high discount rate. Also, the many positive effects of forestry which are external to the market are potentially important in deciding how much land to convert to forest use, as are the negative external impacts. The 10% discount rate is no longer applied in the UK public sector and various arguments for applying lower rates to forestry have been accepted at different times. The current recommended rate for official appraisals in the UK is 3.5% (H.M. Treasury 2003).

Several studies have been undertaken since the 1972 work and they reflect the broadening of the debate about the advantages of forest planting under the impact of increasing awareness of various environmental issues. In recent decades declining timber prices have further encouraged this recognition of the external benefits of forestry. This process has become dominant in forest evaluation and the most recent report on forest economics (Willis et al. 2003) focuses entirely on the social and environmental benefits of forestry. This report cannot be reviewed in detail here but salient points are summarised before turning to possible future developments in evaluation. The report presents its results both "at the margin" and capitalised using a 3.5% discount rate. These are summarised in Table 1, which also provides minimum detail of the basis of these estimates.

Table 2. Annual and Capitalised Social and Environmental Benefits of Forest in GB.

Environmental Benefits	Annual Aggregate value £m	Aggregate Value capitalised at 3.5% per annum £m
Recreation	393	11,218
Landscape	150	4,292
Biodiversity	386	11,029
Carbon Sequestration	94	2,676
Air Pollution Absorption	0.4	11
Total	1,023	29,266

Source: Willis et al. 2003

The number of recreational visits arises solely from the sample survey which measured them (UK Day Visit Survey 1998). The value of recreation benefits was estimated using a benefit transfer model applied to an EU dataset and one single value was applied to the numbers of recreational visits recorded in each region. Notable innovations in Table 1 include enhanced biodiversity due to planting of various species and types of woodland and the number of deaths and hospital stays avoided. The values estimated are then aggregated to the national level to determine annual and capitalised values for the benefits and costs, as reported in Table 2.

It is obviously vital, in using such estimates in evaluating policies, to strive for the greatest precision, which must include accurate and exhaustive enumeration of costs and benefits. Up to now it has proved difficult to evaluate many benefits and costs precisely and this report represents a major improvement on the studies which have preceded it. Nevertheless, there remain some important areas which require further improvement if such evaluations are to be useful in forming forest policy.

This is not the place for a complete review but four issues are mentioned which are particularly important. These are first, the databases which are used to raise unit values to national and regional aggregates; second, the application of constant unit values to perpetual streams of benefit when relative values are changing over time; third, the social benefits lost by transferring agricultural land to forestry and, briefly and finally, the vexed question of the social rate of discount.

Accurate measurement of environmental values will become yet more important as the Forestry Commission's urban forest programme expands. This promotes the establishment of *urban* forests, largely on recreational and environmental grounds, near to major conurbations. The benefits from such investments will be mainly recreational and environmental and, because of their proximity to large populations, are likely to be significant.

3. Raising unit values: databases

Table 2 summarised some aggregations of value for a diverse set of benefits and costs of forestry. Some of these seem reasonably well known but some are highly speculative. For example the recreational benefits are estimated by multiplying a single value of a day-visit,

Table 3. Estimates of Regional Value of Forest Recreation in England.

English Region	Regional Recreation Visits to Forests	Standard Errors of Estimates		Aggregate Value of recreation
	millions	millions	per cent	£m
North East	3.20	2.22	69.4	3.54
North West	31.10	6.92	22.5	34.43
Yorkshire/Humberside	42.86	8.12	18.9	47.45
East Midlands	31.87	7.00	21.9	35.28
West Midlands	38.30	7.68	20.1	42.40
South West	35.88	7.43	20.7	39.72
Eastern	54.48	9.15	16.8	35.28
South East	68.94	10.25	14.9	91.09
England	319.99	22.19	6.9	392.65

Sources: Columns 1 and 3: Willis et al. 2003; standard errors: Forestry Commission, pers com.

determined using a benefit transfer model, by a number of visits from a national recreation survey which samples some 3,000 households and asks participants about their recreational behaviour over the previous year and the previous two weeks. The resulting data are then aggregated and published every two or three years and are the available for studies such as this.

The Day Visit Survey covers Great Britain and sampling errors are available for its constituent regions. For example, in 1998 the standard error for England amounted to 7% which is equivalent to 22 million visits. That may be an acceptable error, at the national level but, when the sample is disaggregated to the standard regions of England, samples become much smaller and errors correspondingly larger. Willis et al. use such values to estimate regional aggregate values of recreation in forests which they also report. Their published estimates are compared with the standard errors of the number of visits in Table 3.

The case of the North East (NE) is notable in having such a large standard error (SE) and in that its reported aggregate for recreation value is the smallest for any region, by several orders of magnitude, although it has the largest area of forest of any English region. The low number of visits to forests in the NE could partly be a reflection of the spatial distribution of its population in relation to forests. The NE population tends to be concentrated in the South and East of the region whilst its forests tend to be located in the North and West: a distribution which certainly does not apply to all the English regions. However confidence in these regional results is further reduced by the fact that one single value of a ‘recreation visit’ has been applied across all regions here, ignoring the likely systematic variation on these values between them. Such variation is likely because of considerable diversity in the levels of income between regions as well as in the location of populations in relation to that of forests. The substantial diversity between regions in basic economic characteristics is likely to influence levels of recreation participation. It is understood that the present method of determining the rate of leisure visiting the countryside is to be radically changed in the near future and that a much larger sample will be used in the survey. This should improve the potential for accurate estimation of regional recreation benefits.

However, these arguments by no means apply to all the regional estimates and may well be irrelevant to some of them. For example, the contribution to the abatement of global warming is correctly estimated using one single value for all regions because all reductions will help the UK to meet its national quota, irrespective of the region in which the carbon is sequestered. All that matters in that context is the precision of a single estimate. But for some of the other benefits, for example those arising from landscape, enjoyed by residents and commuters, it is improbable that unit benefits will be equally valued in all regions as has evidently been assumed here. Such benefits are likely to be closely correlated with property values which are extremely diverse across the regions of England. So to apply one value to all landscape effects on commuters or residents in every region risks introducing errors. The value used could have been adjusted for regional property values or a proxy variable reflecting regional income, such as car ownership per household.

The general point of these arguments must be that, although we may have sophisticated means of estimating the unit value of the beneficial impacts of forestry, many such values vary substantially across whole countries. Some vary with the distribution and income of populations whilst others will vary with property values. In some cases the spatial distribution of population will be critical to the benefits measured whilst in others it will be immaterial. When, as in the UK, there is interest in assessing the regional distribution of costs and benefits, this will require significant increases in the availability of information at the regional level. This must include reliable data as well as accurate measurement of the relevant economic values.

The future for such evaluations is reasonably bright, not least because of improvements in the availability of comprehensive data on the movement of people around the countryside. The UK Day Visit Survey is to have a much larger sample soon, which will allow accurate regional disaggregation of its results. In the longer run the current enthusiasm for electronic road pricing systems may extend to the broader rural areas which, potentially, will generate data on travel which could also be used to assess recreational demand. No doubt many other improvements in data availability will allow more accurate measurement of the evolving demand for public goods arising from primary land use which must underpin improvements in policy evaluation.

4. Changing relative values over time

In common with most cost-benefit analyses, the UK work on appraising the benefits and costs of forestry rarely allows for changing relative prices over time. This is important when comparing the future values of goods for which the income elasticity of demand is both diverse and changing systematically over time. Technological change in primary good production also generates supply shifts to the right, at varying rates, as production costs fall. Forestry, with its long production cycle and growing emphasis on public environmental goods is one sector where such issues should be considered. In the case of forestry in Britain, there is only one study which mentions the income elasticity of demand for its products (Forestry Commission 1977) and that considers only the future demand for wood, finding a small but positive income elasticity for the raw product. However, there is evidence of a belief amongst economists that the income elasticity of demand for environmental goods is positive and even, perhaps, greater than 1. This notion has been challenged by Kristrom and Riera (1996) who dismiss the idea as ‘folklore’. Their argument seems to be based largely on five local recreational demand studies which considered the income of participants as well as their recreational habits. Their paper also includes substantial discussion of the economic evidence on charitable donations.

Folklore it may be, but it surely is the case that relative prices do change over time reflecting movements in a number of factors including the demand for and supply of the relevant goods. Such changes arise from changes in the incomes of consumers and various other parameters including tastes and preferences. They also reflect changes in supply conditions, including falling costs of production under the impact of technological change as well as government intervention. Changes in cost arise mainly from input price change and technological advances. To ignore such temporal changes can only introduce inaccuracy into calculations and lead eventually to losses in economic efficiency. As far as raw products are concerned the supply of both food and fibre has generally shifted to the right over time as technical methods applied to production ad extraction have pushed costs downwards. However, such a claim can be no more than a guess, as the behaviour of producers has been substantially distorted by production subsidies and to disentangle such effects is beyond the scope of this paper.

Table 4 reports for some nominal price data for the UK over three decades. It is accepted that these indices refer to large and varying bundles of goods over time. Those relating to all retail prices and food show the greatest increase and, in the case of food, contrast significantly with the price of raw food ‘at the farm gate’ which has increased much less than that of food at retail. Many influences are at work here: not only has the mixture of foods consumed varied significantly over this period, but the value added to food in processing and distribution has also increased. It is also notable that expenditure per capita on raw food has declined steeply as consumers have redirected their expanding incomes to other goods. Meanwhile the slow growth of farm output prices reflects increases in the efficiency of production as well as competition for the UK market from exporters – some within the EU, but many in the rest of the world. Raw commodity prices are also subject to significant price changes from time to time as world markets fluctuate.

The main contrast in this table is between the behaviour of retail prices and those of raw primary products. The latter have shown very little real growth at all, which explains why farmers have tried to increase their incomes by moving ‘along the food chain’ and gaining some of the retail mark-up available to them. It is also an obvious reason why foresters have started increasingly to recognise the environmental public goods they provide for society.

This point is relevant to the arithmetic indicated by Kristrom and Riera. The question in their title implies that they believe the income elasticity of demand for environmental goods to be less than 1. In contrast, an older study by Walsh (1986) reports a substantial array of income elasticities for diverse goods and services from US studies, which are summarised in Table 5. It is notable that the elasticities he reports for some categories of recreational goods are substantially greater than 1 (for example restaurant meals and all recreational expenditures). But all the elasticities he reports are greater than that for food. The food elasticity here is roughly equal to that in the UK for food at retail (National Food Survey 2000).

The arithmetic here is not too complex. The key conclusion these estimates suggest is that there is *some* income elasticity of demand for recreational goods. Possibly it is in the range from zero to one, but it could be higher than this for some recreational goods. Given that forestry investments are being evaluated over long production periods it is worth noting the potential significance of such elasticities. If incomes grow at 2% per annum, then an income elasticity of only 0.5 would combine with that to produce an increase of 1% per annum in the good being evaluated. Over 40 years this would compound forward to an increase from 50%. An elasticity of 1 would indicate a compound increase of more than double the initial value over the same period. If similar elasticities apply to other environmental goods, as detailed in Table 2, over the same period, then we would introduce substantial errors into the cost-benefit calculations by ignoring such effects.

Thus I would conclude that, in cases where appraisals relate to long periods of time, there is a very strong case for considering the relative movement of both prices and costs. If it is concluded that they are likely to move systematically, but the likely extent of movement

Table 4. Three decades of Price Movements in the UK: Indices of nominal prices with 1973=100.

Prices	1973	2002
All Retail Prices	100	931
Retail Food	100	973
Farm Gate Farm Output	100	139
Standing Softwood	100	198

Source: Annual Abstract of Statistics (UK) various years and www/forestry.gov.uk

Note: the small increase in food prices from 1973 to 2002 may be partly due to the sudden surge in food prices in 1973, due to the so called 'Great Grain Robbery' when US grain stocks were suddenly reduced through a clandestine Russian purchasing operation on world grain markets.

Table 5. Estimated income elasticities of demand for goods and services in the US.

Good or Service	Estimated Income Elasticity of Demand
All Food	0.2
Swimming Trips	0.31
Fishing Trips	0.47
Skiing	0.50
Recreation Expenditures	1.4
Restaurant Meals	1.48
Automobiles	3.0
Gasoline	1.1
Consumer Durables	1.8

Source: Walsh 1986

cannot be measured precisely, then policy makers may be excused for falling back on the indications from folklore, as a last resort. If indications from folklore agree with common sense, policy-makers would be well advised to heed them and conclude that the income elasticity of demand for such goods is greater than zero, in the absence of clear evidence and the presence of a strong belief. Such an expedient, regularly checked against unfolding economic events, would seem preferable to the present widely adopted practice of ignoring relative price movements over long periods. If the best that economists can advocate is adherence to the recommendations of folklore, it would be more honest to say so! At the same time we could strive to produce reliable estimates of the value of income elasticities of demand for the relevant goods as a matter of some urgency.

5. The value of lost agricultural use

Perhaps because the Forestry Commission is the main driver of appraisals such as those discussed here, the emphasis has been on forest benefits. However, there are potential costs of transferring land out of agricultural use and these have usually been ignored in the arguments made. This might be defended on the grounds that, insofar as evaluations relate to established forests, there is no need to consider the cost of so doing. However, if calculations are to be used to justify further forest planting, then the value of lost agricultural use should be included in the calculations. Including such issues would obviously complicate the evaluation process considerably but would be vital if further land transfer from one use to another is under consideration.

This argument relates essentially to the question under consideration. If we are merely trying to justify expenditure on a forest policy which is not transferring land between existing uses, then the focus on forestry might be justified. If forest expansion at the expense of other uses is the focus, then the value lost from existing uses becomes relevant. This would be difficult to achieve with the current form of agricultural policy being directed increasingly at promoting rural development, rather than the direct supply of commodities. Nevertheless, it may be a key element in the framing of the question under consideration. Thus the studies reviewed above could not be used to justify forest expansion without broadening their scope and improving their precision.

6. The discount rate

Because of the long production period in forestry, the discount rate is a crucial variable in economic forestry appraisals. Various economists have considered the issue of the role of discounting and argued for modifications to its application (Price 1992). This is not the place to add to that vast literature except to note that the rate of discount chosen has a powerful effect on policy-driven investment decisions and the basis on which it is used for public sector appraisals has changed over recent decades in the UK. The 3.5% rate currently advocated in the UK (HM Treasury 2003) is notably less that the 10% applied in the 1970s. The use of one single discount rate across all costs and benefits in a public appraisal adds to the case for allowing for relative price movements when comparing projects with various payback periods.

7. Conclusions

Economic appraisals of forestry are clearly necessary if the public forest estate and the support for private forestry are to be efficiently managed over the long term. This will require careful use of existing data sources and recognition of the need for much better information on a number of aspects of forestry and the economy. Economic appraisals of converting agricultural land to forestry must recognise the resource cost of doing so and deduct the value of agricultural output lost in conversion (net of subsidies).

The present and prospective demand for the beneficial outcomes of forestry and the resource costs of securing their delivery require considerable attention and research before we can feel secure in diverting public funds to support forestry. Changing modes of governance will necessitate greater confidence in investment decisions. In the UK, for example, the current recurring interest in devolving economic management to regions, as well as the evolution of world trade and changing environmental concerns, together call for more careful and detailed appraisal at a smaller scale than has yet been undertaken.

The broad conclusion from the above review of experience is that, although we have made commendable improvements in the methodology applied in this difficult area, it cannot yet be claimed that we have reliable assessments of the costs and benefits of the conversion of land from agricultural use to forestry. There is much work to be done on improving the available estimates before we will arrive at that situation. The estimates of forestry benefits have improved in precision and focus over the decades considered but more work will be needed for an accurate evaluation of the full implications of changes in forest policy.

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Outlines of Forest Policy in Italy: Past Experiences and Recent Developments

Lorenzo Venzi

Department of Ecology and Sustainable Economic Development, University of Tuscia, Viterbo, Italy

Abstract

This paper reviews the forestry policy developments in Italy, from its beginning at the unification of the Country, since only in the 1860s a cohesive and strategic set of legislation was designed and implemented.

The objectives of forestry policy changed over time from soil conservation to timber and fuel production, to sustainable management, to employment enhancement and more recently to environmental conservation. A national forestry plan in the late 1980s was designed as last action of a national forestry policy by the State, since Regional authorities took over. Eventually, a diversified outcome in forestry policy came out and in a few occasions the industry was neglected in terms of orientation, goals, means and structures.

New opportunities seem offered recently by the Common Agricultural Policy, which allocate to forestry specific measures in the Rural Development Plans. Although they are a useful support and contrast to forest degradation, these opportunities appear outside a truly comprehensive and cohesive approach for an independent sectoral policy, taking care of the whole "filiere", from soil and nurseries, up to the consumers of timber and non timber products.

Keywords: Italian forestry policy, historical development, objectives and strategies

1. Introduction

I'd like to express my sincere appreciation for this event that pays a wonderful tribute to the memory of Maurizio Merlo, an unrivalled scholar in Italy in the domain of Forestry Economics and related disciplines, an initiator of the modern approach in Italy scientific

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domain (his textbook has been, and still is, widely adopted in our Schools of Forestry), a well respected member of the international community interested in Forestry and Rural Development well reputed at EFI, FAO, EU Commission, IAAE, EAAE, IUFRO, etc. The large and highly qualified attendance gathered in this event is proves the great appreciation and scholarly esteem that we all have for him.

First, a short personal reflection: when I was called to teach Forestry Economics and Appraisal at the University of Tuscia 25 years ago, my knowledge on these subject matters was rather limited. I immediately realised that the right person to call upon for help and expertise was Maurizio. He was a wonderful positive adviser; provided me with his lecture notes (later the book), called me to co-operate in various research and teaching projects and most of all, he organized the international Ph.D programme at the University of Trento, Faculty of Economics, on Forest, Timber and Environment which is still continuing with great success.

And again, later, when the University of Tuscia initiated the course on Forestry Policy, I exchanged ideas with Maurizio about it and he again sent me reading lists and course outline for the academic year 1993–94, which I fully endorsed and recommended to my students as a concise, but comprehensive, analysis of the Italian Forestry Policy implemented so far and, most of all, as a fruitful framework for putting in the right perspective the forest policy approaches, guidelines, and implementations.

This paper is a tribute to him, to his guidance, to the seminal work on forestry economics and policy he pursued and to the lasting results he achieved. Coming now to this paper, as usual, one could say that it is not easy to give an outline of Forest Policy in Italy because of the long time span of our national policy, the great diversity of forest-eco-systems, the new institutional framework, State-Regions slowly implemented from our Constitutional dictate, and just recently fully empowered.

2. The historical development

As past experiences of our Forestry Policy, I could rather easily report on and analyse it until the late 1990s, but after that, as more powers were delegated from the Central to Regional governments, it is difficult to provide a thorough picture of the vast array of their forest policies and the connected national co-ordination up to the present time. The great variety of regional contexts, both bio-physical and cultural, could justify the design and implementation of forest policies different in approaches, expectations, ways and means, time horizons, hierarchies, their monitoring and evaluation, which thus makes extremely difficult to co-ordinate at national level, whenever this has been attempted.

Forest policies in Italy have been performed over long periods in recent centuries. Legislations providing the framework and the means for policy implementation were present in many of the small pre-Risorgimento States, which divided Italy before 1870. In many cases, these policies endorsed modern technical forestry principles derived from the French and/or the German-Austrian schools, which flourished at the end of the seventeenth and during the eighteenth century.

By 1870, at the birth of the Kingdom of Italy, the need for a unifying drive to cope with major issues was quite clear and forest policy soon became a priority problem, because of large areas of de-forestation and consequent soil devastation. This feature became for a long time one of the most relevant and leading elements in shaping territorial policies, and forest policy was in the fore-front in order to regulate watersheds, afforestation and forest management.

In fact, the three specific laws (1877, 1910 and 1933) at the basis of the forest policy of the Italian Kingdom were all primarily concerned with hydro-geological management, i.e. prevention of floods, and woods were seen as one of the major tools for preventing landslides, avalanches, flooding in the plains, where large extensions of land were still marshes, underutilised and plagued with malaria.

Of course, vested interests were behind this approach: the first law, named after its author Maiorana Calatabiano, strictly imposed rules to preserve soil stability on hill sides and consequent management of woods, introducing new issues and/or imposing new approaches to those regions in the Kingdom with limited awareness of the public goods and interests embedded in the forests, or strongly pressed to exploit woods for energy (fuel) at the birth of the railway system, or for timber (building) under large urban developments with the new Capital, Rome.

Other relevant issues to be dealt with in a forest policy at this stage, and later on, such as to provide a long-lasting forest production for the country and for present and future generations, or to generate income and rural development in wooded areas, or to promote the timber industry and increase *in situ* the value added from the resource, were yet not adequately considered also in the following two Forestry Laws, the Luzzatti (1910) and the Serpieri (1923).

Again, although many other issues were considered, such as the relevance of a well defined watershed basin for planning policy measures, the structuring of a qualified administration for implementing and enforcing forest policy, the comprehensiveness of interventions relating not only to soil preservation, but also to afforestation, infrastructures, fire prevention, other features, however, nowadays in the forefront of a forest policy, were not explicitly mentioned.

Sustainability in its three or four, qualifying features and biodiversity were not clearly mentioned, but these concepts were largely included in the common culture of our mountain populations, accustomed to living in a severe and poor environment, where they had developed, over the centuries, traditions, rules, techniques, based entirely on the concept of sustainability through years and generations, and on bio-diversity in terms of crop rotations, mixed cropping, multi-species herding and so on.

The 3rd Forestry Law produced a large, positive, impact on hilly and mountain territories and populations, with some conflicts with vested interests (shepherds, absentee landlords, ineffective communal land administrations, etc.), but reached its main goals, particularly in the afforestation activities, up to the beginning of the second World War. This law contributed to the implementation also of a much larger effort in agrarian policy, the Integrated Land Reclamation – la Bonifica Integrale (1933), anticipating by 10 years up-hill restructuring and water basin rational management, to contain down stream flooding.

After the War, new legislation was issued by 3 Laws for “the Mountain” (1952, 1971, 1994), to cope with the problems of vast territories more and more pushed into a marginal position within the national economy, decreasing in population and domestic product. Agricultural land in mountain areas was largely abandoned, but its reversion to woodland was not an easy job because of juridical, administrative and technical problems. Despite substantial financial efforts, at the end of the 1980s, after 30 years only half a million hectares were re-afforested, i.e. 10% or 8% according to forest classification, of total forest surface, largely reduced by the impact of forest fires.

In a few cases these efforts produced wrong outcomes, due to mistaken decisions on species to be introduced (*Pinus Nigra*, *Abies*), from the point of view of ecology, timber (*Eucalyptus*) market, sylvicultural practices and so on. A similar ill fate occurred to the Special Project no 24 for afforestation in the Mezzogiorno, well endowed financially, but scarcely popular in its implementation.

One reason for these poor results can be traced in the pursuit of different objectives in the afforestation projects, which aimed, in reality, to procure and secure employment in mountain districts, to regulate the natural drift of populations away from the land, more than to determine timber/pulp import substitution, raw material for furniture and so on. At that time, the increasing perspective freedom in global trade for timber and pulp was not yet perceived and, more important, neither was perceived the increasing relevance of ecology in reshaping afforestation, which could have induced more stable eco-systems on lands subject to renaturalization processes, this could have provided alternatives to imposing species unsuitable to the environment for productive purposes, but it was not the right time for this approach.

However, some relevant initiatives in the 1980s were attained, such as the National Forestry Inventory (1985), which classified as woodland 8.5 million hectares, thus differing roughly by 2 million hectares, with respect to those of the National Statistics Institute.

During the 1980s was also implemented the first EEC Regulation (Reg. 269/1979) clearly referring, for first time in EEC documentation, basically to forest investments in the Mediterranean regions of France and Italy, followed by Reg. 2088/1985 “Integrated Mediterranean Programs” whose sub-program for afforestation continued the positive effects of the previous Regulation.

It was in 1987, however, that the National Forest Plan was issued as a general review of the Italian and international situation and a coherent program of actions to be implemented in the following decade.

It was a relevant and thorough analysis and an effort to structure together objectives, actions, means and procedures, which allowed the whole industry to be considered not only along the “filiere” approach, but also with respect to other sectors, and to anticipate the environmental issues that soon were going to prevail in determining Italian forest policy, or a substantial part of it. Many of its actions are still implemented and, even long after the 10 years of its foreseen life span, are coming into operation at present.

3. The latest developments

At the end of the 1990s, the regionalization of public administration became an accomplished reality in Italy and the Ministry of Agriculture lost powers on designing, implementing and monitoring agricultural as well as forestry administration. The regions and autonomous provinces fully exercised their powers and it is relevant that the Ministry changed name from “Agriculture” to “Agricultural and Forestry Policies”, since in its new role it retained the power of addressing , co-ordinating and leading, more than managing and administering.

This passage, together with the strong environmental emphasis inspired from Brussels and NGOs, created some strategic as well as operational difficulties in implementing forest policies and most of all in co-ordinating them, because of the co-presence of the Ministry of Environment.

Not all regions were fit and endowed, from the administrative and technical points of view, to cope with their own forestry policy. Many of them did not consider this matter of the highest priority, nor were willing to engage their limited staff in an array of surveys, law making, technical and financial matters, lengthy political debates with the public and in local parliaments.

Nevertheless, a few regions issued their own forestry laws, technical and legal (policing) handbooks, and programmes. As usual, some of these efforts were outstanding and rich in details and provisions. Others produced hasty documents, not always coherent, biased and unsuitable for implementing an effective policy.

Meanwhile, perhaps as a reflection of the (low) relevance specifically attributed to forestry by the European Commission, where issues relating to forestry were considered as segments of other policies, i.e. the environment, agriculture, rural development and even research, also at national level it became difficult to conceive and provide a comprehensive policy approach for forestry.

From the 1990s up to nowadays, even the filiere of forestry at large was a matter, in some cases, of internal negotiations between regional ministers. In a region of central Italy, forestry nurseries and timber processing were administered by the Agricultural Department, while wood management, fire prevention, and timing plus monitoring of felling were under the control of the Department for the Environment.

This rather strange outcome is now slowly changing its pattern, because of two different approaches occurring, almost at the same time. First, the new Common Agricultural Policy, stressing rural development, implies that all rural industries have to be considered (not only, as before, first maximising output of agricultural commodities, then setting land aside, then turning to eco-compatible, or biological products). There is now full recognition that forestry (not just timber) can provide substantial inputs in developing an area by providing an improvement to landscape, recreational opportunities, protection from meteo hazards, as well as a large renewable source of energy. The forestry sector, then, contributes to rural development planning by bringing its own expertise in a cohesive way, not any longer as provider only of projects “upon demand”.

Second, the Italian Ministry for Agricultural and Forestry Policies has stressed its leaderships over the regions, by setting a platform for negotiations on the “guidelines for regional forestry plans”, according to agreements issued at European level. These guidelines have been accepted in 2003 and validated in the standing Conference between State and Regions and are, therefore, evidence of a participatory mechanism, at least at the stage of institutions well accustomed to a top-bottom planning approach.

A further step towards restructuring and capacity building of the forestry industry is the coming to the stage of the “National Observatory of the market for forestry products and services”, within the National Council for Economy and Labour, upgraded services for information storing and retrieval. After two years of preliminary efforts, the Observatory aims at becoming not only an instrument for exchange of information, but also a focus for exchange of opinions and suggestions on forest policy.

4. Final remarks

This brief outline of Forestry Policy in Italy, necessarily has left out many more items than those included. It has been necessary to cut out many issues and details at this stage in order to give, as stated, an outline of our situation.

At the end of this paper, it appears evident that a forestry policy as such, even at the early stages of the Italian state, never existed, at least as it emerged in other European Countries with almost the same forestry traditions.

The sequence of basic issues which stood as pre-requisites for a forestry policy ranged from protection from soil erosion and floods, to forging an administrative structure (including para-military forces) to govern woodlands and State Forestry Estates, to securing socio-economic stabilization in the immediate post-war, period supporting rural employment, and, most recently, within the EU framework, as diversion from agricultural production, as environmental support and finally as a relevant input in rural development policy.

Of course, there have been a few occasions when forestry gained the forefront of the Italian social and political life, but this situation did not last enough to consolidate, or allow for adjustments, monitoring and evaluating results. I refer to the 3rd Forestry Law and more recently to the National Forestry Plan.

A possible comparison in the primary sector of the economy between forestry and fishery is curious, and so far unexplained. Both provide renewable resources, refer to specific sections of the national population, each based on long standing traditions, and representing the initial segment of filieres which later are endowed with high value added; yet, despite the large statistical relevance for forestry in terms of product value, employment, exports of finished products and number of firms, fisheries draw more friendly attention from the public administration, within the same Ministry in Italy, and at European level, where in Brussels we have a General Directorate for the latter, but none for Forestry (only a Strategy) and also a larger flow of subsidies.

Having said all that, however, and feeling uneasy for the "benign neglect" conferred on Italian forestry, I would like to point to the few signs for improvement of the situation (that is the "enlistment" of forestry experts in co-operating for in rural development, the promotion of the Observatory) to which must be added the long suffered restructuring of the State Forestry Corps and services within the former General Directorate, the increasing foreign links and networks at international level which strengthen the capacity and expertise of administrators.

All this could induce some hope for a comprehensive, well thought-out, shared and effective forest policy, which could provide the industry and its population with appropriate guidance to cope with the multifunctional role it is called on to perform at present and in the near future.

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Multifunctionality and the Management of Alpine Forests

Geremia Gios

Department of Economics, University of Trento, Italy

Abstract

This paper focuses on Alpine forest multifunctionality and its consequences on different forms of forest management. Different Alpine forest functions are examined within the theoretical framework of Total Economic Value (TEV). Some problems in estimating the different components of TEV are highlighted and the results of empirical studies are described. Finally, some suggestions are made for implementing effective management models when multifunctionality, conjoint production and numerous stakeholders coexist.

Keywords: Alpine forests, forest multifunctionality, Total Economic Value of forests

1. Introduction

The theme of multifunctionality is certainly not new to forestry but within the ambits of forest economy it has recently become the focus of rapidly growing interest. There has consequently been an increase in both theoretical and applied research aiming to bring greater clarity to the various benefit flows produced by forests, also in terms of economic evaluation.

Well over 30 years ago, Patrone (1970) identified four types of forest function: production, landscape, protection and ecological/nature. So it has long been known that forests do not produce only timber and non-timber goods, but also “intangible” services (Wibe 1995), “creating multiple benefits (economic, social and environmental) for society” (Price et al. 2003). Clearly the importance of the different functions “is strictly related to the socio-economic and environmental context of which the forest is a part” (Mammuccini 2004), but it is also true that “integration of the different functions is not always free of conflict” (Janse and Ottisch 2005). It follows that it is in the changed socio-economic context, leading to increased importance for certain functions and a reduction in the role of others, that we must seek the reasons for this rediscovery of multifunctionality and the need for deeper analysis and new research into issues that, in essence, have already been explored by previous generations of academics.

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As far as the southern slopes of the Alps are concerned, the objectives associated with these functions have been pursued simultaneously by adopting forestry models based on what is usually called natural forestry (Pollini and Gios 1986). It now seems appropriate to pause for a moment of reflection on this way of seeing forests, not so much because this conception has in itself become obsolete, indeed the spread of sustainability principles has extended the validity of such a view far beyond its ambit of origin, but rather because the relative weight of its various aims has been changing, incurring a need to re-examine the ways in which these forests are managed.

Within this framework this paper seeks to highlight aspects requiring further investigation, and lines for future research, rather than suggest solutions. The paper is thus divided into three parts. The first part contains both a possible taxonomy of the various functions performed by Alpine forests from a total economic valuation (TEV) point of view, and the results of recent investigations that aimed to evaluate the different TEV components. The second highlights some of the problems involved in estimating various TEV components, which have not yet found a satisfactory solution. Finally, the third part examines some management problems, particularly in the light of so-called club goods theories.

2. Multifunctionality and total economic value

The problem in evaluating forest benefits, as in the evaluation of benefits from many other environmental goods, has not yet been solved in a totally satisfactory manner. Since they are the result of environmental functions that entirely or partly share the characteristics of public goods (non-excludability and non-rivalry), the majority of these benefits usually have neither market nor price. In order to overcome these limitations and avoid resorting exclusively to complex, vague, much criticised sets of physical indicators, an approach based on the estimation of all or some total economic value (TEV) components has increasingly come into use over recent years. This seeks to evaluate economically all the functions (marketable or otherwise) of natural resources, including forests.

Such an aim is not shared by all and is indeed justified in an anthropocentric approach that adopts the paradigms of traditional economics. However, for those who consider nature to be a value in itself, and not only in terms of what it may represent for the current and future requirements of humanity, this reduces the problem to levels where it risks losing all meaning. At the same time this approach follows the logic of reductionism and is therefore unable to satisfy anyone basing research on a systemic type approach.

We should also point out that when defining TEV we can draw a distinction between rationalist, incremental and mixed approaches (Bottoud 2002). Though sometimes difficult to operate, the first is not only the most frequently used, but is also in our view the most suitable for achieving results that are comparable in time and space. The additive version of this approach is particularly interesting, based as it is on the measurement of the total value and global utility of an environmental good as the sum of the specific values of each single function it performs.

If we wish to apply the additive version of the rationalist approach to Alpine forests, we must first identify all possible benefit flows from the forest itself. There will then be a corresponding TEV component for each of these. One of the many possible classifications of these components is shown in the following tables. We should remember that since TEV has only recently been introduced, its single components are not always referred to in the same way. In some cases numerous synonyms are used for the same function, in others we can see duplications and overlapping so that the same utility flow may be counted several times.

Table 1. Direct use values.

DIRECT USE VALUE	⇒ in situ values (a_1) = in close proximity to the resource	⇒ *with evident consumption of the resource* (a_{11}) = the removal of a resource for immediate consumption: harvesting timber and other forest products
		⇒ *without evident consumption of the resource* (a_{12}) = use of the resource for recreational or relaxation purposes without its material consumption: landscape-recreation value
	⇒ ex situ values (a_2) = no immediate relationship with the resource	⇒ *with evident consumption of the resource* (production values) (a_{21}) = extraction of the resource for use in the production of other goods: value ofmedicinal ingredients to be found in forest plants
		⇒ *without evident consumption of the resource* (vicarious use values) (a_{22}) = associated with ex situ enjoyment of the resource: nature documentaries

Source: Tables 1 to 4 based on Gios and Notaro (1998).

These limits become particularly evident whenever it is necessary to compare research carried out by different authors.

However, while aware of such drawbacks, in the following tables we present the various basic TEV components for Alpine forests considered worthy of careful evaluation, specifying that the examples are only indicative and in no way claim to be exhaustive.

As far as indirect use values (Table 2) are concerned, the different components (b_1, b_2, $b_{3)}$ can obviously not be added together since they constitute partially overlapping subsets. Choosing one component rather than another will depend on the purpose of the estimate and/ or the base data available.

With regard to values in uncertain conditions (Table 4), option and quasi-option values concern all the components described in Tables 1, 2 and 3. So it would be possible to estimate the relative option and/or quasi-option value for each of these components whenever operating in a scenario of risk or uncertainty.

Although there have been few cases so far of the abovementioned methods being applied, the outcome of two investigations carried out in Piemonte and in Trentino is reported below as an example. The results obtained, though of similar size, differ. The reason for this difference can be traced to various causes, including: the different characteristics of the forests analysed, the different methodologies used and the sometimes dissimilar meaning attributed to the different TEV components.

Table 2. Indirect use values.

INDIRECT USE VALUES	⇒ *protection* (b_1) = performed by economic agents to limit the economic impact of production and consumption processes (prevention or restoration activities): cost of reclaiming deteriorated areas after the destruction of a forest; cost of replanting a forest (without achieving the original biodiversity); ⇒ *compensatory defence activities* (b_2) = to remedy a negative external factor before the damage becomes irreversible: cost incurred in remedying upheaval to natural water courses after deforestation; costs incurred in purifying the air to a degree comparable to natural forest action; ⇒ *damage compensation* (b_3) = cost of compensating individuals or goods for damage: compensation to residents for damage arising from reduction in rainfall after the destruction of a forest, compensation to the entire global population for damage arising from increased CO_2 in the air after the destruction of a forest.

Table 3. Non-use values.

Vicarious value (c_1)	This refers to a resource evaluation that is not based on personal use, but on the opportunity for contemporaries to use the good: desire to safeguard Alpine forests to enable local populations to continue their traditional way of life.
Inheritance value (c_2)	Members of the current generation wish to hand down to future generations an endowment that is as intact as possible: the wish to leave children and grandchildren a full forest ecosystem
Existence value (c_3)	Based on Q-altruism, also known as intrinsic altruism, arising out of the knowledge (on the part of human beings) that a resource Q benefits in itself from remaining undisturbed as long as possible, intact in its functioning. In this case, the role of human beings is to voice this intrinsic right of the resource to exist: maintenance of the forest ecosystem in order to enable the different species (known and unknown) to remain.

Table 4. Values in uncertain conditions.

Option value (d_1)	The maximum amount that non-users of the resource are willing to pay to keep open the option of being able to use the resource in future: maintenance of the forest for possible future visits.
Quasi-option value (d_2)	The benefit of putting off a decision that would lead to the irreversible consumption of a resource when benefits arising from its conservation are uncertain: maintenance of a forest ecosystem for the as yet unknown benefits that may come from medicinal plants.

3. Problems in estimating the different benefits produced by forests and the various TEV components

There are many ways of calculating TEV components based on different presuppositions and using non-homogeneous calculation methods. It does not seem appropriate to try and identify here, through comparative analysis, the most suitable techniques for forests. Indeed, the ongoing comparison of these methods for environmental goods is lively, full of contributions and far from conclusive, and we believe that useful indications, specifically applicable to forests, will arise out of this debate.

Table 6. Estimated values of some TEV components in three Alpine forests (value per hectare).

Components	Forests in the Comune d'Oulx	Trentino
Productive function (flow used)	77.64	83.29
of which:		
• Timber	(40.01)	(55.43)
• Undergrowth and mushrooms	(33.48)	(27.86)
• Pasture	(2.70)	
• Wildlife	(1.45)	(11.82)
Productive function (stock variation)		46.71
Landscape function	55.16	36.12
Climate stabilising function (CO_2 absorption)	7.36	12.63
Hydrogeological protection	183.28	182.69
Total	323.44	373.26

Source: Paletto (2002), modified by Gios et al. (2005).

However, while it is premature to attempt an unequivocal definition of estimation methods, it may be useful for future research to reach an unequivocal definition of the various TEV components for temperate forests, at least for Italy if not Europe. The first step could well be to set up an ad hoc workgroup.

What we do intend to do, maybe a little presumptuously, is attempt to highlight benefit flows that require deeper analysis, in order to gain information useful both for management purposes and in outlining expedient economic policy measures. In this logic it seems appropriate to note the following:

a) Production function. This is obviously the most studied function and the main difficulty seems to lie in the lack of reliable statistical information, particularly concerning undergrowth products and mushrooms. On the basis of known investigations, these bear a relatively heavy weight and are probably on the increase. Attention should be drawn to the fact that current national accounting tables provide for any substantial difference (UN 1993) between "cultivated" land (i.e. forested land covered by a forestry activity targeting timber production) and other land (i.e. forested land on which no forestry activity is carried out, in spite of the existence of natural growth). In the former case (cultivated land) standing timber trees are indicated as "productive activity" and the added value, equal to timber growth, is included in gross national product (GNP), while in the latter case (other land), standing timber trees are considered "non-productive activity", and the added value is included in GNP only when the timber is harvested (Eurostat 1999). It follows that in the latter case variations in standing timber stock are not estimated. In practice, it seems that variations in forest timber stock are never considered for Alpine forests. In a period such as the current one, when the timber mass is increasing, this leads to an underestimation of the role of the productive function. Similar problems can be met in estimating the value of wildlife.
b) Landscape value. In many areas the spread of tourism increases the economic value of the forest landscape. The number of investigations and research projects aiming to evaluate the methodology and applied aspects of this function has therefore been steadily increasing. Starting with Merlo's (1986) pioneer work on the pine forest of Val Rosandra, different techniques have been used and interesting results achieved (Scrinzi et al. 1995). In this case too, however, we should call attention to an all too frequently underestimated

aspect. In spite of the constant presence of landscape in our lives, we often underestimate the importance of understanding the nature of the value of the landscape itself and its components. This leads to an incorrect choice of estimation tools. With this in mind, very briefly, we should remember that the benefits generated by forest landscape, similarly to those arising from rural landscape, can be divided into three categories: aesthetic, recreational and spiritual. It follows that the value of a forest landscape can be seen in terms of three components. The first relates to the scenic landscape value derived from benefits produced by observing certain aesthetic types of landscape. The second relates to the recreational value of "the possibility of carrying out activities associated with tourism, recreation and leisure in general, in quality scenic contexts" (Novelli 2005). The third relates to nostalgic and evocative value. For the last it should be borne in mind that as well as the "desire to conserve values and traditions that are part of the historical memory, or heritage, of an area" (Novelli 2005), there may also be a social component associated with the value attributed to the existence of the forest, particularly where it is associated with the maintenance of democratic institutions and forms of self government. For example there are the "Regole" of Alpine mountains. Again we must not forget that the "demand" for landscape does not in most cases mean one single element, it refers rather to a harmonic whole made up of a number of components. In our case, an alternation of forest and open space seems to be appreciated more than an unbroken expanse of forest. Attempts to single out the contribution made by one component have therefore proved to be rather demanding.

Undoubtedly, the intensification of investigation and comparison of results is an important step towards achieving greater reliability in the results that can be obtained when estimating this type of benefit.

c) Protection function. Although this is the most important component in the benefit flow produced by Alpine forests, it is scarcely analysed. The few estimates available present widely differing values and the methods used require both deeper methodological and deeper operational analysis. We believe that it is more necessary than ever to dedicate energy to evaluating the hydrogeological function of Alpine forests, even if this means less research into the role of these forests as carbon sinks. There has been an explosion in the amount of work in this latter area that is disproportionate to the effective importance of this function.
d) Ecological-natural function. This is the least studied forest function as there is a lack of suitable empirical and methodological applications. Issues such as biodiversity and existence value are still limited to statements of principle; they are frequently nominated but without being followed up by adequate in-depth study. Undoubtedly the Alpine forests are among the forest ecosystems most frequently studied. Consequently there is an abundance of biological, ecological and forestry information available. In principle therefore, attempts to evaluate the benefits associated with ecological/natural functions are likely to be successful. Obviously the creation of multidisciplinary groups is basic to the achievement of valid results.

In conclusion, there is ample space for research into the different aspects of Alpine forest multifunctionality. As in other cases, the possibility of obtaining valid results depends, as well as on personal commitment, on knowledge of the actual situation and on the capacity to identify appropriate theoretical reference models.

4. Management problems

As mentioned before, in comparison with even the recent past what has changed is not the multifunctionality of the forest, so much as the relative weight of its various components. More specifically, the productive function has lost importance in that we have swung from a problem of overexploitation to one of under use, due to factors both internal and external to the forest itself. These are linked to changes both in the overall economic framework and in the timber production chain. In the past, Alpine forests were indispensable to various local primary industries (such as coal, lime etc.) and facilitated the production of numerous products integrated in the farming economy. Nowadays, the forest has a specialised productive function targeted almost entirely at timber production. The remaining production (e.g. products from the undergrowth and mushrooms) is linked more to leisure activities than production chains. However, production specialisation has not been accompanied by adequate transformation in cultivation methods, also because of the introduction of specific innovations. For a natural type silviculture, virtually the only innovations available derive from technology designed for environments with different characteristics. This is an issue that requires further discussion, but is not within the scope of this paper.

Just as the importance of productive function is diminishing, the importance of other functions is increasing. This can be summarised as follows: while in the past the forest satisfied basic needs (for the survival of the community), nowadays it satisfies requirements regarding quality of life. This obviously involves changes in the users of forest-derived benefits. While it was once the local residents who were the direct beneficiaries of forest products, nowadays, the main benefits (in the form of externalities) go to non-resident populations in most cases. In other words, the value of forest capital is high, but one product obtained from it (timber) is worth relatively little. Such a situation does not appear sustainable in the long term. There are at least two alternative ways of dealing with the problem. One way can be outlined as follows: if the importance of timber production is decreasing there is no need for undue concern. The important thing is to safeguard the other functions, and these are performed without human intervention. Indeed the less we touch forests, the less the damage incurred. From this point of view the decreasing importance of the productive function not only creates no damage but also becomes positively desirable. In other words, conservation is considered possible without management. In reality we have to realise that this is not possible, both because the environment must be considered globally (it would be useless to safeguard Alpine forests if this meant the destruction of forests elsewhere), and because, in the long term, the cost of conservation as an end in itself would be unsustainable.

We must therefore consider the second form of management, beginning with the assumption that the protection function together with the other forest functions in fact go to make up a combined production, so, except for limited areas and periods, the latter cannot be maintained without the former. If this is the case, then conservation requires management and successful, long term conservation requires the upkeep of links between local populations and the forest.

This raises the problem of how to achieve such objectives. One important aspect concerns the appropriate theoretical framing of the problem. We are used to considering the existence of two categories of goods: private goods for market management, and public goods to be managed through the State and its institutions. In the case of the forest (just as for many other environmental goods) we are, in reality, up against a “mixed good”. It is a good requiring specific management methods that can be traced theoretically to club goods theory and historically to the Alpine collective ownership model.

In second place, it is necessary to experiment utilisation methods that, while safeguarding the principles of natural silviculture, keep the costs of utilisation down facilitating the introduction of innovations in process and organisation.

In third place it is necessary, wherever possible, to internalise within forestry management the benefits that the forest produces as externalities. This could be the case, for example, of entrance tickets to areas of particular value, or of similar instruments that are beginning to be experimented in certain European areas.

In fourth place, public intervention that aims to guarantee at least the covering of major costs incurred by certain silvicultural methods appears appropriate wherever recourse to the market proves inadequate in guaranteeing remuneration for forest produced benefits. To this purpose it is possible to use different, and to some extent complementary, paths that may range from the use of production incentives to income support.

Finally, if we believe that it is not so important to safeguard the existing tree as it is to conserve the possibility for new trees to grow, operating for the maintenance of forests as renewable goods, it is essential that forests remain firmly anchored to the interests of the local population. Indeed, only if the local people are involved through an immediate interest is it possible to guarantee the conservation of the forest for future generations.

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Part 2 – The Role of Institutions in the Decision-Making Process

Market and Rural Policy Institutions to Stimulate Multifunctional Food and Fibre Production

Guido Van Huylenbroeck

Department of Agricultural Economics, Ghent University, Belgium

Abstract

Although multifunctionality is used as a political concept to defend a societal view on agriculture and forestry, it may also be translated at micro-level. This paper analyses how agricultural producers can be stimulated to change the combination of commodity and non-commodity outputs resulting from their activities in order to deliver a desired level of non-commodity outputs. The paper first analyses the characteristics of a number of non-commodity outputs of agriculture and of market failure in their provision. Next a micro-economic model to analyse multifunctionality at farm level is presented. Then a number of market and non-market instruments are presented that may be used either to express the demand or to create incentives for multifunctionality. Finally some institutional approaches are overviewed that may be used to organise the collective demand or supply of certain functions that are underprovided.

Keywords: non-commodity outputs, Government intervention, environment of function, public goods

1. Introduction

According to OECD (2001), multifunctionality is to be interpreted as a characteristic of an economic activity such as agriculture in the sense that an economic activity is producing multiple and interconnected (joint) outputs or effects. These effects or outputs may be positive or negative, intended or unintended, complementary or conflicting, valued in existing markets or not. In general terms one can speak about commodity and non-commodity outputs of an activity. Within a given market and policy setting, the economic activity will result in a certain combination of the joint products. As long as this combination is satisfying the demand toward the different outputs, there is no problem as an equilibrium situation is reached. However, due to shifts either in the supply side (e.g. technological innovation) or in

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the demand side (e.g. higher demand for recreational goods), there may be under- or overprovision of certain commodities making corrective actions necessary.

In this paper we will concentrate on these corrective actions or in other words how can agricultural producers be stimulated to change the combination of commodity and non-commodity outputs resulting from their activities and what does this imply at micro level. First the necessity of corrective actions and the difficulties connected to it are analysed on the basis of some concrete examples of market failure in the production of joint non-commodity outputs. The paper then continues by analysing which instruments may be used to change the output combinations. Finally some conclusions and policy reflections are presented stimulating further discussion and research.

2. Examples of joint non-commodity outputs

When producing commodities such as food and fibre a number of other outputs are produced as joint products. Examples of joint outputs are employment, food security, landscape, biodiversity, soil-, water- and air-quality, cultural heritage and so on.

In Table 1 a number of examples are given. A first observation is that the analysed non-commodity outputs do not or only partially depend on the production level of the commodity output. The link with the production level is only clear in case of negative externalities (cf. the example of water quality). In most other cases the link with the production level is weaker and has to be interpreted as follows: agriculture or any form of cultivation is in most cases a necessary condition to obtain the non-commodity output, but the yield on itself is not as important. In a few cases, however, production the non-commodity output decreases or is endangered above a certain threshold of production (e.g. meadow birds are endangered if the farmer wants a first cutting of his grassland earlier than the breeding season, genetic diversity is not compatible with having only high yielding varieties).

More important is that in all cases, the non-commodity output is dependent on the applied farm practices, systems or technologies. This confirms the production possibility model of joint production stating that it will depend on economic conditions at what point of output combination farmers will produce. As the required farming systems for having a higher delivery of non-commodity outputs normally result in lower commodity outputs (or higher costs for the same output level), the problem is to find price mechanisms that shift the equilibrium on the production possibility line towards more non-commodity output (Merlo and Gatto 1999). In most cases the non-commodity output is also linked to agricultural structures : specialisation and increased scale of farming have caused larger physical structures which on their turn allow the use of more modern technologies. All these factors together may contribute to the under-provision of certain functions. A specific problem is that the level of jointness is in most cases depending on topography, soil quality, climate conditions and thus spatially differentiated, causing problems of competitiveness when in a particular region measures for multifunctionality are taken.

A second aspect analysed is in how far non-agricultural provision of the non-commodity output is possible or in other words in how far delivery of non-commodity outputs can be de-linked from commodity production. In theory, in most case this is possible because the non-commodity output is dependent on certain cultivation practices, but not on the production level itself. In theory it is thus possible to conserve the practices without selling the products (or at least not to be dependent on the selling). In practice, however this is in most cases a very expensive option to conserve old. For non-commodity outputs with a high dependence on farming, agricultural provision is often the only way.

Table 1. Examples of non-commodity outputs of agriculture and their characteristics.

Cases	Case 1 Water quality	Case 2 Orchard eco system	Case 3 Water con-servation	Case 4 Regional landscape	Case 5 Meadow birds	Case 6 Field flora	Case 7 Genetic diversity	Case 8 Soil con-servation	Case 9 Cultural heritage
Physical linkage with agriculture									
- dependent on production level	Y	N	(Y)	N	(Y)	(Y)	Y	N	N
- dependent on farming system	Y	Y	Y	Y	Y	Y	Y	Y	Y
- dependent on agricultural structure	Y	N	Y	Y	Y	N	(Y)	Y	Y
- spatial differences	Y	N	Y	Y	Y	Y	Y	Y	Y
De-linkage									
- complete de-linkage possible	(N)	Y	Y	(Y)	(Y)	Y	Y	Y	Y
- cost of complete de-linkage		H	H	H	H	H	H to L	H	L to H
- partial de-linkage possible	Y	Y	Y	Y	Y	Y	Y	Y	Y
- cost of partial de-linkage	H	L	L to H	L to H	L	L	L to H	L	L to H
Effects on other non-commodity outputs of partial de-linkage									
- rural employment/social viability	-	-/=	-/=	-/=	-	-	=	-/=	=/+
- food security	=	=	=	=	=	=	=/+	+	-/=
- environment	+	+	+	+	+	+	=	+	=
- landscape/biodiversity	=/+	+	=/+	+	+ (-)	=/+	=	=	+
Market failure									
- effect of commodity price decrease on non-commodity supply (*)	+	-	=	-	?	?	-	?	-
Characteristics of public good									
- excludability possible	N	Y	(N)	(Y)	(Y)	(Y)	Y	(Y)	Y
- rivalry possible	N	N	N	N	N	N	(Y)	N	Y
Delivery instruments									
- direct market (pricing of non-commodity)	Diff.	N	N	N	N	Diff.	Y	N	Y
- indirect marketing linked to non-commodity	N	Y	N	Y	Y	Y	Y	N	Y
- indirect marketing linked to commodity	N	Y	N	Y	N	(N)	Y	N	(Y)
- government intervention (mandatory)	Y	N	Y	Y	Y	(Y)	N	Y	Y
- government intervention(economic incentive)	Y	Y	Y	Y	Y	Y	Y	Y	Y
- involvement of clubs/trusts/organisations	Small	Small	High	P	P	P	High	Small	High

(*) this effect is taking into consideration the above competitive risk

Symbols:

- Y = Yes, N = No, when put between brackets, it means that there may be some doubt about it
- \- means that a negative effect is expected; + means that a postive effect is expected ; = means that no effect is expected and ? is that the effect is uncertain. When between brackets, it means that the effect is probably rather low
- H= high and L = low, Diff. Is difficult to realise

A third point that needs to be taken into consideration is the mutual influence on other non-commodity outputs. Hereby distinction can be made between social functions (employment and rural viability), food security and environmental and landscape functions. In general there is a conflict between the first and third group because (partial) de-linkage will in general be linked to a reduction of the employment (directly or indirectly because of weakening of the competitiveness) at least if no instruments are found to remunerate the higher costs for or lower production of commodity outputs.

In all studied cases no real effect is expected on food security, in the sense that in most case delivery of the non-commodity functions investigated require that at least the land is cultivated or occupied by a vegetation so that the situation can easily be reversed if necessary. The only case where there is a possible danger for food security is when cultural heritage protection by non-agricultural delivery (e.g. farming buildings) should mean that the land is occupied for industrial or domestic functions which may not be reversed. In some cases there may be competition among some functions such as e.g. meadow bird conservation and bio-diversity in the meadows as both non-commodity outputs require different farming practices.

Finally it is indicated in how far decreases of commodity prices are creating a market failure in the provision of non-commodity outputs. This is not as obvious because the effect of price decreases of the commodity outputs is not straight forward. In some cases this has a clear positive effect on the non-commodity provision such as in case of reduction of negative externalities, or in cases where the intensity of the farming system will be reduced without loosing competitiveness: e.g. more extensive beef production because of price reductions can be good for meadow birds or for field flora as long as farmers do not switch to other commodities (e.g. ploughing their land) or do not leave the sector. In other cases the effect is negative because price reductions stimulate farmers to cut further on costs and to apply more efficient farming systems (which are less compatible with the delivery of the non-commodity output). Examples are the pressure on landscape or cultural heritage elements not compatible with lower cost technologies as well as the negative effects of intensive practices on landscapes such as e.g. the use of modern feed containers. In a number of cases the global effect is not clear as it will depend on substitution possibilities, overall competitiveness (and thus the remaining in production). The central question hereby will be in how far the adjustments in farming systems are compensated.

3. Institutional instruments for non-commodity outputs

In general the problem of the delivery of non-commodity outputs can be qualified as a transaction of a public good problem between farmers and society. The problem is one of transaction and remuneration rules because for public good individual demand is hard to express because the market is not functioning. But not only the individual demand can not be expressed for collective goods but often also the supply must be coordinated (e.g. in case of flood control or landscape provision) with as major problem how to avoid free riding. To coordinate demand and supply a number of intermediate institutions are possible. Figure 1 gives a schematic representation which is then further discussed.

3.1 Market creation

When the equilibrium point on the production possibility curve is not satisfying the demand for one of the non-commodity outputs, mechanisms or instruments have to be found shifting the equilibrium point toward the desired combination. Market creation or in other words

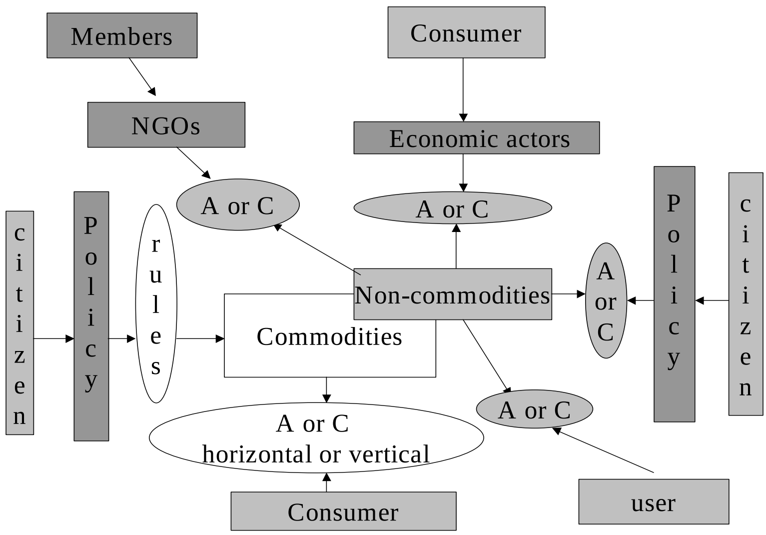

Figure 1. Intermediate institutions (A = arrangements and C = Coalitions) to deliver a changed commodity-non commodity output bundle.

making it possible that the demand is expressed through the price mechanism is of course is the first option. However, this highly depends on the public good characteristics of the non-commodity output. Most of the analysed non-commodity outputs are pure or local public goods with as characteristics non-rivalry (meaning that use by one consumer is not reducing the possibilities of other consumers) and non-excludability (meaning that it is not possible to avoid consumption). Organising rivalry is in most cases not possible except in some specific cases where a use value exists and property rights can be assigned that limit the use by others (e.g. special breeds or old farm buildings that may have a value for other activities (restaurant and so on). Also when the non-commodity output is or can be linked to a commodity output, a market can be installed. Direct market creation (meaning that the non-commodity output as such can be marketed) is in most cases impossible or very difficult. More frequent in practice are forms of indirect marketing, meaning that farmers will provide non-commodity outputs because this creates higher possibilities and remuneration for associated commodity products. In the case of agricultural commodities it means that the value of the non-commodity output is reflected in the commodity prices using institutional arrangements such as labels or other market separation mechanisms. In the other case, the production of non-commodity outputs makes it possible to create more added value e.g. through direct marketing in regions that can attrack rural tourism. In both cases specific arrangements (e.g. labels) or coalitions (between tourism and farming sector) can increase the value of the commodity production and by that also the production of the associated non commodities.

3.2 Government intervention

However, for many functions markets are not functioning because it concerns pure public goods. For functions where market failure exists, government intervention is necessary, either to translate the societal demand into regulations, standards or norms or by providing incentives paid by the tax payer in order to create a demand market. Collet et al. (2001)

distinguish, based on Salais and Storper (1994), three action models for intervention: either the authorities act as prescriptor (meaning that they tell what and how to produce), as regulator (meaning that they only tell what to produce, but leave it to the sector on deciding how to reach it) or as actor (meaning that the authorities is searching and developing together with the farmers and/or other actors delivery mechanisms by stimulating innovation but without ex-ante defining a certain amount or objective). Which action model is the best highly depends on existing knowledge on the relation between farm practices and the delivered outputs and the possibility of control. If a certain level of non-commodity output can be reached through different practices and the authorities are able to monitor the result, regulation through norms and standards, this is the easiest way. If however, one or a few practices are able to deliver the required level of non-commodity outputs and the practice is easier to be controlled than the final result, the state has to enforce the practices. In the third case, when the exact delivery mechanisms are not yet (fully) explored, the authorities may better act as stimulator of innovation, than as prescriptor or regulator. In a lot of cases of course intervention will be based on a combination of prescription, regulation and stimulation. Situation may also change in time. In the beginning, the State may stimulate the search for alternative production practices and when these have proved their possibilities regulating and/or prescribing their application. A good example is the development of integrated pest management systems where first the innovation has been stimulated and later regulated (through reconnaissance of the system) and even prescribed for certain applications.

The above models of action can be translated in four forms of intervention: 1) direct provision; 2) mandatory instruments obliging farmers to provide other functions; 3) the public pricing of the function and 4) compensatory payments providing economic incentives.

3.2.1 Direct provision

The first possibility is the direct provision by the authorities of the function. This is of course only possible for a small quantity of public goods that are highly valued such as e.g. cultural heritage elements, highly valued ecological systems and so on. This instrument means that a public authority obtains the property rights on the land and pays for the maintenance or provision of the function that needs to be protected or delivered. In some cases the state may even pay farmers for it (e.g. to maintain a certain farming system or cultivating the land according to certain practices necessary for the maintenance or delivery of the function). The main difference with other instruments is that the state (or a designed body) obtains full property rights making the negotiating position totally different compared with other instruments where farmers keep property rights. Therefore this instrument is only suitable for very specific cases and functions, in particular those which can hardly combined with a competitive form of farming. A prerequisite here is of course that the state has full knowledge on how the non-commodity output can be obtained.

3.2.2 Command-and-control instruments

A second instrument is mandatory provision through so called command-and-control measures. This means that farmers are by law or regulation obliged to deliver certain functions mostly by limiting the property rights of farmers concerning land use choices (e.g. forbidding the ploughing of grassland) or concerning application of certain farm practices (e.g. limitation of cattle stock per hectare or on the use of manure). In most cases this seems feasible, but the question is if it is in all cases the best solution. Following elements need to be taken in the discussion: 1) the amplitude of the measure and effect on internal competition (all farmers within a country or only part of them) as well as on the international competitive position and 2) the possibility of enforcement of the measure.

With respect to the first point, the effect of the measure on internal and external competition, it is clear that as long as an obligation concerns all farmers within a country (or a group of countries), there is no high problem of internal competition (although it may be that certain farmers can better adapt to the new regulation than others and that indirectly competitiveness among farmers is influenced), but that there may be a problem of international competitiveness of a sector (e.g. more stringent regulations in one or some (group of) countries may influence the international position of that sector). Therefore a balance will always to be found between demand for the non-commodity function versus the economic consequences for the delivery of the commodities produced. Hence, in the long run it may be that if competitiveness of a sector is not guaranteed, also the non-commodity function that was aimed to be protected, is endangered (if there is a close link with the existence of the farming system). This is the main reason for the EU to defend a certain general support for farmers to compensate the reduction in competitiveness due to a number of other functions EU farmers are obliged to fulfil. One of the problems is of course the lack of a benchmark situation for comparing competitiveness.

If a measure is more targeted (what for a number of functions may be necessary as delivery is or has not to be uniform over all farms), mandatory measures may also influence internal competition. Important may be in how far certain constraints will be reflected in the price of resources (mainly land). If mandatory measures cause a reduction in land prices because taken this land in production becomes less attractive, in the long run this may compensate the loss of productivity. A problem is of course that this only compensates future generations of farmers, but not the actual one who may even loose two times (once because of reduced productivity in the commodity production and once because they may not be able to recuperate the high land prices they have paid). This may be overcome by buying out the loss of property rights of present farmers (by preference trough a one time payment or if not possible temporary compensations for a given period).

A major problem in the application of mandatory instruments is of course the enforcement. In theory it is possible to work out a regulation for the provision of non-commodity outputs, but in practice they can hardly be controlled or only enforced at a high cost (e.g. the non-use of certain inputs to protect the biodiversity function or the application of certain farming practices such as late mowing). Therefore another element in the discussion are the transaction costs in enforcing the delivery trough different mechanisms. In general, this makes that mandatory instruments are restricted to situations in which they only prevent extreme under provision of certain functions (mainly causing negative externalities) or in situations where the reduction of property rights is not as big and easily controllable (e.g. exploitation permits, permissions to change cultural heritage elements, …)

3.2.3 Pricing of non-commodity outputs

Another way of influencing the delivery of non-commodity outputs through government intervention is pricing the non-commodity output. This can be the case for functions for which there is clear societal demand, but not a distinctive private demand. If government (or an other collective organisation) can bundle this demand through a pricing system for the non-commodity output (e.g. clean water, produced flowers or number of meadow birds' breeding pairs). If private market creation is not possible, this seems of course a very appealing alternative. It may, however, in practice be very hard to realise because in a lot of cases the link between the action of the farmer and the output of the non-commodity is not straightforward but influenced by actions of neighbour farmers (e.g. water quality in the water courses surrounding the fields) or external factors (e.g. weather conditions). Another problem is the control and monitoring costs as of course such a system would require to count or to measure the individual contribution of each farmer. Besides some attempts in the Netherlands with breeding pairs of meadow birds, to my knowledge no real other examples of direct pricing of non-commodity outputs exist mainly because what need to be achieved is often a shift in farming practice and not a real measurable output.

3.2.4 Economic incentives

Therefore the fourth and, probably most applied instrument for achieving a shift on the production possibility line, apart from mandatory regulations, are economic incentives to producers for applying on voluntary basis certain production practices (or preventing that they shift to less a less desirable combination of commodity and non-commodity outputs). In most cases the mechanism used is to give subsidies or compensatory payments to cover the cost or price difference with farming systems that do not provide a sufficient level of non-commodity output. As long as the remuneration is sufficient to cover the higher cost they have not to affect the competitive position of farmers. However, the stability of such measures in the long run is debatable as in most cases the situation will be reversed when the remuneration is ceased. A problem may also be that long run effects are under-estimated if only actual losses are compensated. This might e.g. be the case when due to the contractual arrangements farmers have lower possibilities to innovate or to apply new technologies what may affect their future competitive position. A lot of the measures in the framework of regulation 2078/92 and Agenda2000 take the form of such voluntary provision in turn for compensatory payments.

4. Collective action

So far, we have concentrated on individual provision of functions by individual farmers through market-led or government instruments, which finally also create an individual market (either through the influence on resource prices or by creating a market for voluntary provision in turn for compensatory payments). Another possibility is a more institutional approach in which collective action is stimulated. This may take two forms depending if it is the demand side for non-commodity outputs that is organised or the supply side (or a combination of both). At the demand side, the problem is that it is often impossible to organise transactions between individual consumers and individual suppliers (and thus payment) of the non-commodity output. If however, mechanisms can be find to bundle individual “willingness-to-pay” and thus organise the collective demand, it may be possible to organise the transaction with suppliers. This may be a good alternative for local public goods (such as e.g. local landscapes, soil conservation or avoidance of erosion) or rather scarce public goods for which people wants to contribute. In these cases trust or local NGO-organisations may be formed either to negotiate the provision of the non-commodity output, or to collect money of individual consumers or citizens to pay for its provision. This mechanism is then the same as the state-pays-instrument of section 3, but in this case the money (or the resources such as e.g. the labour for maintaining the non-commodity output) is collected and organised through a private fund or trust. Again it is often a problem of transaction cost to get such systems work because this involves a lot of organisational costs that also have to be paid from the collected money. In some cases, however, this may work as e.g. to protect cultural heritage or natural value elements (e.g. local action or nature conservation groups). Maybe, this kind of mechanism through which individuals may express their willingness-to-pay for certain functions should be further developed (possible in co-operation with authorities, cf. tax reduction systems for money allocated to certain objectives, etc.). There may be scope to use or develop new collective financing possibilities (e.g. ethic investment funds or other innovative financing mechanisms).

Also at the supply side, organisation of the offer may be a way to increase supply of certain non-commodity functions. As stated above, one of the problems for individual market or compensatory payment schemes are the high individual transaction costs. Through bundling the supply side, important economies on transaction cost can be realised. For an individual producer e.g. it is a very high cost to set up a private label to make it possible to market the jointness with a non-commodity output. In that case organisation of farmers allows to divide the costs and in particular to reduce the private transaction costs to search information on production practices required, legislation, market opportunities, to negotiate a premium price with large distribution channels or to monitor the jointness between the commodity and non-commodity output. In Verhaegen and Van Huylenbroeck (2001) it is indicated for a number of innovative marketing channels how transaction costs can be reduced through collective action.

Collective action at suppliers side may also be a solution if supply of the non-commodity output or function depends on the joint action of different actors. A good example of this are environmental co-operatives delivering landscape goods and services (Slangen and Polman, 1999) or farmer groups organising local water conservation. But collective action must not be limited to farm organisations; coalitions are also possible between farmer associations and organisations of other stakeholders with interests in the rural area such as the already mentioned tourism sector, but also local communities who may be want to pay for water conservation. Other economic actors (water companies, tourism sector) will act as intermediates translating the demand of individual consumers and negotiating with local farm associations in order to protect their own economic interest

By organising farmers, a global plan of action can be developed in which the role of individual producers is defined. The global plan is then approved and paid for by the authorities or the trust demanding the provision of the non-commodity output while the collective organises the payments of individual contributions. This allows not only to exploit the synergies of collective action (the global organised provision may be better than the sum of individual provision) but also avoids under- or oversupply that may result from individual reaction on incentives. This is certainly also a mechanism that needs further to be explored and developed. A major problem may be the monitoring of individual contributions and avoiding free rider problems. But investment in effective cost monitoring and control systems may overcome these problems.

Collective action may overcome some of the problems mentioned at the end of section 3 in case of individual delivery, but also collective action is sometimes hampered by problems at the juridical, legislative, financial, and fiscal level. Stimulating the delivery of non-commodity functions may therefore also require action at the institutional level for creating more adapted institutional forms. Hereby the property right issue may be crucial as for a number of public goods it is necessary that one or another form of collective ownership is installed in order to create a club good.

5. Conclusions

Agriculture has always provided different functions to society. They can be regrouped in three main categories: commodity outputs (food, but also non-food commodities), socio-cultural functions (employment, rural viability, cultural heritage) and environmental functions. Prevailing combinations of these functions are the result of reactions of farmers on commodity prices on the one hand and incentives for non-commodity outputs on the other hand. If there is market distortion or in other words if there is a demand for more multi-functionality, the “price”-ratio between commodity and non-commodity outputs have to be changed so that the equilibrium point on the production possibility line is shifted. This can be done by using different instruments as the late Maurizio Merlo had very well understood in his writings.

In theory non-agricultural provision is possible, but this is in most cases more expensive then agricultural provision. Therefore, market or non-market incentives are necessary to convince farmers to adjust their resource combination toward the desired equilibrium. The level of incentives necessary to convince farmers will of course also depend on commodity prices. One of the reasons for under-provision of certain functions may be the distorted prices for commodity products. However, one must be careful in his analysis as a global price decrease for commodity outputs does not necessarily mean that the provision of non-commodity outputs would increase because this will *inter alias* depend on the competitiveness of farm production systems. It may be that with lower commodity prices only large scale and intensive farming systems with lower levels of non-commodity outputs may survive or that land is taken out of production and thus also the non-commodity output. This give some argument to provide a general (non-coupled income) support to farmers, although a more differentiated system of stimulation of farming systems that provide a higher level of non-commodity output but that are therefore disadvantaged and not competitive in the commodity markets, would be more corrective.

Although directly or indirectly markets may be created for a number of non commodity outputs, because of their public good character, government intervention seems inevitable in a lot of cases. Such intervention may take different forms. Often the role of the State can be limited to the provision of a legislative framework so that market creation is possible or even institutionalised (e.g. allowing private labels, collective property rights). Sometimes, a more prescriptive form of intervention may be necessary, certainly to avoid negative externalities. However, in most cases a combination of both configurations has to be searched and the State has to stimulate private and collective action. In such configuration, the state tries to stimulate innovation through legislation, regulation, subsidies and other instruments in order to achieve the required shift toward farming systems providing the requested mix of commodity and non-commodity outputs without imposing it. There is certainly also scope for forming coalitions between different rural stakeholders. A lot of other stakeholders in the rural area are dependent on non-commodities produced by farmers. By searching for specific arrangements among them new possibilities to remunerate farmers for non commodity outputs may be created. It is then up to the individual farmer or to groups of producers to make use of the created possibilities. The new EU rural development policy should stimulate more this kind of interactions between rural stakeholders by creating possibilities for bottom-up approaches which do not only involve farmers but also other stakeholders having economic and other interests in the rural area.

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Institutional Analysis of Changes in British Forestry: Evidence for Post-Productivism?

Maria Nijnik[1], Alexander Mater[2] and Gary Hill[3]

[1]Social Economic Research Programme, The Macaulay Institute, Aberdeen, Scotland, UK
[2]Department of Geography and Environment, University of Aberdeen, Scotland, UK
[3]Sustainable Development Research Centre, Moray, Scotland, UK

Abstract

This paper focuses on post-productivism (PP) in British forestry in aspects of public opinion, forest policy and practice. The transition of forestry from the expansion of material production to new objectives, particularly related to the environmental services, is analysed from the institutional economics perspectives. The paper concludes on the necessity of operationalising social values into concrete forest management decisions, where shifts from a timber management to a multiple resource model, and from a forest-focused to a people-focused concept are crucial. The findings suggest that the existing forest economic models must be refined, and new economic theories must be developed to incorporate the features of PP in the sustainable forestry practices.

Keywords: multifunctional forestry, post-productivism (PP), institutions, public involvement, sustainable development

1. Introduction

The concept of sustainability in forestry was formulated in German forestry literature as far back as in the 18th–19th centuries. It started from a narrow idea of the yield of wood. In 1804, Hartig defined sustainability as follows " Every wise forest director has to have evaluated the forest stands without losing time to utilize them to the greatest possible extent, but still in a way that future generations will have at least as much benefits as the living generation (Schmutzenhofer 1992: 2). The term "human benefit sustainability" was introduced into the North American forestry practice in the middle of the 20th century, and the following benefits from forest have been identified as most important: timber, fish and wildlife, recreation, range

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and fodder and watershed protection. Since the late 1970s the concept of "social forestry" has gained prominence, with a shift from a forest-centered to a people-centered paradigm (Wiersum 1995).

By the time of the UNCED conference (1992), quite a few countries had developed principles for sustainable multifunctional forestry. The principles were discussed and the debates resulted in a document that reflected the first global consensus towards sustainable use of the multiple forest functions. The statement of Principles of Forests "forest resources and forest lands should be sustainably managed to meet social, economic, ecological, cultural and spiritual human needs of present and future generations" has become a guiding document. The Principles and the emergence of various international institutions and agreements have accompanied changes in the dominant attitudes towards forests in many parts of the world.

When forests are becoming multi-functional places of amenity consumption, recreation and wildlife observation rather than mono-functional places of production (Mather 2001) (Table 1), the concept of sustainability in forestry expands to cover sustainable multi-functional forest use. Sustainable forestry concerns delivering a socially acceptable distribution of incomes and benefits from forests, and suggests creating opportunities for more people to enjoy woodlands and helping rural communities to benefit from them (Nijnik and Hill 2005)

A reduced emphasis on material production, combined with an increased importance on the provision of environmental and social services has characterized forestry in Britain, on the edge of the last centuries. This phenomenon is also observed in (midland) Central Europe, North America and Australia (Mather 2001). Forestry in the UK aims at meeting multiple and dynamically evolving requirements of the people, which reflect public preferences for multifunctional forestry and necessitate their satisfaction in a sustainable manner. Post-productivism could be used as a descriptor of this transition in emphasis away from policy concern with increasing material production, and towards concern with the provision of environmental services (Mather et al. 2005).

The articulation of the observed transition in forestry development and obligations with forest policies within different countries is a motivating issue. The paper focuses on Britain and starts with methodological aspects of examining forestry transition to PP. By using the institutional paradigm as the principal framework, multi-functionality in forestry is examined. It is revealed that PP is the reflection of social, economic and environmental conditions when the principles of sustainable forest management are becoming different than the timber yield regulation principles of forestry, in the past. The paper discusses some of the elements of PP and examines its emergence and performance in forestry in the UK. This leads to a number of conclusions, with the view of considering future directions of forestry development which, in turn, depend on the policies and institutions, the forestry adopts.

2. Rules in use: do they work for post-productivism?

2.1 Methodological aspects

The neo-classical economic theory analyses the demand and supply sides of production, and suggests that a well-functioning market can account for the costs and benefits created in the economy, by putting right prices to guide resource use in a sustainable way. However, social gains from forestry are becoming increasingly multiple, and they are often not included in economic models. Multiple forest values have a much broader spatial and temporal distribution than the distribution of the costs. It happens therefore that the recipients of forest

Table 1. Forest benefits.

Production/goods (material)	Services (non-material)
Wood: - logs - industrial round wood - pulpwood - paper and paper board - chips and particles - wood based panels - fuel wood	Environmental Regulatory: - protection of soil - regulation of climate global and local - water regulation and purification Support: - of livelihoods and habitats - biological diversity
Non-wood products: - berries, mushrooms, nuts, honey, game, birch juice - medical herbs - fodder for domestic animals - materials, as wool and skins - decoration	Social Recreational functions: - leisure and tourism - game and fishing - landscape Information and reservoir: - a source of species and genes - socio-cultural, spiritual - intrinsic natural values

Source: adapted from FAO (1996).

benefits do not repay the society in full for the costs of their activities, and externalities negatively affect forestry. The reason of the existence of various externalities can also be explained by the fact that forest benefits often exist as public goods. The non-marketable public goods of forest possess the properties of non-rivalry and non-excludability that cause market failures (Slangen 2000). For that reason, the role of good institutions (Shleifer and Vishny 1998) to control the tenure, management, financing and production of public goods in forestry is becoming incredibly important.

In neo-classical economics, preferences are fixed and stable, and economic agents are rational. The value system and time preferences are exogenous and decided largely by the market. Institutions are exogenous either and their role in achieving economically optimal outcomes is neglected (Kant 2003). With the inclusion of peoples' preferences for multiple forest functions in the decision-making process, attitudes and values held by the public become endogenous. When the traditional mono-functional concept of forestry fades and 'sustainable multi-functional forest management' is embraced, public involvement is becoming increasingly influential (Kant 2004). The high level of participatory democracy is manifested in collaboration of key stakeholders, in the initiatives to involve the public in environmental decision-making and in the extension of information and education (DETR 2000).

There are three basic mechanisms of governance: markets, hierarchy (authority) and collective action (Gerrard 2000). Today, governance that conceptualises public perceptions, and first of all those of local communities, evolves. The governance is largely based on collective action when people act together driven by common interests. Sustainable forestry under these conditions focuses not only on sustainable timber management, but even more so on sustainable management of non-marketable forest goods and the intrinsic values of forest environment. Multi-functionality characterises PP, when social values of landscape amenities, wildlife and forest recreation etc., are increasingly perceived as more important than commodity production. PP is a reflection of economic, social, cultural and environmental developments in a modern Britain, where and when forestry no longer can be considered through the underpinning principles of neo-classical economics.

The results of simulation modelling of timber rotation indicate that a profit maximising objective does not always correspond to efficient behaviour, and therefore often, neither Faustman (and even more so), nor Fisher rotation leads to optimal solutions and to highest social benefits (Nijnik 2004). Often when amenity values are large and not captured by the forest owner, inefficiently short rotation of timber is promoted. To take into account multi-functional use of forests the Faustman model was extended into the idea of maximisation of the NPV of the revenue flows from both timber and non-timber forest outputs (Hartman 1976). When forest's ability to accumulate carbon is incorporated into the model it is further extended (Van Kooten and Bulte 2000). In most cases, the rotation ages of stands in forests used for multiple purposes appear to be higher. Thus, especially where multiple forest values are considered to be important, some time it may be socially optimal to postpone harvesting depending upon non-timber contributions from forest.

The ideas of multifunctional forestry and the ideas and principles developed by evolutionary, institutional and ecological economics must be taken into account in forestry decisions. The boundaries of forest economics must therefore be extended toward the incorporation of a multiple equilibrium and new consumer choice theory in its newly developed models (Kant 2003). These multiple-use and multiple criteria modes of a post-productive forestry must be sensitive to institutions the current state and the dynamics of which are becoming critical for addressing sustainability successfully in a multifunctional forestry.

This paper does not proceed to the extension of the boundaries of forestry economics. Instead, it employs methodological approaches of new institutional economics (NIE) to examine some elements of forestry transition to post-productivism. The theory of NIE suggests that there are two main approaches for examining institutional changes (Ostrom 1990; North 1993; Sabatier 1998). The first approach considers "action arenas" and focuses on actors, in our case in a forestry field. The actors have their preferences and information-processing capabilities. According to this approach, substantial changes in the "action arena" must be made to advance forestry development. The characteristics of the physical world and "the rules in use" that constitute both the institutional environment and the attributes of the community should be modified (Ostrom 1994).

Among the ways to explore the mechanisms of institutional changes from this perspective is to consider changes as caused by the actors' responses to shifts in prices and preferences (Weimer 1995). This approach argues that, though inefficient institutions can exist because of path dependency, more progressive institutions are continually created in society (North 1993). Another view within the actors' scheme explains the transition as a result of conflicting interests, when institutional arrangements change because of bargaining, and thus not all the changes are progressive (Knight 1992). The second approach to address institutional transformation, e.g. forestry transition to PP is to focus on economic development as its primary cause. A system of institutions is then considered endogenous, and being dependent on economic progress. It is argued that, at certain stages of societal development, economic progress exceeds institutional advance. When the gap appears to be broad enough, political and social preconditions for institutional transformation arise within society itself. Organisations and actors' perceptions are regarded important, but they are not considered the main cause of institutional changes, but rather their consequences.

The paper follows the "actors' perspectives" approach of exploring institutional changes. The institutions are believed to represent themselves through a legal relationship between policy actors in the "action arena" of forestry, and the rules in use, both formal (policy and economic rules) and informal, are the driving forces that govern the patterns of interaction

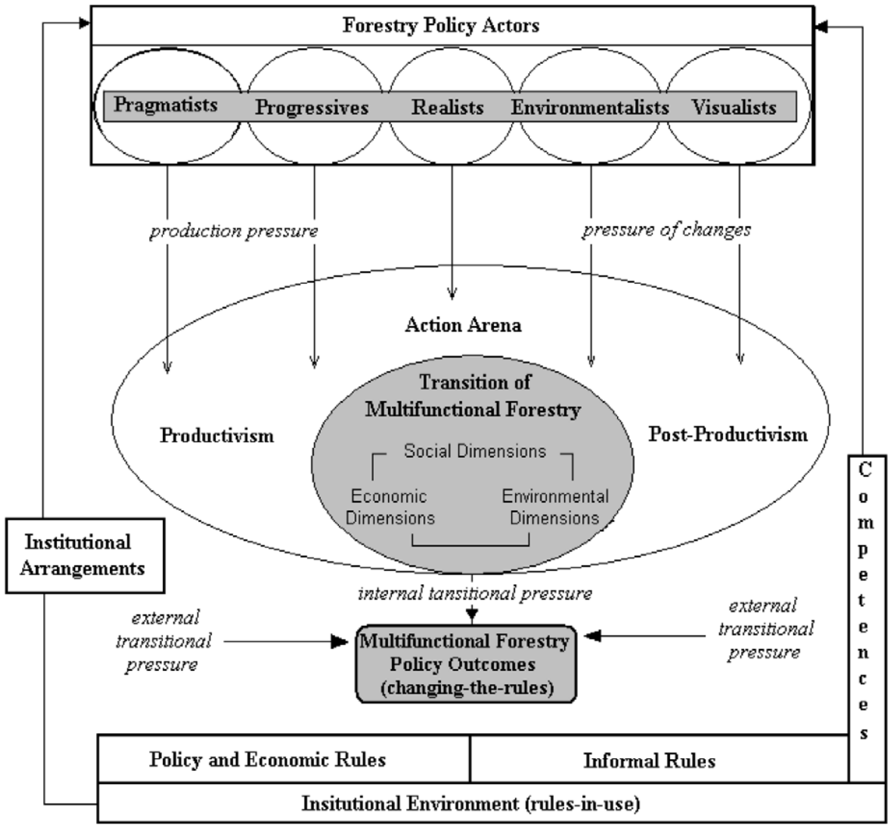

Figure 1. The framework of forestry transition to PP.

within the whole institutional system. The framework of forestry transition to PP has been developed to provide a better understanding of the processes that are taking place in a multi-functional forestry. The institutional environment and arrangements, and the interaction between policy actors in the "action arena" of forestry, are shown in Figure 1.

2.2 Institutional environment: "the rules of the game"[1]

Allowing for this perspective to address the question of whether there is a shift in British forestry toward PP, the institutional environment has been examined. Traditionally, "the rules in use", or policies relating to agriculture and forestry in Europe, have been oriented towards production. Yet starting from the 1980s, such schemes as e.g. Environmentally Sensitive Areas (ESA) and changes introduced in the reform of the Common Agricultural Policy (CAP) (EC 1992), have provided support for multiple objectives. In 1996/1997 to compare with 1987/1988, for instance spending on ESA has increased 13.5 times in England and Scotland

1 For more discussion, see North (1993). See Nijnik and Oskam (2004) for a discussion on governance in forestry. For explanation of attitudinal diversity of forest policy actors, see Nijnik (2004).

alone (Hanley et al. 1999). Today, aid for woodlands development for multiple purposes is given by the European Union (EU) initiative, in which the Agricultural Guidance and Guarantee Fund finances up to 75% of the costs. Primarily as a result of the support (but also for other reasons) the area of EU forests (113Mha) has extended by 3% over the last decade. The expansion of forests, to the extent that their area has more than doubled, was one of the main land-use changes in Britain during the 20th century. Initially, the change was driven mainly by a perceived need to increase timber production. However, by the early 1980s the coniferisation of some areas of native woodlands was attracting opposition. By the mid-late 1980s there was strong resistance to the establishment of monoculture forest plantations on both, environmental and social grounds.

By 1992, the Forest Principles had provided an external impetus to review the forest policy and re-casting its objectives. These consisted of sustainable management of the existing woodland estate, and continued steady expansion of woodland (FC 1991). Subsequently, forest strategies were introduced, with over-arching themes such as sustainability, integration and partnerships and each with a set of aims or 'directions' that could be categorised as multi-functional, and 'post-productive' in the sense that they post-dated and contrasted with previous policies that focused primarily on timber production. Data from Table 2 complements the principal priorities of the measures within the Rural Development Programmes (RDP).

The RDP priorities are summarised in Table 3 and split into three categories: re-structuring and competitiveness; environment and land management; and rural economy and rural communities (MLURI 2004). The analysis of the priorities across countries shows that, for instance in Scotland, priority 1 measures comprise most of the significant woodland options, including the promotion of the Woodland Grant Scheme (WGS), agricultural diversification, plantations of short-rotation coppice and afforestation. This country has explicitly identified measures aimed at the protection of historic and archaeological sites and at the encouragement for tourism. Forestry development and diversification of the activities are the first priority measures also for Britain as a whole. Other measures with a common level of support amongst countries are environmental protection, including that of landscape management.

There is quite some evidence therefore that the development of the "rules of the game" proceeds in the direction of multi-functionality toward PP.

2.3 Institutional arrangements: "the play of the game"

The institutional arrangements in forestry are characterized by co-management arrangements among such major actors as: central government agencies, local governments, community-based organizations, farms and enterprises. The devolved structure of government means that many of the principal regulatory frameworks and the policies most significant in terms of human-nature interactions are determined by the Scottish Executive (SE) and Scottish Parliament, the National Assembly for Wales, Northern Ireland Executive and Assembly, or through government departments for England, but with inputs from regional planning groups, and the public. Each part of the UK has its approach to implementing delivery mechanisms of the schemes that support forestry related objectives, and those relating to biodiversity conservation, landscape designations, and protection of cultural heritage. Government agencies implement the policies according to different rules and regulations. The Forestry Commission (FC) summarizes standards and measures to manage forest sustainably.

The policy of woodland expansion is supported by direct financial instruments in four different programs which subsidize 60–90% of the costs. Payments vary across land categories, tree species and distances of the land from settlements. An annual payment also

Table 2. Forestry strategies objectives across countries.

England	Scotland	Wales
· Rural development · Economic regeneration · Recreation, access, tourism · Environment and conservation	· Maximise value of the wood resource · Create a diverse resource · Positive contribution to the environment · Opportunities for more people to enjoy trees, woods and forests	· Woodlands for people · New emphasis on woodland management · Location for world-class forest industry · Diverse and healthy environment · Tourism, recreation and health

Sources: FC (1998); SE (2000) and Welsh Ass. Govern. (2001).

Table 3. Principal priorities of RDP measures across countries.

	England	Scotland	Wales
Restructuring / Competitiveness:			
Agricultural water resource management	1	-	-
Development/improvement of infrastructures	-	-	1
Food quality – incentive scheme	-	-	2
Food quality – promotion	-	-	1/2
Investments in farm holding	-	-	2
Investments in processing / marketing	-	-	1
Marketing of quality agricultural products	1	-	1/2
Training	1	-	2
Environmental / Land management:			
Afforestation and forestry	1	1	1
Agri-environment/ animal welfare	-	2	1/3
Environmental protection (agriculture, forestry and landscape management) and animal welfare	2	1/2	1
Areas less favoured and with environmental restrictions	2	1	3
Rural economy / rural communities:			
Basic services for the rural economy and population	1	1	-
Diversification of activities to provide multiple activities or alternative sources of income	1	1	1
Encouragement for tourism and craft activities	1	1	-
Renovation/development of villages, protection of the rural heritage	2	2	-

Source: Based on (EC 2003).

encourages farmers to convert productive land and receive compensation to offset the foregone income from "production". Subsidies are available for woodland expansion, restocking and stewardship, and are usually given for 10–15 years when broadleaved or local species are planted, and wood is not harvested for 30 years (SE 2000). Guidelines are provided on the nature of the desired outcomes, such as a 'balance between forestry and other land uses', and the importance of multi-benefit forests as bringing diversification into the rural economy. The development of native woodlands is strongly supported by the delivery

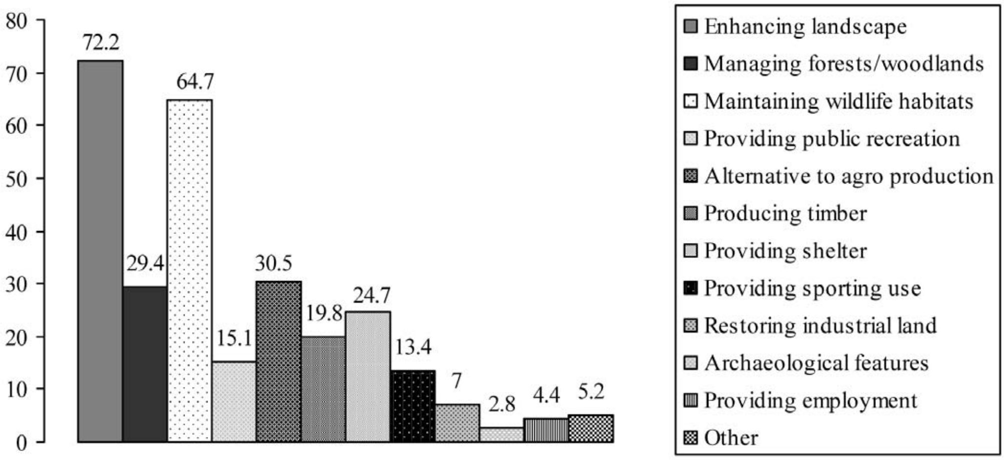

Figure 2. WGS: HP objectives defined in applications of 1995-2002, %. The estimates shown in Fig. 2–5 were computed on basis of data kindly made available by the FC. Number of HP applications=18755.

mechanisms, providing 60% of costs of proposals that include removal of non-native vegetation; deadwood management; essential thinning; and small scale felling to encourage regeneration, etc. (FC 2004).

One of the principal schemes that supported woodland has been WGS.[2] Following the procedure, WGS applicants indicated relative priorities of the objectives relating to applications. The characterizing of profiles of objectives, and in particular of the rankings of 'producing wood and marketable timber' offers a means of quantifying the extent to which PP has become established, in terms of a shift in forest policy and on the ground. Analysis of 'high' priority (HP) objectives, as specified in 1995–2002, leads to two main findings relating to the number of HP objectives per application and their relative rankings (Figure 2).

On the first, the average number of HP objectives per application is 3, with a slight increase from 2.8 in 1995 to 3.2 in 2001. In other words, the new forests are multi-functional. On the second, objectives relating to material production are clearly overshadowed by those relating to the environment.

Also, landscape and wildlife objectives are the most common of those classed as HP. The classic 'productivist' objective of 'producing wood and marketable timber' is only sixth. In the scheme (FGS) that preceded WGS, timber production had to be the primary objective. The fact that it is no longer mandatory, and is in a modest position suggests a significant shift, and lends credence to PP. A similar pattern applies across the country, from the parts of Britain that witnessed rapid 'productivist' afforestation in the 1970s–1980s (Highland and Strahclyde) to those that did not (South-West and South-East England) (Mather et al. 2005). Figure 3 shows that cumulative number of applications, defining non-material forest benefits as HP, is rising at highest rates. This also supports the trend toward PP.

2 Following publication of FS in 2000, the Woodland Grant Scheme (WGS) and the Farm Woodland Premium Scheme have been reviewed in Scotland, resulting in the new schemes – the Scottish Forestry Grants Schemes (SFGS) and Farmland Premium (FP). The WGS is largely closed now also in England, with the transition to the England Woodland Grant Scheme (EWGS), as seen on the website www.forestry.gov.uk/. Other schemes e.g. in Scotland include Scottish Forestry Grants Scheme Farmland Premium.

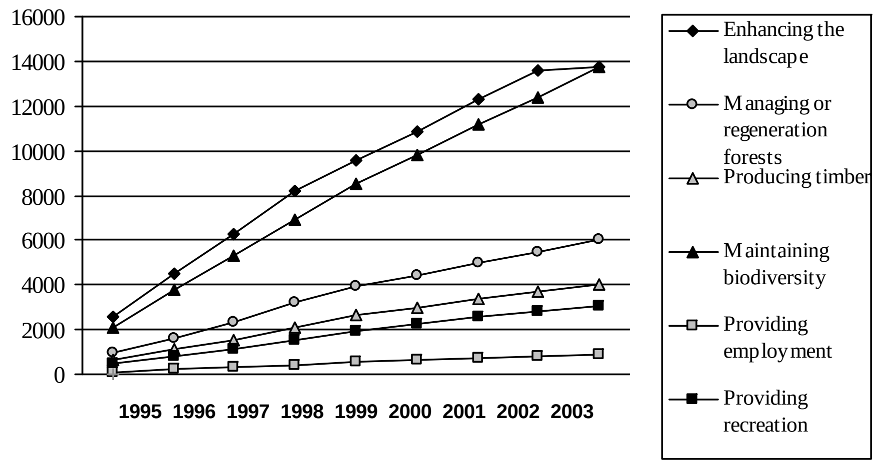

Figure 3. Cumulative number of HP applications, UK, 1995–2003.

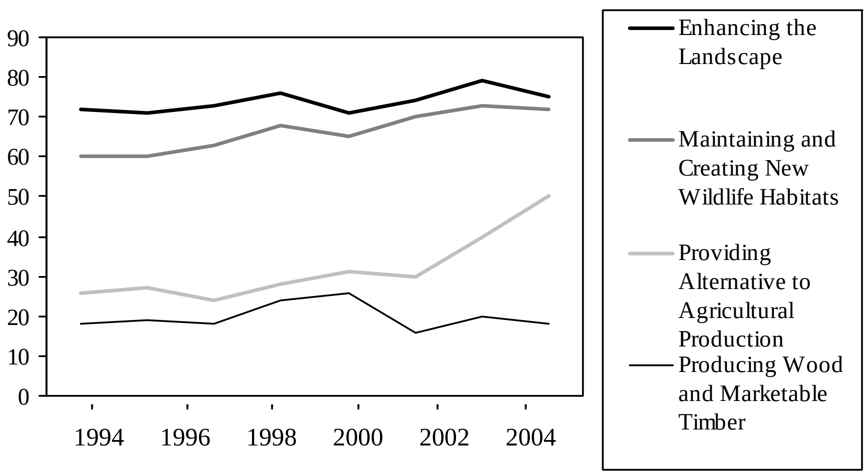

Figure 4. Objectives indicated as HP in WGS applications, %.

The relative tendency has been maintained over several years, whilst the gap between productivist and PP objectives has widened (Figure 4).

Evidence from WGS applications reveals the behaviour of land managers as expressed in the creation of new forests and points to validity of the concept of PP. In addition to the evidence considered above, further signs of institutional transition exist in other forms, such as the felling to waste of non-native species in the course of restructuring some state forests; the increasing attention to ‘continuous-cover forestry’, and the emphasis placed on ‘community’ forests etc.

Finally, Figure 5 provides a more general indicator that permits corroboration of the trend. Until the late 1980s, the planting of broadleaved species was insignificant in terms of the proportion of the area, accounting for well under 10% of all new planting. Since then, the

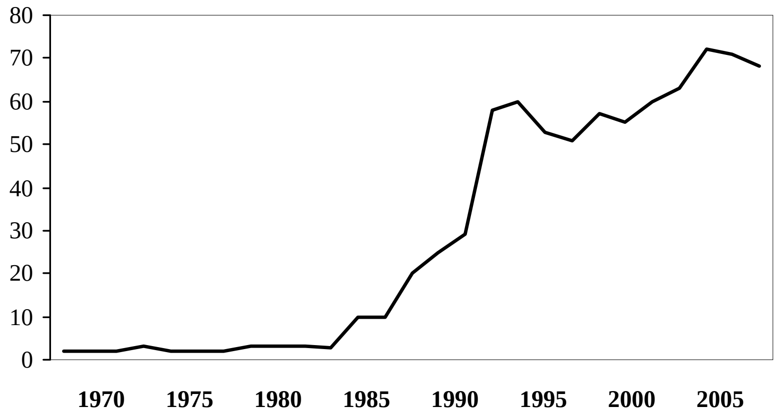

Figure 5. Broadleaved (new) planting as % of total (new) planting. Source: FCa (2003).

proportion has risen steeply. Its trend can serve as a rough proxy for PP, since it is associated with a shift in emphasis towards landscape and wildlife objectives.

The observed institutional transition has led to significant changes in "action arena" of the countryside. Prior to the mid-1980s, farm forestry in Britain was largely unknown. The policy climate, with its sectoral structure, in which agriculture and forestry were often in conflict, had been inimical. While some farmers considered land sales for forestry, few would have contemplated direct involvement in afforestation. Since then, there has been significant institutional integration in land use policy and practice. A fundamental change of emphasis from production to the provision of environmental benefits has occurred in the UK over the last two decades, and the abruptness of the forestry transition to PP is striking.

3. Public involvement

For the reason that much depends on people's opinion about relevant issues of the transition, on public support of the policy reforms, on the competencies of main stakeholders and on their active involvement in implementing changes, the human factor of forestry transition to PP appears to be influential. A growing interest in multi-functional forestry has been observed in Britain. In the most recent Public Opinion Survey (FCb 2003), 91% of respondents indicated at least one public benefit as a good reason for supporting forestry with public funding, with wildlife habitat and recreation the most commonly mentioned benefits. Also, 58% wanted forest expansion in Scotland to continue, while only 1% wanted less forest. Support for multifunctional forestry is also provided in the recent consultation on the management of 'national' forests, i.e. those under the ownership of the SE and management of FC (FCa 2003). This section aims to go beyond these broad survey conclusions. Its primary purpose is twofold: firstly, to provide the results of the analysis of public perceptions on the development of forestry, and then, to discuss public participation in implementing forest policy decisions.

In the light of the Lisbon Resolution's awareness of the "need for an increasing dialogue between the forest sector and the general public to define widely accepted objectives for forest policy" (MCPFE 1998), the research had two main objectives: to assess existing opinions on land-use changes and to provide insights into values and preferences held by the public. The diversity of the ideas of various stakeholders on forestry development and on the integration of ecological, socio-economic and aesthetic aspects in land use changes in Britain has been analysed by using Q-methodology. The results of the research offered a useful contribution to the formulation and refinement of forest policy, by considering in-depth its multiple components, and put forward some innovative perspectives on the areas of consensus and conflict between people, regarding the key objectives of future forestry development.

The results have provided evidence of public support of the policy that promotes tree-planting and expansion of woodlands for multiple purposes. An agreement that multi-functional forestry development is the right direction in which to go in order to multiply forest benefits to society, economy and the environment, has become obvious. The results are in broad agreement with those suggested in previous sections of this paper. They indicate that the protection and improvement of national heritage, biodiversity, and landscapes amenity values are considered by the people in Britain as very important directions of the forest policy (Nijnik 2004).

Moreover the results of the analysis are proven by practice. Public involvement in multi-functional forestry development currently includes thousands of people and various organizations, and trusts (Nijnik and Hill 2005). Scottish Native Woods is e.g. a charity dedicated to the conservation of native woodlands. Like many other not-for-profit organisations, it is supported by government grants, funds from the EU, and by private and charitable donations. Organizations involved in woodlands restoration and landscape management, and biodiversity protection include e.g. Reforesting Scotland. It is a networking organisation of those who are active in the ecological and social regeneration of this country. Involvement of different stakeholders in renovation of the Caledonian Forest has led to the formation of the Caledonian Partnership (1994). There are many other organisations and trusts across the UK, which are involved in managing forests sustainably, for the benefits of current and future generations.

4. Conclusions

The paper has added to some empirical and theoretical evidence of British forestry transition toward PP. This transition is not interpreted as an end to production, rather it is considered as an outcome of social, economic and environmental changes, when forestry principles are becoming different than those of the forest management in the past. PP is addressed as a process that is taking place in forestry, and it is explored on basis of the main standpoints of NIE. The paper attempts to explain some of the changes occurring in forestry. Research of a different spatial focus or scale might provide different results. It is beyond the scope of this paper to conceptualise PP, and a unique explanation of this phenomenon hardly exists. However, since essential institutional changes have occurred in British forestry to affect its shift from productivism to PP, the challenge for its theorization, in terms of primary causes and sectoral implications, is obvious and huge. Furthermore, the challenge is to clarify: Why has the transition to PP occurred at the edge of the 20^{th}–21^{st} centuries? Why in this country? What does it signal about the changing role of rural land in contemporary society? At what extent are attitudinal changes involved? What is the nature of the inter-relationship between possible changes in values at the societal level and that of individual stakeholders? What will be the impact of CAP reform on the development of forestry, as well as the effect of other external drivers, such e.g. as possible changes on the international timber market and trade? How to incorporate a multiple equilibrium and new consumer choice theory in newly developed forestry models to adjust them to modern requirements? How to account for various uncertainties, e.g. for a long list of those associated with climate change? The deliberation of the concept and of its validity puts forward even more questions and bears no less of the typical features of academic discussion. Pertaining to forestry in the UK herewith is our modest contribution to this broad scientific debate.

Acknowledgements

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Using Forest Land for the Compensation of Negative Impacts on the Natural Environment caused by Urban Development

Georg Leefken and Bernhard Moehring

Institute of Forest Economy, University of Goettingen, Lower Saxony, Germany

Abstract

In Germany, a considerable amount of rural (open) land is converted to urban area every day. Under the German law, the impacts of these actions on the natural environment must be mitigated or compensated by the developer or the planner of the action. For economic reasons, however, the almost exclusive usage of agricultural land for compensation measures is no longer possible. This gains an opportunity for forest enterprises to offer nature conservation services for the purpose of compensation in place of farms and to achieve higher returns from this than from conventional forest production.

Keywords: nature conservation services, biotope assessment, business area nature conservation

1. Impacts on the natural environment and their compensation

In recent decades, the developed area (buildings, infrastructure, business and recreation areas) in Germany has continually grown. In the western federal states, it has almost doubled over the last 40 years (BBR 2000: 37). The so-called annual "land consumption" can be regarded as a measure of the current rate of conversion of open land into urban area. According to official information, this amounted to an average of 110 hectares per day during the years 2000–2003 (DESTATIS 2004. Many indicators, such as the continually growing demand of the German populace for more ample housing, the establishment of new business space as well as the growing mobility and the increase in private transportation, indicate that these trends will continue (Gehrke and Kühlbach 2001: 7). Relevant prognoses expect a nationwide increase in the proportion of developed area, including roadways, by the year 2010 from 11.8% (level in 1997) to 13.4%. This corresponds to an area of 564,000 hectares. Urban development will

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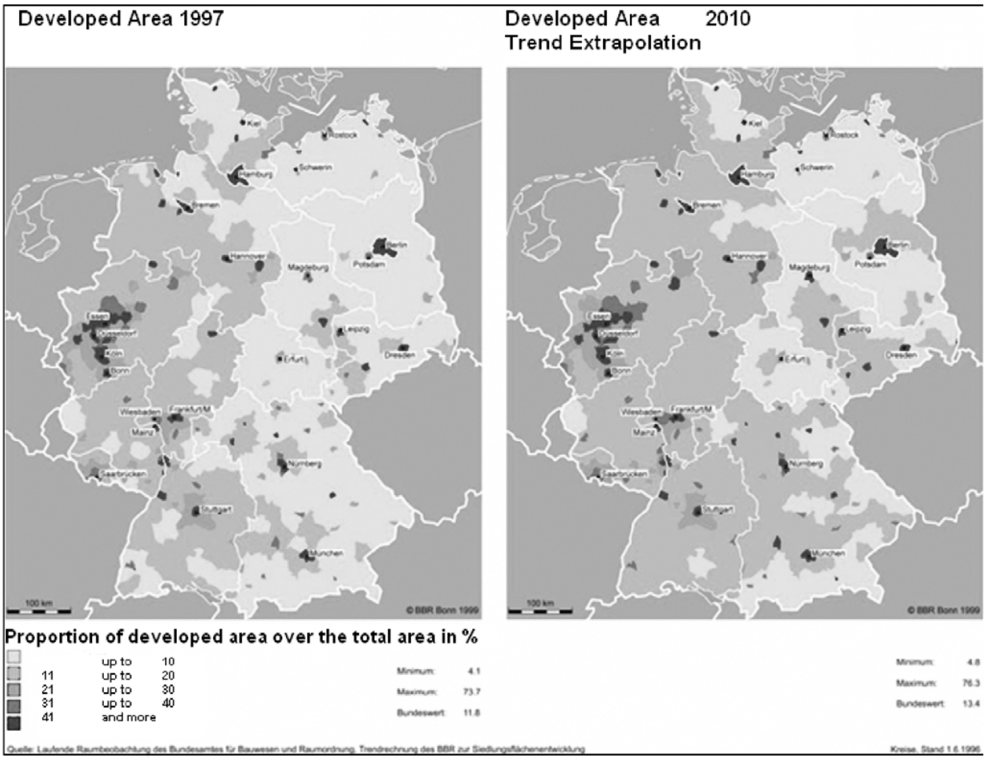


Figure 1. Prognosis (status quo trend extrapolation) for the expansion of the developed area in Germany by the year 2010 (BBR 2004).

continue, especially in the more rural districts of urban regions in western Germany (Dosch and Beckmann 1999: 506, also see BBR 2000: 182f) (see Figure 1).

The urbanization of open land is usually accompanied by impacts on the environment, i.e., alteration of the landscape or usage of the land, which can lead to an impairment of the ecosystem or the appearance of the landscape. Since 1976, nature conservation legislation (the Federal Nature Conservation Act (BNatSchG) in connection with directives of the different states), requires that these negative impacts are mitigated or environmentally compensated. The corresponding activities are now usually summarized under the term “compensation measures”, which also is the commonly used legal term (Bruns 2001, p. 34). Since 1998, as stated in amendments to the nature conservation and the building legislation (Federal Building Code (BauGB)), compensation measures may also be performed outside the area of intrusion (“external”), as long as this is compatible with the desired rural development, the objectives of regional plans and the protection of the natural environment (spatial decoupling).

Previously, most external compensation measures were performed on cultivated agricultural land of good to best quality (cf. e.g. Bunzel and Böhme 2002: 242, ARSU 2003: 101). In most cases, the compensation area was bought by the developer or the community, and the previously intensive agricultural utilization was mitigated in the sense of nature conservation by extensivation (e.g. by conversion into pasture, afforestation or planting of non-timber trees and bushes).

Converting agricultural land for these purposes is becoming more and more difficult for the farmers (Battefeld 1998: 3). Reducing the amount of agriculturally utilized land is viewed critically (e.g. by Gercke and Kühlbach (2001: 8)), because it might endanger the sustainable farm management. Additionally the costs of land acquisition for compensation measures are a considerable burden. This is held true especially in densely populated regions with fertile, intensively cultivated farmland. This combination of characteristics can be found in many regions in Germany (BBR 2001: 158). Moreover, the organizational structure of the farm is an important determinant of the ability to provide land for compensation purposes: The more specialized the farm, especially in animal husbandry, the more difficult it is to relinquish land for compensation services (ARSU 2003: 41).

In addition to the increased costs of compensation measures, the scarcity of land has to be judged critically with respect to the objectives of nature conservation. It has been reported that the fragmented locations of available land can lead to unsatisfactory situations from the viewpoint of nature conservation (Bezirksregierung Arnsberg 2001: 26). At the same time, fulfilment of the required compensation measures in connection with the establishment of residential and business areas or infrastructure is becoming increasingly difficult for local governments regarding to their shrinking budgets. As a consequence, compensation measures that are required by the development plans often cannot be carried out to the extent intended (Meyhöfer 2000: 325 and Balla et al. 2000: 142). As an additional weakness of the previous practice of compensation, it should be mentioned that successful measures are often counteracted (Bezirksregierung Arnsberg 2001: 26) or the long-term maintenance of the realized measure is not fully provided (Balla et al. 2000: 141).

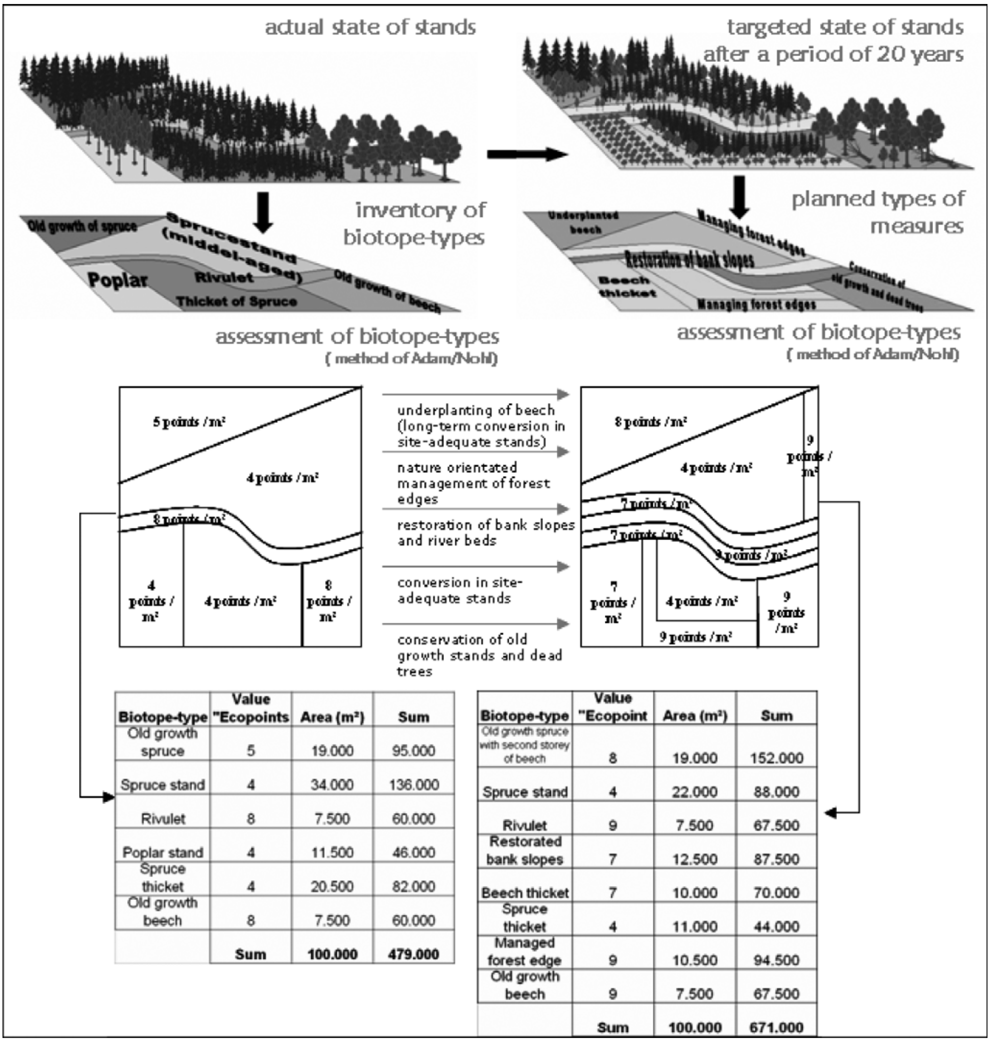
These aspects raise questions as to the existence of alternative concepts to the current practice of compensation. Forest land could become especially important, since new regulations allow its use for the realization of compensation measures.

2. The ecological assessment of compensation measures

2.1 Assessment methods

Since negative impacts of an action on the natural environment must be mitigated by compensation measures, the action and the planned compensation must be assessed on the same scale. A large number of methods, models and procedures for ecological assessment exist, both at the state level and at the level of districts and communities. According to Köppel et al. (1998: 197f), assessment methods can be divided into three categories:

1. Verbal-argumentative assessment bases the extent of compensation on a qualitative dimension. No formalized assessment (calculation) is performed. The results of all assessment steps are typically expressed in words only (cf. Poschmann et al. 1998: 86f, also see Runge et al. 1999: 7f).
2. Biotope value methods assess the ecological value of biotopes to determine and balance the necessary extent of compensation measures. They are based on indicators such as naturalness, restorability, endangering, maturity, structure, species diversity, abundance. Ordinal biotope values are determined for the state before and after the intrusion. The difference between these values determines the required extent of compensation measures.
3. Compensation factor methods are similar to the biotope value methods. They apply factors that define a ratio between the area of compensation to the area of impact in specified intrusion scenarios.



Biotope-type	Value "Ecopoints	Area (m²)	Sum
Old growth spruce	5	19.000	95.000
Spruce stand	4	34.000	136.000
Rivulet	8	7.500	60.000
Poplar stand	4	11.500	46.000
Spruce thicket	4	20.500	82.000
Old growth beech	8	7.500	60.000
	Sum	100.000	479.000

Biotope-type	Value "Ecopoint	Area (m²)	Sum
Old growth spruce with second storey of beech	8	19.000	152.000
Spruce stand	4	22.000	88.000
Rivulet	9	7.500	67.500
Restorated bank slopes	7	12.500	87.500
Beech thicket	7	10.000	70.000
Spruce thicket	4	11.000	44.000
Managed forest edge	9	10.500	94.500
Old growth beech	9	7.500	67.500
	Sum	100.000	671.000

Figure 2. Ecological assessment of compensation areas and compensation measures with using a biotope value method (here exemplary the method by Adam/Nohl/Valentin).

Of these methods, the biotope value methods are the most distinguished in practice. Due to their feasibility, comprehensibility and standardization, these methods are often applied (cf. e.g. Brandenfels 2004: 3 or Runge et al. 1999: 54). In spite of some formal methodical problems, they have developed to conventions (Köppel et al. 1998: 216).

2.2 Using of the biotope value methods

Biotope types provide important standards for the assessment of resources like soil, water and climate/air as well as structure indicators about the environment (MELF NDS 2002: 82). It therefore seems advisable to first record the current state of both the areas affected and the proposed compensation areas in order to estimate the extent of compensation measures.

Table 1. Example of an ecological assessment (method of Adam/Nohl/ Valentin) of forest biotope types in northwestern North Rhine-Westphalia (NRW, Germany) (Leefken and Möhring 2002: 64).

Tree species	Age (years)	Comment	Ecological value (Ecopoints / ha) ADAM / NOHL / VALENTIN 1986
Common Oak	0-60		70000
	61 -100		80000
	>100		80000
Common Beech	0-60		70000
	61 -100		80000
	>100		80000
Black Alder	0-30	on high water-table (glei) sites	70000
	31 - 60		80000
	> 60		80000
	§	old, natural alder swamp forest	90000
Silver Birch	0-30	"normal" stands, no swamp forests	50000
	31 - 60		60000
	> 60		70000
	§	old, natural birch swamp forest	100000
Norway Spruce	0 - 40		40000
	41 - 80		40000
	> 80		50000
Scots Pine	0 - 40		40000
	61 -100	with underplanted beech or oak	50000
	>100	with underplanted beech or oak	60000

The reference for ecological assessment is the current state of each biotope type. Having characterized this state, the ecological assessment and valuation of the intended future state (targeted state) must be performed analogously for each biotope for the compensation area within a given period (here 20 years). Subsequently, the values of both the current and the targeted state are summed up and are weighted (multiplied) by the respective area (m^2) to yield a score (“sum of ecopoints”) for the projected compensation area (“compensation area pool”). The scores are then compared to determine the potential for ecological restoration (see Figure 2). This method of assessment of biotopes thus corresponds to the basic model of balances in the sense of a before-and-after comparison (cf. Kanning 2001: 273). In the following is shown an exemplary application of the assessment method by Adam/Nohl/ Valentin (Adam et al. 1986).

3. A practical application

The “Raesfelder Tiergarten” provides an example for a compensation area pool. It is a compact private forest comprising 150 hectares that lie in the northwestern part of North Rhine-Westphalia (NRW), one of Germany’s western federal states. It consists mainly of elder oak and beech stands of medium quality, a considerable area is covered by pine and spruce stands that originated from other sites. The biotope types over the total area were identified and assessed with respect to their ecological state with the help of specially adapted tables (see Table 1).

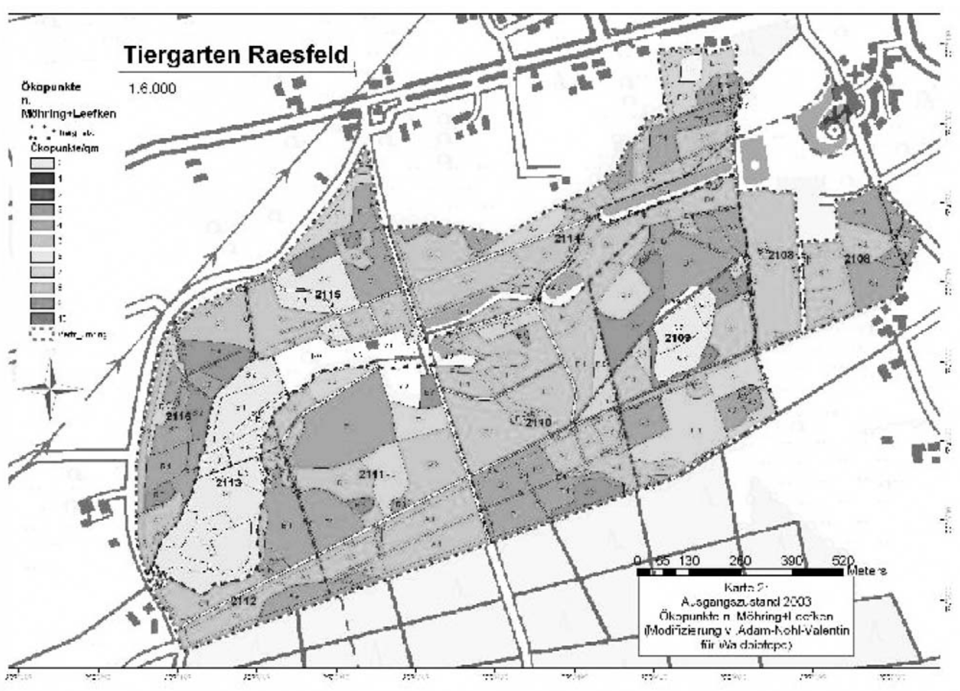


Figure 3. The current ecological value of the forest stands (2003) in the Raesfelder Tiergarten, assessed by the method by Adam-Nohl-Valentin (1989) (Leonhardt et al. 2003).

The results of this assessment were recorded in a geographic information system (GIS) and represented in a map (see Figure 3).

Subsequently, measures were planned for a period of 20 years based on the local objectives of nature conservation. Their predicted results were ecologically assessed (see Table 2). These plans were carried out in cooperation with the local nature conservation administration, the forest enterprise and a forest management consultant. The average potential for restoration of the Raesfelder Tiergarten consisted of a total of ca. 250,000 "ecopoints" or almost 2 ecopoints per m² (by the method of Adam et al. 1986, see Table 3).

4. Economic aspects

Based on actual cases of environmental compensation measures in this region, an average of ca. 1 euro is paid per "ecopoint". Accordingly, the assessment of the 20-year-restoration-potential in the "Raesfelder Tiergarten" amounts to ca. 2.15 million euro or 17,550 € /hectare. At an interest rate of 2% this would result in an annuity of 1,073.30 €/ha. For comparison, under local growth conditions and current forest management regime, the proceeds of timber production minus harvesting costs in this area would reach only 10% of this amount.

Even though the average payment per „ecopoint" will probably decrease as more forested land becomes available for compensation measures, the proceeds can still be expected to lie considerably above those from conventional forest management. For this reason, the

Table 2. Example of ecological restoration (measured in „ecopoints“, method by Adam/Nohl/Valentin) of certain forest biotope types in northwestern North Rhine-Westphalia (NRW, Germany) through single nature conservation measures (Leefken and Möhring 2002: 65).

Nature conservation measures	Implementation	Point in time	Ecological value (ecopoints / m²)	Ecological enhancement in value (Ecopoints / ha)
			ADAM / NOHL / VALENTIN 1986	ADAM / NOHL / VALENTIN 1986
conversion of a coniferous stand in a site-adequate stand with broad-leaved trees	a) clearing of stand, succession	now (actual state)	4	
		in 20 years	7	30000
		in 30 years	8	40000
		langfristig	9	50000
	b) clearing of stand and planting of broadleaved trees	now (actual state)	4	
		in 20 years	7	30000
		in 30 years	8	40000
		langfristig	9	50000
	c) clearing of stand, restoration of a high water table, succsession	now (actual state)	4	
		in 20 years	9	50000
		in 30 years	9	50000
		langfristig	10	60000
renaturation of swamp-forests	clearing of non-site-adequat tree species, restoration of a high water table, planting of black alder, european ash	now (actual state)	6	
		in 20 years	8	20000
		in 30 years	9	30000
		langfristig	10	40000

Table 3. Calculated ecological gain in „ecopoints“ through different types of measures planned for the “Raesfelder Tiergarten” over the next 20 years.

Ecological gain in ecopoints in a period of 20 years			Decade		
Measures		Implemantation	1	2	total
1.	aging		3700	14600	18300
2.	modification of stand type	development by selective removal of tree species	13200	59500	72700
3.	managing forest edges	development of broaleaf forest edge: removal of coniferous trees, promotion of shade intolerant trees	117100	3500	120600
		development of coniferous forest edge: promotion of broadleaved trees, opening up of canopy	207500		207500
4.	conservation of old growth stand	no cutting of mature trees	36400	340200	376600
5.	renaturation of swamp forest	clearing of non-site-adequate tree species, restoration of a high water table	27500		27500
6.	conversion of coniferous stands in site-adequate stands	clearing of stand, underplanting site adequate broadleaved trees	118800	349200	468000
		clearing of stand, succession	45900		45900
		clearing, restoration of a high water table, succession	42500		42500
7.	long-term conversion of coniferous trees in site-adequate stands	protection and development of underplanted broadleaf trees in coniferous stands	116000		116000
		underplanting site-adequate broadleved trees	240700	411800	652500
8.	no activities				0
	total		969.300	1.178.800	**2.148.100**

performance of nature conservation services ("ecopoints") on areas such as the "Raesfelder Tiergarten" appears to be a reasonable alternative to the production of raw timber. However, this requires a clear and long-term strategic change in forest management regime and should therefore be carefully considered and planned.

Certainly the results presented here cannot be completely generalized for other forest enterprises in Germany. They nevertheless show that forested land with a poor productive capacity may possess an economically advantageous potential as environmental compensation area. On such areas, economic productivity can be realized through nature conservation services.

5. Conclusions

It is advisable to systematically develop forests for environmental compensation measures. For forest enterprises, the restoration of forest land for nature conservation purposes presents a good opportunity for appreciable earnings. The money is to be paid by firms whose activities cause negative impacts on the natural environment and are thus required to perform compensation measures. Especially in areas close to cities with high population pressure, there will be a large demand for compensation areas that, for reasons of costs and lack of availability, can no longer be satisfied by agricultural land. Therefore compensation measures on forest land have to be integrated in regional compensation concepts (e.g. particularly in so-called FFH-areas (Flora-Fauna-Habitat)). Such concepts should involve land users at the early stages of regional and urban development planning as well as agricultural and forestry planning. In order to be able to offer compensation measures, forest enterprises have to take an inventory of all sites with ecological restoration potential (e.g. artificial forest stands, especially on ecologically interesting sites such as watercourses, wet or dry areas, cliffs, etc.). Furthermore, the early establishment of contact with representatives of planning, authorizing and implementation agencies (districts, communities, etc.) is necessary in order to clarify whether and to what extent compensation measures are locally needed.

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Forestry Measures in the Context of Rural Development Policies: Application in Italy and Case Studies in Selected European Countries

Luca Cesaro[1] and Pier Carlo Zingari[2]

[1]Inea – National Institute for Agricultural Economics, Italy
[2]European Observatory for Mountain Forests, France

Abstract

The EU Forestry Strategy (1998) emphasizes the role of forest resources in the maintenance and improvement of living conditions in rural areas. The strategy also recognizes that "a chapter specially dedicated to forestry inside the Agenda 2000 could provide a basis to implement the guidelines of resolution for a European forestry strategy". In a sense this statement has been the first step towards a wider consideration of forest resources in the European policies for rural and regional development.

The core instrument for Rural Development Policy is Council Regulation 1257/1999, which stated the objectives and operational rules for the implementation of Rural Development Programmes across Europe.

This paper analyses how forestry measures have been considered and implemented within the framework of rural development policies and plans in Italy. Some additional information refers to major European nations. Emphasis is placed on the strengths and weaknesses of rural development forestry measures in the programming period 2000–2006 and, on that basis, a critical overview is presented of the proposal for a Council Regulation and strategic guidelines for RDP 2007–2013.

Keywords: forestry, rural development, afforestation, other forestry measures, forest policy

1. Introduction

The EU Forestry Strategy (1998) emphasizes the role of forest resources in the maintenance and improvement of living conditions in rural areas. The strategy also recognizes that "a chapter specially dedicated to forestry inside the Agenda 2000 could provide a basis to

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implement the guidelines of resolution for a European Forestry Strategy". In a sense this statement has been the first step towards a wider consideration of forest resources in the European policies for rural and regional development.

The core instrument for Rural Development Policy is, as is well known, Council Reg.1257/1999 (Rural Development Regulation – RDR), which stated objectives and operational rules for the implementation of a rural development policy in Europe and constitutes the legal framework of RD since 1999.

Since the reform, the policy programming instruments for RD measures have been subject to a unification process that combines structural, environmental and forestry measures into a single policy (Storti and Monteleone 2004) and, from a strictly operational point of view, into a single programming document.

This approach, clearly due to a need for simplification, has caused a few problems in terms of implementation.

Referring specifically to forestry measures, since 2000 these have been grouped into two categories: afforestation (of both agricultural and non-agricultural land) and a large group of measures named "other forestry measures". Both have been financed by RD funds. Planned EU spending on forestry for the period 2000 to 2007 is about 4.7 billion euro, half on afforestation and half on other forestry measures.

Four years after implementation of the RD policy as stated in the Agenda 2000, the process of review has been started at European level and, consequently, within the Member States. This process will lead to the definition of a new Regulation, with orientations and measures to be implemented in the period 2007–2012.

Although negotiations are just at their initial stages, it seems appropriate, besides a summary of the main features of the 2000–2004 implementation period, to provide an overview of the new elements of the draft regulation and the main phases that will lead to the approval of the new RDR. Within this overview, a summary of the positions of some countries will be given, with special reference to the forestry measures in the new regulation draft.

2. Forestry measures within the context of RD – Europe and Italy

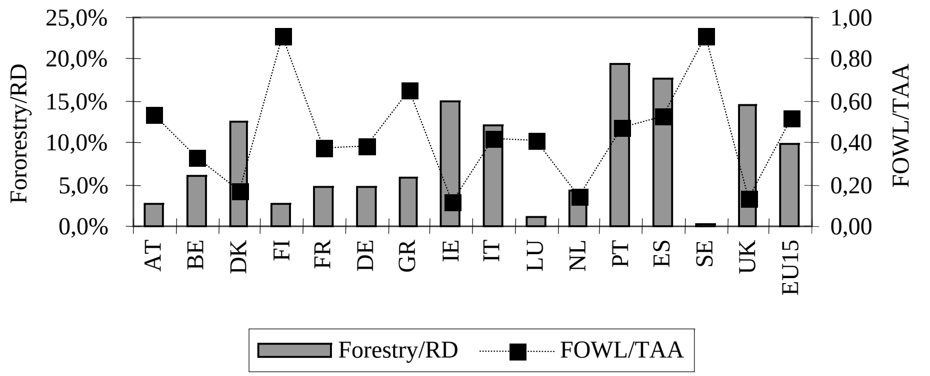
The overall principles of the EU forestry strategy (e.g. multifunctionality and sustainability) are reflected (or are at least supposed to be) in the RD policy, which brings together economic, social and environmental objectives, and transforms them into a coherent package of voluntary measures.

As stated in the "Communication from the European Commission to the Council and the European Parliament on implementation of EU forestry strategy" (SEC (2005) 333), the integration of forestry aspects in the RD policy follows three pathways, in particular for privately owned and municipal forests:

1 investments to improve the multifunctional role of forests (article 30)
2 afforestation of agricultural land (article 31)
3 improvement of forest protection values (article 32)

The large set of measures related to articles 30 and 32 are generally grouped in the other forestry measures category. Despite the improvement with respect to the previous programming period the implementation of RD policy is still rather complex.

In Italy, the process of devolution to regional authorities leads (Monteleone and Storti 2004) to a fragmentation of rural policies, together with a regional diversification of policy strategies. This is particularly true in the case of forestry measures, which are often



Source: Eurostat New Cronos (FOWL and TAA), EU Commission (RD budget)

Figure 1. Relevance of forestry measures on total RDP budget.

fragmented (not only in Italy, but also in the European context) in a large set of different measures, not always completely coherent with territorial analysis and diagnosis.

On the other hand, including forestry measures in RD plans leads to a better consideration of forest policies at European level. In fact, since Agenda 2000, forest policy has been a prerogative of Member States (in some cases Regions) without common objectives at the European level.

Despite common objectives introduced by Agenda 2000 and adopted by regional and state administrations in the formulation of RDPs, the implementation of forestry measures within RD schemes, has been rather diversified across Europe.

Firstly, although in general the level of financial resources allocated is rather high ([1]), on average around 10% of the total RD budget, the situation differs widely across Europe. Comparing (Table 1 and Figure 1) the financial forecasts of individual European countries, it can be noted that about half of them devoted more than 10% of the total RD budget to forestry measures. There is apparently no rule for this, as the group includes both Mediterranean (IT, ES, PT) and northern countries (UK, IE, DK). On the other hand, there are a few countries with a relevant forest production, which destined only a small proportion of their RD budget to forestry measures (first of all SE 0.3%, but also FI 2.6% and AT 2.6%).

Figure 1 also compares the ratio between *budget for forestry measures* and *total budget for RD* (left axis) and the ratio between Forest and Other Wooded Land (FOWL) and Total Agricultural Land (TAA) on the right axis.

Firstly it can be noted that countries where the stock of forest resources is low, and the need for investments in the forest sector is consequently expected to be high (typically DK, Ireland, UK), devoted a relevant part of RD budget to forestry measures. On the other hand countries where FOWL is a relevant part of TAA (typically AT, FI, SE) and the forest sector is well developed the amount of financial resources devoted to forestry measures is extremely low.

It is interesting to note that the relevance of other forestry measures compared to the total budget allocated for forestry measures is rather variable. At European level, an average of 50% of the financial resources for forestry measures is destined to other forestry measures, but this seems to be higher in countries where the forest sector is more important and well

1 Compared to the previous programming period (1992–1999), more than double the financial resources are forecast to be devoted to forestry measures in 2000–2006. Some 1,500 million euro were spent in the period 1992-2000 on afforestation of agricultural land (UE Reg. 2080/92), while Reg. 867/97 has been of scarce importance in financial terms.

Table 1. Financial forecast (.000 euro) of RD programmes 2000–2006 and forestry measures within the programmes: EU contribution under EAGGF (leader + excluded),

Country	EAGGF Budget for rural development	EAGGF Budget for forestry measures			forestry / total RD budget	Other forestry measures / total forestry
		Afforestation	other forestry measures	total forestry		
Austria	3,249,445	8,080	78,620	86,700	2.7%	90.7%
Belgium	401,767	6,153	18,068	24,221	6.0%	74.6%
Denmark	336,420	35,330	6,600	41,930	12.5%	15.7%
Finland	2,393,294	23,330	40,731	64,061	2.7%	63.6%
France	5,762,532	37,606	238,268	275,874	4.8%	86.4%
Germany	8,661,787	110,012	299,379	409,391	4.7%	73.1%
Greece	3,253,700	57,800	129,967	187,767	5.8%	69.2%
Ireland	2,558,291	350,800	31,500	382,300	14.9%	8.2%
Italy	7,493,685	560,123	341,189	901,312	12.0%	37.9%
Luxembourg	91,000	14	1,101	1,115	1.2%	98.7%
Netherlands	427,000	12,210	5,450	17,660	4.1%	30.9%
Portugal	3,552,483	345,865	341,116	686,980	19.3%	49.7%
Spain	8,515,947	663,539	832,793	1,496,332	17.6%	55.7%
Sweden	1,232,269	0	3,621	3,621	0.3%	100.0%
UnitedKingdom	1,555,509	175,910	51,452	227,362	14.6%	22.6%
Total	**49,485,129**	**2,386,772**	**2,419,854**	**4,806,626**	**9.7%**	**50.3%**

Source: Commission staff working document annex to “Communication on the implementation of the EU Forestry Strategy”.

established and FOWL is relatively high. A generalization could be made by saying that countries that have fewer forest resources allocated more financial resources to afforestation and vice-versa. However, this statement could be unrealistic in some cases, in fact, as highlighted in several reports (mid-term evaluations, EU Court of Auditors 2004), much of the money available for forestry measures in the period 2000–2006 has in practice already been allocated in the form of CAP accompanying measures because of the long contract period for afforestation of agricultural land. Afforestation established before 2000 and running for a maximum of 20 years (the period for which compensation for loss of income is payable) have taken up considerable funds for the afforestation measures. As a matter of fact both the EU Commission and Member States are expecting a low level of application of the afforestation measure in the period 2000–2006.

2.1 Implementation of forestry measures in Italy

In Italy the process of devolution to regional authorities led to a regional management of RDP (Storti and Monteleone 2004), which of course implied high diversification and fragmentation. In general terms the scheme of application of RD policies differs in objective 1 regions (south and part of central Italy) and objective 2 ones.

This kind of “regionalization” of forest policy makes analysis of the implementation of forestry measures in Italy rather complicated. An analysis of how forestry measures are implemented in Italy (INEA 2005) has recently been done comparing Italian regions on the basis of RDP, level of realisation of measures, priorities, objectives and territorialisation.

At national level, forestry measures represent a relevant part of RD policies both in objective 1 and objective 2 regions. In particular in the northern and central Italian regions they come second, in terms of budget, only to agro-environmental measures.

Afforestation of agricultural land is done by regions on the basis of objectives and procedures that seem to be difficult to generalise. In general terms, if afforestation done within the 2080/92 scheme and still paid within RD budget is not considered, up to the end 2002, 12,131 hectares have been planted, mostly with broadleaves or mixed (broadleaves + conifers).

The main problem in the application of afforestation of agricultural land appears to be the weight of expenditure due to investments made by farmers in the previous period. Figure 1 shows the surface area of afforestation done in the period 2000-2002 under the RD scheme (blue bars – a total of about 13,000 hectares) and that done with the afforestation programme under Reg. 2080/92 and still committed as concerns loss of revenue premiums that are still paid within the RDP framework. All together afforestation “dragged” from the previous programming period represents a surface area of more than 60,000 hectares.

Also in financial terms, it should be noted that afforestation represents more than 10% of total RD budget. Within this budget only 2.2% is covered by new afforestation programmes, whereas more than 8% represents budget endowments of Reg. 2080/92.

An analysis of the geographical distribution of afforestation provides evidence of two important facts. Firstly a concentration in the central-northern regions, mainly due to the fact that the budget for afforestation in objective 2 (southern) regions is largely used for Reg. 2080 payments. Secondly, mid-term evaluation reports (this was also mentioned in the Court of Auditors’ report) underline a concentration in zones with high quality and high value land. This is clearly related to the RDP prioritisation given by regions, which is often not addressed to marginal or mountain areas.

Doubts on the effectiveness of afforestation had been raised in 1997 by the Economic and Social Committee, who wrote: ‘another question which needs to be addressed is whether it would be more effective in the long run to use EU resources for promoting the marketing of timber, including its use as an energy source, rather than provide direct assistance for afforestation’. Many of the recommendations were taken into account in Regulation (EC) no. 1257/1999, however the Commission evidently forgot that commitments made under Reg. 2080/92 are still the core expenditures.

Another important weak point underlined in the Court of Auditors’ report is the dispersion of afforestation. This also appears to be relevant in Italy, where most of regions adopted horizontal application of forestry measures across the territory with no priority given for example to mountain or environmentally sensitive areas.

The other forestry measures cover a wide variety of actions and interventions and are set out in Reg. (EC) 1257/1999, Articles 30 and 32. They concern mainly investments in forestry but also afforestation of non-agricultural land.

Some aim at maintaining and improving the ecological stability of forests where their protective and ecological role are of public interest. Others aim at preventing fires and other natural disasters and combating erosion.

In Italy this set of measures has been implemented by regions in a very variable way. Any categorisation of interventions, other than that proposed by the Regulation is rather complex.

Referring to main categories proposed by the Regulation, many actions, such as afforestation of non-agricultural land, promotion of new outlets for the use and marketing of forest products, restoring forestry production damaged by natural disasters and fire, and prevention instruments have been programmed by almost all Regions, but the level of realisation is still very low. Most of the surface area under commitment is represented by the measure “investments in forests aimed at improving their economic, ecological or social value”, which covers about 95,000 of the 96,000 hectares of article 30. However this measure

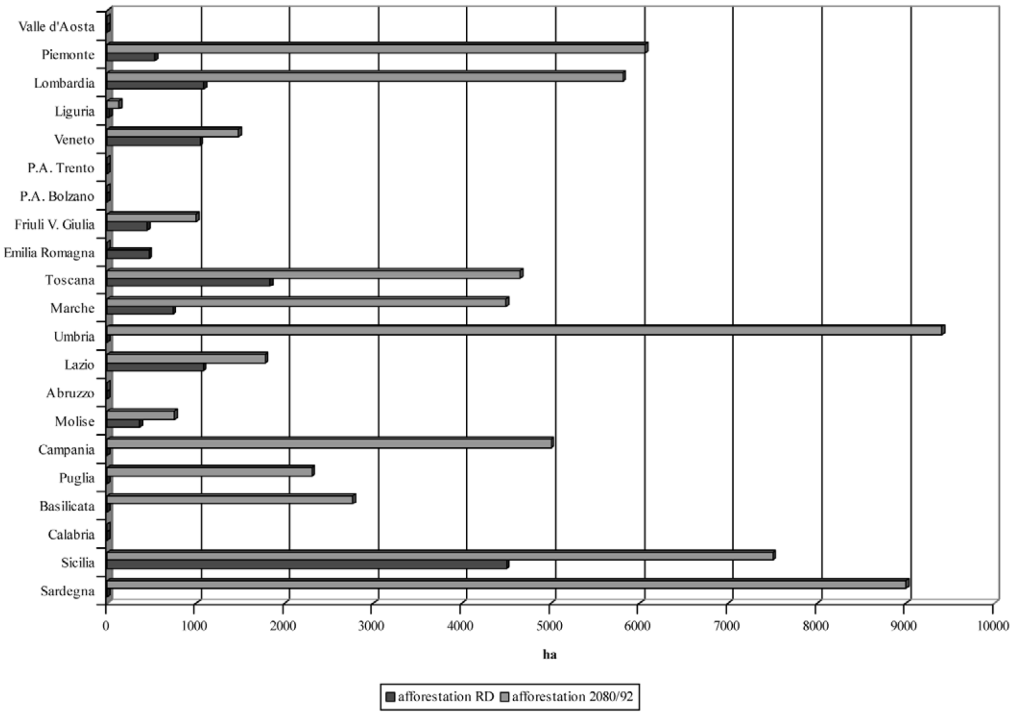


Figure 2. Afforestation – surface area under commitment in RD regional plans.

is applied by some Regions with actions that are typically investments in forestry, such as management, conversion from coppices to high forests, cleaning. On the other hand, some Regions have programmed other measures, such as the construction and maintenance of forest roads, or more often, the definition and implementation of forest management plans or inventories. In other cases, hydro-forestry preventive measures have been implemented.

Among other complementary measures, of relevance in terms of physical implementation, are some related to trade and manufacturing of forest products and the prediction and prevention of forest fires. Other measures under article 30 (among others, association of forest entrepreneurs, new commercial outlets for forest products) and article 32 (maintenance of fire-break cuts) have been scarcely implemented. Finally, the maintaining of the ecological stability of forests has been implemented in only four Regions with a total of 11,500 ha and some 50 beneficiaries.

The national framework for implementing the i) measure (art. 32), although incomplete, appears to show some difficulties in the implementing of new measures. Indeed, although measures for forest improvement and investments in trade and manufacturing – both already implemented in the former programmes – seem to be progressing well in various regions, the same cannot be said for measures that were not included in the former EC programmes. Concerns can be raised over the difficulties currently found in some crucial measures for the forest sector, such as support for forest associations or promotion of new commercial outlets, which are still practically undeveloped.

One of the limits in the implementation of the “other forestry measures” is the difficulty in involving businessmen and forest owners, who are traditionally under-represented and little

Table 2. Other forestry measures – surface area under commitment and n. of projects.

articolo 30	area and n. of projects article 30		*of which forest improvement*		area and n. of projects article 32	
	n.	hectares	n.	hectares	n.	hectares
Piemonte	311	155	203	155	514	309
V. d'Aosta	5	0	0	0	5	0
Lombardia	164	0	105	0	269	0
P. A. Bolzano	1.884	3.000	1.670	3.000	3554	6.000
P.A. Trento	409	70.537	230	70.537	639	141.074
Veneto	673	1.494	350	1.205	1023	2.699
Friuli V. Giulia	271	674	83	0	354	674
Liguria	279	7.131	176	7.130	455	14.262
Emilia Romagna	65	457	26	446	91	903
Toscana	231	8.386	116	8.385	347	16.771
Umbria	0	0			0	0
Marche	36	3.979	8	3.979	44	7.958
Lazio	45	0	0	0	45	0
Total	4.373	95.812	2.967	94.836	7340	190.649

supported by professional organisations. There is definitely limited information and a lack of technical assistance in the preliminary phases of definition and communication of the proposals and projects. This is indeed a well-known problem in the Italian forest sector, which is rather marginal and low-earning compared to agriculture, and without adequate interest from agricultural organisations. If this situation is an opportunity for forest experts, who can provide technical assistance to forest landowners (often the state), it is at the same time a major concern regarding small forest owners whose interest in the measures do not justify an investment in the administrative process of acceding to funding without technical assistance.

3. Forestry measures in RD policies after 2006 – proposal contents

The first draft of the new regulation for RD was presented by the European Commission last July.

Innovative aspects in relation to the current programmes are rather significant. There is a change in the funding methods, with the introduction of a single financing framework for rural development (EAFRD), a re-definition of areas and objectives, a review of specific RD aims and their combination into different axes. Moreover the process of programming is more progressive, including, besides formal approval by the Council, also the definition of a document of strategic orientations that should include the integrative norms on state aids. The process includes, in the case of regional implementation of RD policies, a formal involvement of the Member State that has to define a Strategic National Plan which includes a financially binding plan at national level.

Operationally, the new draft of regulation is based on three priority axes: competitivity of the agriculture and forest sectors, environmental improvement and quality of life in rural areas.

Table 3. Chronogram of new RD - negotiation, approval and application.

	2004	2005				2006			
	IV quart	I quart	II quart	III qart	IV quart	I quart	II quart	III qart	IV quart
1. UE Council approval									
a. Approval of Council regulation	■	■	■	■					
b. approval of strategic notes			■	■					
2. National strategic plan									
a. Concertation (state / regions)		■	■	■	■				
b. Formulation of Strategic plan		■	■	■	■				
c. negotiation State / UE				■	■				
d. formal approval by commitee of regions					■				
3. Regional development plans									
a. Preparation - Formulation			■	■	■				
b. Negiziation and approval (UE)						■	■		

Forestry measures, unlike the former programming, are established on the three axes, according to their objectives. Changes and new aspects are rather important. A first essential point, common to all the environmental axis, is an increased territorial concentration. In particular, the draft regulation clearly requires Member States, including Regions, to identify eligible areas not only for the compensatory payments but also for some forestry measures: afforestation of agricultural land, especially for environmental aims, the implementation of forest-environmental measures, and for forest areas with fire risks.

Another important change is the respect of requirements over the whole areas of the farms. The draft regulation defines that beneficiaries of forestry measures, including the afforestation of agricultural land, are required to respect the standards over the whole farm.

3.1 The position of selected European Countries (France, Austria, Scotland and Italy)

France

France adopted a National RDP with no regional plans. The heavy storms in late 1999 did not allow the measures to be implemented as planned and required significant amounts to be transferred to the rehabilitation of forests.

Direct local stakeholders – private and municipal forest owners – argue that although the five priorities of the National Plan have been identified through negotiation and consensus, the final benefits have been very limited. In some cases, like art. 32, the Plan has not even been implemented.

Meanwhile the forest sector has been losing in economic and employment terms, while many forests have been shifting to liability. In most mountain areas forestry has been abandoned and available timber remains mostly unsold.

In France, forest owners are providing inputs to the next measures and strategies for RD by trying to find a link among the different strategies affecting the sector, i.e. environment, energy, sustainable development. The influential municipal forest owners are setting the main expectations for next period:

1 follow the Lisbon strategy based essentially on sustainable development with a clear territorial reference;
2 a multifunctionality based and managed within the framework of public interest;
3 close communication and relations between rural and urban communities;

4 forests as key components of land use and local development;
5 acknowledgement of mountain on-costs generated by permanent natural handicaps;
6 acknowledgement of quality in management and environment conservation;
7 the need for an adapted financial budget in view of the implementation of measures.

While preparing the next round, some measures are implemented at national level. This is the case for funding investments and actions for forests with a role of protection against natural risks.

As a complementary approach to forestry measures, France is developing territorial contracts and schemes aimed at involving all local actors (including those outside the forest sector) in concerted and binding plans tailored by and for local expectations.

Scotland

For Scotland the three main priorities for the definition of the new regulation are:

- maintain support for afforestation (Scotland still only has 17% woodland cover)
- broaden support for adding value and cooperation in the areas of forestry, wood and biomass.
- secure recognition and support for multi-purpose forest management.

The weaknesses highlighted in the current regulation include:

- lack of support for restocking as part of sustainable forest management (not rectified in the draft RDR);
- support for marketing and processing tied to forest holders and excluding other rural actors (improved in the new RDR);
- lack of integration between forestry, agriculture and wider land use (improved in the new RDR).

However, the UK made relatively little use of the breadth of opportunities to support forestry in the current RDR, focusing mainly on afforestation and forest improvement (called forest stewardship in the UK).

Austria

Since November 2004 Austria has begun to set up the RD programme 2007–2013.

The main priorities of the forestry part of the programme are:

- forest value added measures (construction in a “chain of custody”) (axes 1, 3 and 4);
- forest-environment measures including Nature 2000 (axes 2, 3 and 4);
- measures for protection forests (axis 1, 2, 3 and 4);
- human resources (axis 1, 3 and 4).

It seems that one open question is the cross-linking to the other measures, which is not clearly foreseen. That is also a weak point of the current proposal for a regulation on RD, although there is an improvement in comparison to the current regulation.

This weak point leads to a general question: is RD support just an agricultural priority garnished with some additional measures (forestry, measures of axis 3) or should there be any cross-linking between the various activities in rural areas?

Italy

During the first phase of negotiation on the new RDR, a number of concerted technical meetings have been convened at central level (Ministry of Agricultural and Forestry Policies). The regions and the Ministry had the opportunity to present their priorities for the new RD programming.

The main issues raised within these concerted "tables" with particular reference to forestry measures, are the following:

Strengths:
- strong integration of the forest sector with other RD components
- new support measures, especially related to non-productive investments or activities in protected areas (i.e. Nature 2000 sites); among the new measures, the "forest-environment payments" represent a conceptual turnaround, although on the ground the indications provided by the regulation are complex to implement and possibly in conflict with practical conditions of the forest management practices.

Weaknesses:
- measures for forest associations have been moved from specific measures to general measures providing technical assistance and support to primary sector businessmen; in particular, payments are planned only to users and not to service providers; significant decrease in the levels of public co-funding for many forestry measures, in particular afforestation of agricultural land; support for planting and maintaining cover only 40-50% instead of 100%; significant decrease in annual contribution to lost agricultural incomes that are limited to a maximum of 10 years.

4. Conclusions

The analysis of the 2000–2007 programming of forestry measures highlights some key issues, in particular:

- high level of former funding in the CAP accompanying measures;
- distribution of "other forestry measures" into a number of poorly-coordinated actions;
- territorial dispersal in the measures (especially relating to afforestation) and consequent limited efficiency.

Concerning the new programming, the impression is that with the new regulation 2007–2013 the logic of public support will increasingly follow similar criteria to those applied on other actions: limited public financial participation; definition of the maximum level of support for a single beneficiary; eco-conditionality; monitoring, evaluation and general transparency and verification of decision mechanisms; involvement of different stakeholders in decision mechanisms. These are, in general, criteria that will contribute to improve the quality and efficiency of the public action in the sector.

For the first time in EU policies, a broad and overall operational implementation is given to forest policy that, after decades of discussion (Glück 1998), has been formally adopted in 1998 with the Communication of the Forestry Strategy of the EU, further adopted by a Resolution of the Council (Kremer 1998). Until recently, such a policy, defined as "virtual policy" (Flasche 1998) or "shadow-policy" (Pettenella 1994), only produced some specific types of support (afforestation of agricultural land, interventions against forest fires, forest improvements, monitoring of health and a few others).

The quite high importance given in the past to afforestation measures can certainly be criticised, especially in the Mediterranean countries where priorities are directed to management rather than to expansion of a productive basis, which is already large and diversified. However, it should be recalled that funding for afforestaion has supported a multiple activity of research, testing, nursery production, training, technical assistance and consultancy and the first market effects are being produced. A drastic reduction in the contribution to planting, beyond the fact that it creates discontinuity in the strategy of development, could reduce the interest of businessmen towards actions of afforestation, and also towards the activities and competences developed in their support.

Finally, it is certainly positive to see the obligation introduced in the new draft of the regulation to designate the areas eligible for payments provided for afforestation (both agricultural and non-agricultural land), Nature 2000 payments and restoration of forestry production potential and introduction of prevention action.

List of acronyms and abbreviations

RD	Rural Development
RDP(s)	Rural Development Plan(s)
EAGGF	European Agricultural Guidance and Guarantee Fund
IT	Italy
AT	Austria
BE	Belgium
DE	Germany
DG	Directorate General
DK	Denmark
ES	Spain
EU	European Union
FI	Finland
IE	Ireland
NL	Netherlands
PT	Portugal
SE	Sweden
UK	United Kingdom
FOWL	Forest and Other Wooded Land
TAA	Total Agricultural Area
UAA	Used Agricultural Area

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The Role of Institutions in Forest Development: The Case of Forest Services and Forest Owners' Associations in Portugal

Américo M. S. Carvalho Mendes

Faculty of Economics and Management, Portuguese Catholic University
Porto, Portugal

Abstract

A characteristic of the Forest Services in Portugal since being established in 1824 is path dependence. Their course of action has been influenced by the conditions prevailing during the initial period of the activity of this agency. This influence took the form of a preference for instruments of direct intervention in forestry which are not well adapted to a country where 93.4% of the forest land is privately owned.

The situation began to change in the mid 1980s when forest policy changed course by making financial incentives to private forestry its main instrument. The major unintended side effect of this change in policy was the emergence of forest owners' associations. Despite the fact that these organizations are becoming increasingly important for the development of private forestry, they have not yet reached the top of the priorities in forest policy. The resistance to giving them proper public support is a heritage of that long tradition of state interventionism in forestry.

Keywords: private forestry, forest owners' associations, Forest Services, path dependence

1. The main thesis

The main thesis to be argued in this paper is that the history of the Forest Services in Portugal reveals a strong "path dependence" feature. This means that the conditions prevailing when this agency was established have been influencing its activity for most of the time since then.

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The paper starts by identifying those conditions that may be relevant and then presents the main activities of the Forest Services since their creation in 1824, until the 1980s. The choice of this end point has to do with the fact that it was at that time that forest policy initiated a course where the role of those initial conditions began to weaken.

2. The initial conditions

2.1 Land use and forest land ownership distribution

What will be considered here as the closest ancestor of the present day Forest Services in Portugal was established in 1824 under the title of General Administration of the Crown Forests (AGMRC-Administração Geral das Matas da Real Coroa).

The AGMRC was created under the supervision of the Ministry of Navy, in the follow-up to the Liberal Revolution of 1821. Although these political events brought about some changes in landownership with the nationalisation of property held by the religious orders, in 1835, the distribution of ownership was not very different from the one presented in the following table.

At that time, by far the major issue at stake in the opinion of most of those who spoke publicly about forest policy was the need to take care of the very high percentage of land that was "uncultivated" and unfit for farming. One of the first comprehensive estimates of land use patterns dates back to 1868. Based on this and other complementary estimates, the land use distribution at that time was as follows (Mendes 2002):

a) Forest land: 1240000 ha (14.1%)
b) Agricultural land: 1886000 ha (21.5%)
c) Uncultivated land unfit for agriculture: 5463000 ha (62.3%).

Given this large amount of "uncultivated" land, afforestation was set at the top of the forest policy priorities. It remained there until the 1990s, well after the protection of existing stands should have replaced it at the top. In fact, this change of course in forest policy should have begun in the 1950s when the rural population started its irreversible decline. Given Portugal's climate and the type of afforestation that had been practiced until that time, it should have been anticipated that the decline in rural population would lead to an increased risk of forest fire, which had been controlled until then by the forest utilisations of the local population.

2.2 The initial mission of the Forest Services

As was clear in the initial naming of the Forest Services, its mission was to manage the Crown Forests. Created in the aftermath of the first changes in the political regime corresponding to the fall of the Ancien Regime and the rise of liberalism, the mission of this new public administration was to move towards full management control of the Crown forests by the State, replacing the organization by the Ancien Regime that was still trying to survive based on the old hunting rights of the Crown ("Monteiro Mor"). The mission of AGMRC was also to insure this public control when those lands were transferred to the full jurisdiction of the State in the 1830s, when the liberal regime was fully established. The ambition was also to enlarge the jurisdiction of the State over forest and afforestable land.

Table 1. Area of forests and other wooded land by types of ownership.

Types of owners	1928		1959		1974/82		1995	
	ha	%	ha	%	ha	%	ha	%
State forests	53662	2.3	58000	2.0	78000	2.6	40000	1.2
Communal forests	55954	2.4	145000	5.0	380000	12.4	180000	5.4
Private forests	2221824	95.3	2697000	93.0	2598000	85.0	3129000	93.4
TOTAL	2331400	100.0	2900000	100.0	3056000	100.0	3349000	100.0

Source: Mendes et al. (2004)

Table 2. Area of forests under the control of Administração Geral das Matas.

Years	Hectares
1824	14464
1835	16318
1836	19125
1839	19130
1840–47	19755
1847–65	19940

Source: Ministério das Obras Publicas, Commercio e Industria (1905).

2.3 The belief in the virtues of direct State intervention in forestry

Almost all those speaking publicly and taking public decisions about forestry in those initial times of the Forest Services were unanimous in the advocacy of a leading role for the State in the huge task of afforestation to be undertaken throughout the country. These advocates were certainly aware of the fact that the State, through the Forest Services, had jurisdiction over only a very tiny part of the forests and afforestable land. However, they thought that the private forest owners had neither the will, nor the power to carry out the task. So the main role in this role should be taken by the State, through the Forest Sector or the municipalities.

2.4 The forest profession

When AGMRC was established there was no higher education in forestry in the country. The first Portuguese graduating in forestry got their degrees in Germany (Tharandt) and France (Nancy). The organization of the higher forest education which started in Lisbon in the 1860s was based on these experiences. For more than a century this was the only school of forestry in the country.

The generations of foresters trained in this school had an education with a strong Germanic influence. This orientation favoured a regime of forest management where timber supply and public authority had a leading role. This was very clear in the government commissioned report to organize the forest higher education and the Forest Services by Venâncio Deslandes (Deslandes, 1858) who travelled for one year in that part of Europe.

That kind of orientation was not well adapted to a country where the State only had authority over a very tiny part of the total forest and afforestable land. It was also not well adapted to a country where Mediterranean conditions prevail over a large part of the territory and where agro-forestry and sylvo-pastoral land uses were spread throughout most of the forest and afforestable land.

3. The long history of direct public intervention in forestry

3.1 Afforestation of the coastal dunes

Afforestation as an instrument for erosion prevention had been advocated and attempted as an important mission for a public agency since AGMRC was set up and even before then. The agency headquarters were located in a public forest established in the Middle Ages in an area of dunes along the coast, possibly with that purpose.

This kind of afforestation was the effectively first main mission of the Forest Services. After some failed attempts in the beginning of the 19th century, it was restarted in the 1850s. With ups and downs, it continued until the 1890s when big problems in the public finances and the loss of financial autonomy of the Forest Services meant no funds were available to proceed with the afforestation. The process restarted after those difficulties were overcome, at the beginning of the 20^{th} century, lasting until the 1940s. This was one of the most important legacies of the direct intervention of the Forest Services with very significant social benefits.

3.2 The laws of the "Forest Regime"

The management of the existing forests under the public domain and the extension of this domain to the afforested coastal dunes were still a very tiny part of the total forest and afforestable land in the country. Almost all the rest were either communal, belonging to the municipalities or local communities, or privately owned lands. The ambition prevailing in the Forest Services was to become a leading agent in the afforestation of these communal and private lands, based on the assumption that local communities and private forest owners did not have the means and the will to do so.

After the opportunity was lost to promote a massive transfer of ownership of part of those lands to the public domain in the mid 19^{th} century, only three ways were left to fulfil that ambition of direct public intervention in afforestation. One was to use the power of the public authority to expropriate private lands to promote some "public interests". In this case, the main "public interest" the Forest Services could appeal to was erosion prevention. This path for forest policy was pointed out in some articles of the 1886 decree abolishing AGMRC and replacing it with the Forest Services. The decree stipulated that the State had the right to expropriate, and transfer to the jurisdiction of the Forest Services for afforestation, uncultivated lands belonging to private owners if they were unwilling to do the afforestation on their own that was needed to prevent erosion and improve water resources management. This forest policy path was never undertaken to a noticeable scale. One reason was its high cost for the public finances, which went through very hard times soon after that decree was published.

Another possible path for direct public intervention in afforestation was to appeal to the municipalities instead of relying on the State budget and on agencies belonging to the central public administration, such as the Forest Services. In the 19^{th} there were some timid attempts in this direction. One example was a law proposed by the Government to Parliament in 1857,

Table 3. Area of dunes afforested by the Forest Services.

Years	Hectares	Years	hectares	Years	hectares	Years	hectares
1850–86	1580	1908	370	1930	1007	1952	32
1887	102	1909	338	1931	763	1953	142
1888	128	1910	378	1932	496	1954	67
1889	423	1911	350	1933	703	1955	42
1890	217	1912	314	1934	1559	1956	133
1891	246	1913	262	1935	3368	1957	101
1892	2	1914	336	1936	2402	1958	0
1893	29	1915	352	1937	3179	1959	473
1894	5	1916	416	1938	3001	1960	461
1895	40	1917	410	1939	2477	1961	540
1896	139	1918	375	1940	2069	1962	391
1897	32	1919	372	1941	1187	1963	439
1898	52	1920	434	1942	1491	1964	289
1899	3	1921	499	1943	1146	1965	901
1900	58	1922	320	1944	140	1966	840
1901	0	1923	446	1945	308	1967	820
1902	0	1924	276	1946	0	1968	456
1903	253	1925	299	1947	0	1969	505
1904	386	1926	516	1948	210	1970	326
1905	327	1927	471	1949	32	1971	263
1906	276	1928	635	1950	111	1972	172
1907	749	1929	1065	1951	100	1973	0

Sources:
a) 1850–1906: Ministério do Fomento (1912)
b) 1907–73: Rego (2001)

setting a target of 190 000 ha to be afforested in 50 years. To accomplish this target each of the 3800 parishes existing in the country should carry out the afforestation of 1 ha per year, on average. The main stumbling block for this, both at that time and until the 1970s, was that the local public administration, at both parish and municipal level, did not yet have a well-defined status within the structure of the public administration after the liberal reforms initiated in the 1820s, and their human and financial resources were very weak.

The third path that was left for direct public intervention in afforestation was to give up on the transfer of land ownership to the State and appeal to the transfer of management rights, especially where that was easier, namely the communal lands which were still very important in the mountainous regions of Northern and Central Portugal. For the foresters and others who wrote and spoke about forestry issues, most of those land were "uncultivated" and good for afforestation. Part of the reality that was forgotten in these statements is that, in many cases, they had sylvo-pastoral and other kinds of uses that were important for the survival of the local communities. So if afforestation was to be carried on those lands, in order to be well accepted by the local communities and not contribute to the acceleration of rural depopulation, it should accommodate those traditional uses. What happened in most cases, is that those communal lands were seen by the Forest Services and other relevant stakeholders involved in forest policy design as "uncultivated" and their traditional uses by the local communities were seen as a nuisance to be got rid of for the purposes of afforestation.

It was with this vision that this "uncultivated" part of the country was elected as the main front for direct public intervention in forestry for more than a hundred years. The stage for this intervention was set during the 19th century in three ways:

a) some consensus was developed involving the AGMRC, the rest of the public administration, the forestry profession, and others who wrote and publicly spoke about forest policy issues advocating the need to carry out afforestation in the communal lands under the direct intervention of the public administration,
b) AGMRC initiated some inventories of that territory, laying down the technical foundations for more complete works that were done later;
c) some works of afforestation were initiated on communal lands located in mountain areas of Northern and Central Portugal, which were transferred to the jurisdiction of the Forest Services, allowing this agency to gain some experience in a type of afforestation that was different from that of the coastal dunes.

The legal framework for the afforestation of the commons was set on these foundations, with the so-called laws of the "Forest Regime", consisting of four decrees published in 1901, 1903 and 1905. Going straight to the essential part of this legislation, it marks the end of the illusions about expropriation which was still underlying the 1886 legislation. With the laws of the "Forest Regime" the main instrument to promote afforestation became the transfer of management rights to the Forest Services. These laws also made some room for in-kind and financial incentives to private forestry, but they were not implemented to a noticeable scale until the 1980s.

The main elements of the 1901 decree are as follows:

a) a legal definition of the concept of "Forestry Regime" opening up different ways of public intervention in all forest ownership types, without the pre-requisite of expropriation;
b) a rationale for these kinds of public intervention:
   - direct intervention if the main goal is what we now call the promotion of public goods ("utilidade pública") provided by forests, which the decree explicitly considers to be the case of the contribution of forests to the prevention of soil erosion, water resources protection and climate regulation;
   - indirect intervention through the provision of public incentives, if the goal is to motivate improved forest management in non-State forests;
c) a rationale for entrusting the power of direct intervention to the State, in the first place, with the possibility of delegation of this public authority to municipalities, forest owners' associations or individuals, that rationale being the provision of public goods;
d) a specification of the different modalities of the "Forestry Regime":
   - the "total forestry regime";
   - the "partial forestry regime" which includes three sub-cases:
   - the "mandatory partial forestry regime";
   - the "voluntary partial forestry regime";
   - the "partial forestry regime of simple policing";
e) a legal mechanism to engage the public intervention in each of these kinds of regimes which did not rely on expropriation. This mechanism is a governmental decree of submission of the land to the Forestry Regime based on a previous study developed by the Forest Services to assess the public interest of the submission.

An important piece of legislation complementary to the Forestry Regime decrees is one which restored some financial autonomy to the Forest Services through the ear marking of the revenues of timber sales in public forests to the funding of that agency. For this purpose the decree created what was called the Special Fund of the Forest Services. This fund could also have been an instrument to provide incentives to private forestry, but it was never very active in this direction. This failure was the reason for several reforms of this fund throughout the 20th century (1945, 1963, 1964, 1973) to make it an effective instrument to promote private forestry, something which it never managed to achieve, until its abolition in 1977.

Table 4. Definition of the modalities of the Forestry Regime.

Modality	Owner	Manager	Enforceability of submission to the Forestry Regime	Rights of the owner	Duties of the owner
Total	State	State (Forest Services)	Legally mandatory		
Mandatory partial	a) Municipalities b) Local communities c) Private lands within the limits of a polygon defined by lands submitted to the total regime	Owners or the State (Forest Services) if the owners don't have the means to take care of the afforestation on their own	Legally mandatory	Receive part of the proceeds from the new forests[1]	Let part of the proceeds from the new forests go to the Forest Services to pay back the afforestation costs[1]
Voluntary partial	Private lands outside the limits of a polygon defined by lands submitted to the total regime	Owner	Voluntary (depends on the initiative of the owner)	Access to public incentives (technical assistance provided by the Forest Services for the management plans, free supply of seedlings, tax exemptions, etc.)	Respect of the forest management plan approved by the Forest Services
Partial of simple policing	Private lands outside the limits of a polygon defined by lands submitted to the total regime	Owner	Voluntary (depends on the initiative of the owner)	Free access to the services of the Forest Guard to enforce the private ownership rights of the owner	Provision of 1 ha of land for each 500 ha placed under public surveillance for cultivation by the guard for his own subsistence

1 In the case that afforestation and forest management are the responsibility of the Forest Services.

Table 5. Implementation of the Forestry Regime (ha).[2]

Years	Total regime	Mandatory partial	Voluntary partial	Partial of simple policing	Total area submitted
1931	57000	76000	267000		400000
1950	51000	336000	89000	378000	854000
1960	53000	452000	89000	531000	1125000
1973	50000	503000		866000	1419000

Source: Baptista (1993)

2 These areas include not only forests, but also lands making up the holdings submitted to the Forestry Regime.

Table 6. Afforestation of communal lands by the Forest Services in the mountain areas.

Years	Hectares	Years	Hectares	Years	Hectares	Years	Hectares
Before 1891	0	1912	69	1934	754	1956	12149
1891	47	1913	30	1935	1169	1957	16035
1892	16	1914	163	1936	820	1958	18904
1893	0	1915	271	1937	732	1959	16270
1894	0	1916	326	1938	599	1960	13309
1895	0	1917	186	1939	2621	1961	13929
1896	0	1918	323	1940	2394	1962	14835
1897	20	1919	443	1941	2371	1963	10535
1898	102	1920	543	1942	3930	1964	14266
1899	87	1921	639	1943	2796	1965	7627
1900	32	1922	508	1944	3926	1966	8174
1901	23	1923	491	1945	2868	1967	8470
1902	32	1924	456	1946	1642	1968	8015
1903	167	1925	423	1947	2935	1969	7175
1904	259	1926	439	1948	6917	1970	5434
1905	273	1927	409	1949	6077	1971	4794
1906	270	1928	703	1950	6877	1972	4236
1907	260	1929	913	1951	7299	1973	4506
1908	235	1930	1040	1952	7500	1974	2606
1909	822	1931	868	1953	8040	1975	1448
1910	89	1932	651	1954	8383	1976	1274
1911	75	1933	863	1955	8003	1977[3]	773

Sources:
a) until 1906: Ministério do Fomento (1912)
b) 1907–72: Rego (2001)
c) 1973–77: INE, Estatísticas Agrícolas (data including afforestation in all forest land under the management of the Forest Services)

3 Last year of implementation of the Afforestation Plan of the Commons.

The implementation of this legislation went as follows:

a) the total regime fully accomplished its mission by ending up covering all the State forests;
b) the mandatory partial regime became the main front of the Forest Services work until the 1970s with the Afforestation Plan of the Commons (1939–77);
c) the voluntary partial regime was a failure because only a very few private forest owners participated;

d) the partial regime of simply policing was widely used by large landowners in the southern regions to establish and protect their private hunting rights, without substantial effects on improved forest management (Gomes 1969).

3.3 The last major operation of direct public intervention in afforestation: the Portuguese Forest Project (1981–88)

By the mid 1970s the afforestation of the commons was over. Also, after the 1974 Revolution when a democratic political regime was restored, a decree was approved to give the commons back to the control of the local communities. So within this context, and after several minor attempts initiated in the 1950s, the Forest Services finally turned their attention towards private forestry. Their main priority remained afforestation and their main instruments remained direct state intervention in private forest land. This intervention was organized under the so-called Portuguese Forest Plan, which was funded by the World Bank and ran from 1981 until 1988. The main institutions in charge of implementing this plan were two state-controlled agencies: the Forest Services and the nationalised pulp and paper company (PORTUCEL). The Forest Services assumed direct responsibility for preparing and implementing the afforestation plans in two types of lands:

a) in the public and communal lands under the management of the Forest Services;
b) in the lands of NIPFOs willing to accept afforestation under the following conditions:
   - all the technical responsibility and almost all the funding of the investment costs were on the shoulders of the Forest Services;
   - the landowners had to commit themselves to keep their lands in this kind of use and manage the new plantations appropriately;
   - the public funding of the investment costs was a loan which had to be paid back by the forest owner with 40% of the revenues from fellings of the new plantations when they came of age, until the total amortisation of the loan, for no more than 60 years.

The programme also provided a loan to PORTUCEL for afforestation of the lands already owned by company, or on new lands bought or leased for this purpose. There were also funds available to support the creation of cooperatives of private forest owners and for the organisation of a public forest extension service within the structure of the Forest Services. We should remember that since their creation in the 19th century, these services had mostly focused on the management of public or communal forests, leaving the three-quarters of the forest lands in the hands of NIPFOs without enough technical support.

The main implications of the programme for the issues tackled in this paper are the following:

a) it showed the great difficulties of the Forest Services to carry out a strategy of direct interventionism in private forestry, similar to the intervention they were long accustomed to in State and communal forests;
b) it also showed the great difficulties of the Forest Services to set up two instruments aimed at private forestry, more precisely a public forest extension service and the organization of forest owners' associations.

3.4 The turning point: the EU co-funded programmes in the 1980s and 1990s

Since the country's accession to EEC in 1986, Portuguese forestry has benefited from a series of programmes of financial incentives to afforestation, reforestation and improvement of existing stands:

Table 7. Targets and outcomes of the Portuguese Forest Project.

	Targets	Outcomes
Time horizon	1980/85	1981/88
Afforestation (ha)	150000	131908
1. By the Forest Services		
- total area	90000	71908
- conifers	60500	50026
- eucalyptus	16000	8429
- other broadleaves	13500	7886
- natural regeneration	-	5586
2. By PORTUCEL (pulp and paper company)		
- total area	60000	60000
- conifers	30500	n. a.
- eucalyptus	29500	n. a.
Creation of a public forest extension service	X	Nothing was done
Credit for cooperatives of forest owners	X	Nothing was done

Source: Mendes et al. (2004)

- the Forest Action Programme (PAF-Programa de Acção Florestal) implemented from 1987 to 1995;
- the Forest Development Plan (PDF-Programa de Desenvolvimento Florestal) implemented from 1994 to 1999;
- Reg. (EEC) 2080/92 whose implementation started in 1994.

There are some common features to these programmes:

a) financial incentives under the form of grants;
b) initiative left to the private forest owners to apply for these incentives and carry out the plans for afforestation and improvements in the existing stands.

With these incentive schemes, the Forest Services finally abandoned their old orientation of being willing to take on direct responsibility for the afforestation of private lands. They replaced that orientation with one of providing financial incentives to private forestry. In the beginning, the Forest Services managed to keep some control in the management of these incentives, but soon had to yield many of these responsibilities to the public institute in charge of managing the EU structural funds for agriculture, forestry and fisheries.

In the first EU co-funded incentive scheme (PAF) there was still the purpose of setting up a public forest extension service in the Forest Services to provide technical assistance to private forest owners. However, as in the previous Portuguese Forest Project, there was no implementation of this component.

As we will see, the institutional response to that implementation failure was the emergence of forest owners' associations.

That failure was the last attempt and last opportunity for the Forest Services to develop some productive intervention in private forestry. Having lost this chance, as well as part of their responsibilities for managing the financial incentives in forestry, and also being on a receding course from their role in managing the forests installed in the commons, from the 1980s the Forest Services had two possible courses for action with respect to private forestry:

Table 8. Number of forest owners' organisations by region and by year

Region / Year	North West	North East	Central West	Central East	Ribatejo	Alentejo	Algarve	TOTAL
1977	1	1	9	1	4	3	0	19
1998	13	6	13	14	9	6	6	67
1999	14	40	15	20	11	4	6	110
2002	22	25	28	28	13	8	6	130

Source: Mendes et al. (2004)

a) to remain attached to the old position of state intervention in private forestry, now increasingly limited to administrative intervention;
b) to evolve a position of promotion and support of forest owners' associations.

4. Development of the forest owners' associations since the 1990s

To apply for the financial incentives which became available for private forestry in 1987, forest owners had to prepare and conduct forest management plans. So they needed technical assistance which could not be provided by the Forest Services. To respond to this demand associations of forest owners began to develop throughout the country, especially in the Northern and Central regions where small scale forestry prevails.

Even though this development is a side effect of the change in forest policy, it was not explicitly targeted and supported by that policy. There was also no intensive commitment by the Forest Services to provide technical assistance for the creation and development of most of these organizations.

During their initial stages they received most of the public financial support from incentive schemes which were not directly related to forestry.

Despite the fact that more and more of the instruments of public policy aiming at reaching private forestry have to go through forest owners' associations, the time has not yet come where this necessity has risen to a priority of action in the Forest Services agenda. What still more often happens is an attempt to stick to different forms of administrative interventionism. Old habits die hard.

5. Conclusions

In a country with 93.4% of private forest land, with often fragmented ownership, the emergence of the forest owners' associations in the 1990s has been a major structural change. This change was an unintended side effect of the new kind of forest policy initiated in mid 1980s, but it has not yet been fully accommodated by policy. Much of the resistance to being more supportive of this kind of organization is probably a heritage of the long-held tradition and ambition of direct state interventionism in forestry.

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The Supply and Demand of Partaken Sustainable Management of All Forest Functions in Aquitaine and Euskadi

Jean-Paul Guyon[1], Claire Broqué[1], Christophe Orazio[2] and Nekane Jausoro[3]

[1]ENITA de Bordeaux, France
[2]IEFC, France
[3]Université du Pays Basque Espagnol, Spain

Abstract

Forest management will only be sustainable if the frameworks fixing the goals of the forest functions are co-constructed by the management stakeholders. The stakes turn around the future of the private forest areas. This presupposes that all stakeholders have a deep knowledge of supply and demand so that they can transfer it, as indicators, to the decision-making authorities of the forest institutions and forest managers.

We carried out surveys among about one hundred professionals of the forest network and about one hundred non-professionals. We also organized interviews with about forty forest users and users from other different groups. The forest planning of forty planning decision-makers and forest planners is analyzed as an intermediary tool of the partaken management. All interviews and surveys were submitted to lexical and textual analysis.

The request for forest management closer to nature and responding to all forest functions is in opposition to the profitable economic management of forest professionals.

The willingness to know and act transforms the status of forest planning as a public and political document into a status of operator for the democratic dialogue.

The conflicts between users are such that multifunctionality cannot always exist in all forest areas. The specialisation of forest areas is a possible solution for non-conflicting partaken management.

Keywords: sustainable management, decision-making process, industrial forest, multi-stakeholder forest management perceptions

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1. Introduction

1.1 The challenge: co-construction of a sustainable management

Participative sustainable forest management is entering the practical implementation stage in Europe. In the massif of the Lands, the signatories of the chart for sustainable management and forest owners that have chosen a certification system must possess sustainable management for all the functions of their forests. It particularly concerns, for the managers and forest owners, on the one hand, to join the principle of dialogue that is recommended by sustainable management and, on the other, to use the management indicators for the chosen criteria (PEFC Aquitaine 2002).

Within these criteria, those that concern the other socio-economic functions of the forest, besides wood production, are poorly supplied with indicators, particularly those about the participation in the decisions taken by the stakeholders or interest groups.

To be sustainable, all development requires participation of the population and interest groups in the management decisions (Purnomo et al. 2005).

During the last 10 years several studies have been done in underdeveloped countries by Sarin (2001) on forest planning, Richards et al. (2003) on participative forest management, Peluso et al. (2001) on the forest socio-economic aspects and Saxena et al. (2002) on resource management integration.

In Europe and France these studies on participative management concern several areas such as water (Ferrand 2004) but few authors have studied this question based on the forest.

However there is a debate on the ways in which groups can participate in the decisions and management of their interests that is recommended by the Arrhus convention. Forest management must thus be provided with new forms of governance (Mermet 2004).

This debate is being generalised at the same time as the state and professionals implement their different networks (ESB, contaminated blood), the official statement being that there is a distance between citizens and forest management, particularly in the decisions of the objectives determined in the planning.

Current studies concern the advantages of democratic debate (Mermet 2004) or taking into account the landscape (Fischesser 2004), rather than the users' expectations on all usages of the forest.

The aim of our research is to understand the practices used by forest stakeholders to determine the indicators that are liable to follow the evolution of the involvement of all stakeholders in the management decisions.

1.2 The objectives: to express the perceptions and representations in management

If the perceptions and representations of nature or the forest are well known in Europe (Schmithüsen 1996; 1999; 2000.), (Van Rensburg et al. 2002) and in France (Arnould et al. 1996; Cemagref 2002), their expression when taking decisions for forest management are not very well observed.

The study done in the Spanish Basque Country centres on the socio-economic dimensions of forest practices, the objectives are:

1. exploitation of the different forest perceptions and conceptions
2. to know the different functions that each individual gives to the forests and the way they use those functions
3. to know the perception in the current and future forest situation

Table 1. Different categories of interest groups.

Users	Bikers	Walkers	Farmers	Non-Professionals
Number of persons	19	69	8	50
Professionals	Managers and Administrators			
Number of persons	50			
Decision-makers	Politicians		Planners and Developers	
Number of persons	10		30	

4. to know the expectations of the population from forest planning
5. to know the perceptions and representations of the decision-makers, planners and developers

The main objective in Aquitaine is to have a general idea of the forest perceptions from the forest professionals' point of view and from all the users, managers and planners.

After comparing the results of these studies on different areas and forests we will have enough information for a general study that will be implemented and used by the different partners of the forests in Southern Europe.

In short, our common objective is to make an inventory of the representations and expectations of the different interest groups, for all forest functions, to supply one or more indicators of these representations, to find the points of consensus or dissent, to propose some ideas for reflection to the decision-makers on the resources to be implemented, so that the users can be approached for participation in all decisions.

2. Material and methods

In their study on attitudes, perceptions and opinions, O'Leary and McCormack (1998) underlined the following needs in their research area:

- to use quantitative and qualitative research techniques,
- to have individual interviews and enquiries by mail,
- to do it on a regional level rather than national and include specialist interest groups.

We have surveyed the various interest groups in different situations of Aquitaine and Euskadi (Table 1):

The users (Diepstraten 2001) were asked about their perceptions and representations. The forest professionals and users were investigated through an open survey (Le Louët 2002) about their forest perceptions and representations, forest management and their profession.

The planners and decision-makers (Broqué 2004) were equally asked about their perceptions, representations and practices. The interviewees were:

1. public and private professionals of forest planning,
2. those responsible for the forest structures that participate in the elaboration of forest planning,
3. forest owners,

4. representatives of the forest owners unions,
5. politicians,
6. manufacturers,
7. representatives of forest users groups.

We are working on the hypothesis that planning is an intermediary subject on which there is a written expression of forest practices. We have thus inquired about: i) forest perception and forest planning, ii) the content of forest planning (implementation, way to do it), iii) planning transmission and finally, iv) its application.

These four subjects correspond to the articulation between the willing to know and willing to act; they take part in the implementation of the stakeholders' networks for planning practices.

The willing to know and willing to act are limited by the perceptions and opinions that determine attitudes and preferences.

The characteristics of each individual are: age, sex, profession, belonging to a organisation for nature protection, forest owner or non-forest owner.

Forest planning is considered as a device according to Foucault (1994) because:

- there is a legislative context (Planning, PSG, Law of forest orientation, Forest Code),
- there is a stakeholders' network (private/public/experts/decision-makers),
- this network device goes from the conception until the drafting and application of projects of planning and management,
- it conveys practices: forest rules, contracts,
- there is a meaning in the action (sustainable management, participative management) and it responds to a request from society: former management of the resource for energy, today participative management for all functions, there is debate about the conception of the device and its implementation,
- it is a technical and economic system for engineers, it is a juridical and political system for politicians and jurists, it is an ecosystem for the naturalist and a social system for sociologists and historians (Cemagref).

The general view of this step associates quantitative and qualitative data. A textual and lexical analysis helped summarise the results of these surveys, free or led.

3. Results

3.1 About the perceptions and representations

The professionals

In Aquitaine, 25% of professionals see the forest as a model of nature. To 16% of them, the forest is timber and for more than 10%, the forest is life, the quietness and the environment. The quietness is the main image that professionals have of the forest.

In general, the professionals talk about a varied forest. The forest of Aquitaine is the one that is more frequently qualified as cultivated (25% of answers), mono-specific and private. For the majority of professionals, the forest supplies wood and all forms of work in the forest are a sign of qualitative management.

The answers differ according to the sector of activity, age and socio-professional category. The two first factors represent more than 54% of all differences.

In the Basque Country, the question about forest diversity is approached taking into account their usage.

The users

The users of the forest of Aquitaine see the forest as a representation of nature (75%), the trees and a quiet place. Most think that French forests are quite diversified, but the forest in Aquitaine is boring and mono-specific. All of them have walking in the forest as a hobby. Another important activity is picking mushrooms. The majority of users do not understand the wood and sustainable management very well.

In the Basque Country, the opinions we were given about the forest were not very different from one another. When those questioned talked about the forest, they only took into account the forest itself. In other words, all forests are alike to a non-forester. For some people who were asked if the relationship between the individual and the forest is an active one, as if the forest was a living thing, the words used were freedom, quietness, source of wellbeing, etc.

The answers differ according to the sector of activity, age and socio-professional category. The first two represent more than 33% of all differences.

The decision-makers

For the politicians and forest-owners, the function of forest production is clearly affirmed. When the multifunctional characteristic of the forest is evoked, the forest is considered on a different scale to that used by the forest owners who have a representation of the forest as a heritage to be preserved from generation to generation. The decision-makers do not have that material concept; the forest is rather immaterial (for the future, a power stake)

According to the answers, we have categorised the different types of forest representations in the following terms:

The mythical forest – a natural space, untouched or native, it is ideal because the symbol of nature and space is to be preserved. It is appropriated by the users through this myth. It is the forest of the users. We talk about the object, but not of the object (Barthes 1957)

The material forest – that looking for several attractions and products and first of all for a resource to be managed according to rules and the law. It is the forest of the professionals who do not want to be deposed and oppose the rule to the myth.

The ideal forest – a future goal for the decision-makers, it is the subject of dialogue and communication.

About the forest functions

The professionals

Results for the professionals are depicted in Figure 1. According to the managers, forest planning has as an objective to develop the wood resources. They feel that their work has a bad image with the public.

The professionals have a good opinion of sustainable management that, according to them, represents an important improvement towards better exploitation of the wood resources and other uses, even if most of them consider it more as a commercial step than a technical one.

For them, the economic function is the major function of the forest. Afterwards there are the ecological and social functions. Most professionals think that fragmentation and enemies of the forest represent most of the danger. They use words such as productive, profitable, ecological, capacity to produce, entertaining.

Multi-functionality is rarely evoked by the professionals. To follow several management goals is not the same as rationalizing management.

For these two categories (professionals and users), the answers differ according to age, sector of activity and socio-professional category. For the professionals in the Basque Country the economic function only refers to the wood exploitation.

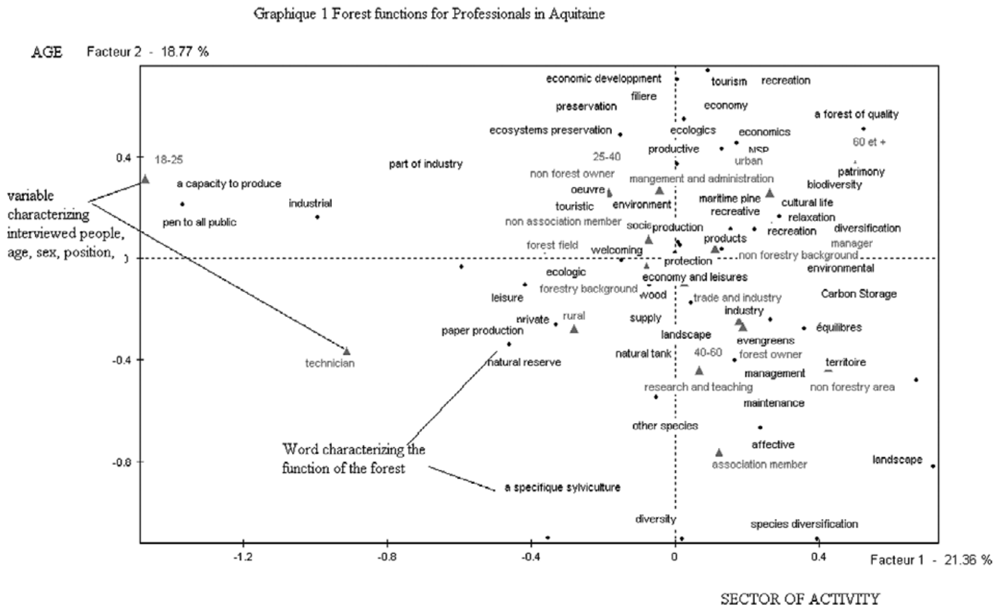

Figure 1. Forest functions for professionals in Aquitaine.

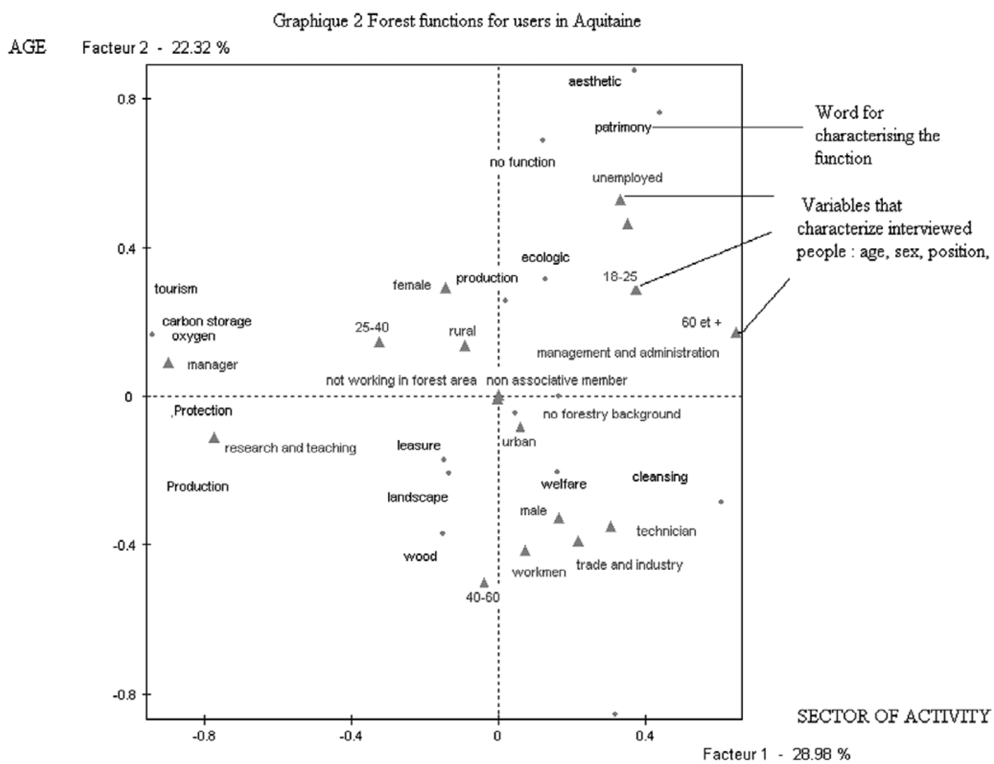

Figure 2. Forest functions for users in Aquitaine.

The users

Results for the users are depicted in Figure 2. For the different users, the conception of the more important functions is quite ambiguous. Most users think that forest management could be improved if the managers developed the social and ecological functions of the forests. They consider the cutting as something bad but that has to be done. Most think that there are enough places to be peaceful and quiet and for walking. But people would like to have more information given by the managers themselves on sustainable management. They would like to be more involved in the decisions that concern forest management, such as its social functions. Few people know what sustainable management is, but once they have discovered its meaning they have a good opinion of it. Talking about forest functions, people use the words heritage, aesthetic, preservation, wellbeing, landscape.

The two first factors of the compared analysis represent more than 50% of the total difference. The most significant differences are found between age and sector of activity.

In the Basque Country, socio-economic functions such as tourism, education, landscape, the environment, are also, if not more, important than the economic function, which is seen as a possible negative factor for the environment.

The decision-makers

For the decision-makers the forest is an object of development, its function must be above all economic, but it must also satisfy all the requests coming from the interest groups.

A proposal for the function indicators

Table 2 summarises the terms given to the forest functions by the different interest groups.

3.2 About the management and forest planning

The professionals

In the Basque Country, wood exploitation shows the diversity of the different types of forests. For people who work in the forestry sector the best indicator of planning quality is connected with the quality of the trees.

Most professionals know about sustainable management, but do not really apply it. The forest certification is seen as a commercial operation to sell wood at a better price. The difficulty, according to the professionals, is to organise the forest taking all its different functions into account.

In Aquitaine the first two multivariable factors represent 46% of the total variance. The sector of activity is the main variable responsible for the differences observed among the professionals surveyed.

The users

In the Basque Country, the users consider that forest planning having wood exploitation as its only objective will not increase the diversity. In multifunctional forests (where wood exploitation is linked with tourism), forest users think that there should be better planning. The planning quality is connected with diversity and the forest’s richness. The users ignore sustainable management and forest certification. They think that planning must concern something other than just wood exploitation. Most users do not know the purpose of sustainable management.

The two first factors of the multivariate analysis in Aquitaine represent 42% of the total variance. The sector of activity, age and level of responsibility are the main variables responsible for the observed differences.

Table 2. Opinions, perceptions, attitudes, preferences of the professionals, users, and decision-makers.

Opinions	Perceptions
The forest produces richness	The management is badly understood
The forest is mono-specific	The forests are native
A multifunctional vocation	Its place is in the territory
Attitudes	Preferences
Poor knowledge of problems connected with the forest Quite effective and quite active Strong and stable feeling	Wood exploitation
Poor knowledge of problems connected with the forest More effective and more active Strong and stable feeling	Organising the forest for aesthetics and landscape
Good knowledge of the practices	A tool for economic development

The decision-makers

There are different perceptions of the forest according to their link with planning practices.

We have highlighted three stakeholders groups: politicians and forest owners, planners and users, cooperatives.

For the politicians and forest owners, the forest production function is clearly affirmed. If the multifunctional characteristic of the forest is evoked, the forest is perceived on a different scale than that used by forest owners. To the forest owner, the forest is a”heritage” that must be made”profitable”,”regenerated” and”passed on”. It’s like their”savings”, a”piggybank”.

The politicians have an idea of the forest on a larger scale. For them it is an”economic advantage” that ensures territorial development. (“Resource”)

The forest planning has a different signification according to the groups.

For the forest owners, planning organises the forest space qualified as geometrical and rational. The action of the Forest Defence against Fires in the organisation of forest spaces is frequently quoted. The definition of forest planning given by the forest owners is”geometric planning”, and gathers together the different forest and technical works.

The forest owners understand it, first of all, in terms of work, cutting, geometry and minimizing constraints. (“Fragmentation”). A simple management plan will be approached after the study description. It is understood as necessary for the forest management of future generations. (“Succession”). They have a material link to the planning.

The action of the politicians aims to develop competitiveness, planning is understood as a tool for rationalising space. Moreover there is strong”mimicry” as concerns planning. It is where they can express their power.

The features of the forest are also raised:”mono-specific, fragile, well-kept, broken down, split up, and lived in.”

For the planners and professionals, the forest is an”ecosystem”. If the social and environmental functions are clearly affirmed (“hobbies, landscape, biodiversity”), the function of production also remains. (“Production, intensive exploitation“).

Revisers, editors and engineers have an administrative and technical link with planning. (“Regulation, tools, forestry“).

In a state forest, planning is supported by”dialogue” with the forest owner, so that the forest can be readapted. (“Re-adaptation”)

Its procedure, codified by the ISO, makes forest planning a tool of dialogue and negotiation. (“Step-quality, relation-client, negotiation, co-management”) It is intended to help the co-existence of two different functions in the centre of the forest space:”canalise, reconstitution”.

The cooperatives, which are placed between the planners and forest owners consider forest planning as”cooperation” with the forest owner, with the purpose of future wood marketing.

The professionals who have a perception of the forest as an ecosystem evoke”successful and efficient” planning. They have several preoccupations as concerns planning: production, industry, sustainable, resource protection.

The stakeholders stress their difficulties in implementing walking paths:”conflict”. They would like their expectations to be more taken into account by the private owners.

Finally, *the users and associations* consider the forest as”artificial, uniform”, but evoke the presence of an important diversified biology. (“Diversified”) This space is at the same time a area for leisure (“games”) and a subject of study.

Planning is summarised as”intensive exploitation” and, for the most virulent,”asepsis” of the environment. These stakeholders stress”lack of communication” about the forest and planning. They have an idealised link with planning and wish they could participate more, so that it could also express their wishes.

The preoccupations of these stakeholders are linked with leisure, which is expressed through the terms”games, culture, environment.“

3.3 Planning implementation

For the administrators, we are talking about a technocratic act and implementation, this is what is revealed through the type of language used by the interviewees: ISO, directive, procedure, vulgarisation, inventory, mission letters, counting).

For the politicians, it is a rational act, the terms used to qualify the planning are: conciliation, investment, communication, contract, relation, dialogue and professional negotiations, technique and rationale, expertise, orientation, participation

For the users, they see planning as a technical and sociological action: visits, lobbying, contracts, expertise, communication.

For the forest owners, it is the technical implementation of the decisions taken, expressed through the words: management, forestry, studies, purchases, regroupings, and session.

4. Discussion and conclusion

4.1 The demands and expectations legitimised by the law

The perceptions and representations made by the users of forest functions, of the management, and implementation of forest management through planning are divergent and sometimes contradictory, confirming recent studies on this subject (ANCR 1993; Arnouldet al. 1996; Arnould et al. 1997).

If the existence of different functions is recognised by the interest groups, the importance of each function changes according to its link with the forest (Resenburg et al. 2002).

It is the right of forest owners and public forest managers and investment that legitimises the economic importance of wood production.

It is also the usage connected with the request the forest users put forward for a more diversified management, and it is also the financial investment that justifies (taxes) this position.

These different approaches have already been mentioned by authors in different contexts, where we find a perseverance of the interest groups in their demands, despite the area or forest culture (Purnomo et al. 2005).

In Southern Europe, the technical rules, such as planning, have been adjusted so that management models can be constructed that will be a link between the willing to know and willing to act, as underlined by Foucaut (1994) when talking about devices.

The decision-makers and users were satisfied for a long time by this instrument, because it corresponded to their wishes. The redistribution of management priorities linked with the evolution in society's needs is turning the consensus of the link willing to know and willing to act into dissent. How to act on dissension? What is negotiable?

4.2 To ensure development of the articulation between willing to know and willing to act

The political dynamics of a device is about articulating the willing to know and willing to act. We exploit this articulation as an indicator of management. The willing to know has changed, but not the willing to act. Forest knowledge is partial and incomplete. The administrative structures rule over the knowledge according to their divergent interests. The willing to act is summarised as the will to inform.

The forest perception and planning of the different groups are removing what is useful from its primary function (viability, what is negotiable, what is not negotiable)

Their perceptions differ according to their link with the planning practices. The politicians and forest owners have a material link, planning being an area for expressing their power.

The editor, reviser, executants and engineer have an administrative link; planning is a tool for dialogue and negotiations.

The users and associations have an ideal link; planning is where they can express their wishes.

This device is becoming the place where the requests of the interest groups can be formed, but it is not a planning priority today for the State or private owners, even if there are some attempts in the public forest (Magnin 2004: Etienne 2004).

The decisions belong to the forest owner and manager. The external stakeholders are standing up for their interests in the planning decisions.

In the public forest, planning is a link between the planner and forest owner (State or town).

In the private forest there is dialogue between the planners and leaders of nature projects.

There is discussion on Nature 2000 (it is not a model for the implementation of this negotiation).

The forest owners are dispossessed of the technique by the forest network, as in the implementation of a chart of sustainable management in the massif of the Lands.

The forest is for the manufacturers, but the forest owners sell their wood, the planner is in the middle, the interest groups are also near and they dispossess the planner.

4.3 A solution between areas and a specialisation?

Faced with this situation where the indicators for the representation (attitude, perception, preference and opinion) of the different groups show a lack of a possible consensus, we identify the specialisation of the territories as an alternative to the current management. All the functions cannot be managed on all forest areas at all times. To keep the territory to its functions, to manage it with its users is a bigger challenge.

The question is, in what structure? The distrust that users have in the forest owner and manager comes from the fact that the right to own and the right to use are opposed. We need an independent structure on a territorial scale. For example a mapping of the conflicts or the contradictory expectations could optimise the ways to act.

However, studies carried in the underdeveloped countries (Kumar and Kant 2005) that compared different bureaucratic systems (fixed hierarchy, centralised power, non-participative decisions, etc.) have shown that if the purpose of the systems is different, the organisation structure is the same, unchangeable, even though the components that are acceptable differ from the decisions that are taken. In other words, it is not the organisation structure that is determinant, but to be able to accept the proposals of the different decision-makers and interest groups. This point of view is shared by Boerwinckel (1998) and Germain et al. (1998) in the USA.

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Ukraine Forest Policies for Sustainable Global Environmental Development

Nataliya Plesha and Steven R. Shook

Department of Forest Products, University of Idaho, USA

Abstract

This paper is an attempt to create model that integrates Ukraine into the sustainable global environmental development process using four pathways of internationalization and domestic policy change. It seeks to address this topic applying published case research in ecological forestry from the view-point of globalization, internationalization and domestic policy change. The review will consider the importance of four selected pathways; these include market dependence, international rules and regulations, norms and infiltration of the domestic policy-making process on the issues of domestic policy change for global integration. The focus will be on such issues as globalization and internationalization models of domestic policy change (particularly forced by transnational actors and international institutions), dependence on foreign markets with ability of transnational actors applying different strategies to the global markets in order to make policy changes, effect of international agreements or policies of powerful international organizations on domestic policy change, value change aspects as a form of restating existing norms and ideas or establishing new ones, and the process of entering domestic policy networks. The paper identifies directions for future research in this important area.

Keywords: globalization, internationalization, domestic policy change, transnational actors, international institutions, ecological forest

1. Introduction

Globalization is a term that explains not just simple theory but a variety of issues related to world development. Social terminology is very rich in its ability to describe global changes in countries around the world. Globalization is often used to make a connection between those changes in either economic, political, or environmental factors that need to be investigated.

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We use this term to explain the growth and spread of investment, trade, and production, the introduction of new technology, and democratic changes around the world. But globalization can simultaneously result in the spread of sustainable global environmental development. Concurrently, the appearance of social and political protest movements opposed to globalization may be necessary in cases where globalization presents a risk to society. It can be argued that globalization process is an old instrument for development that can continue during the developing period or can be stopped at some point. Others argue that globalization is a positive new development for most people around the world.

Regardless of the high importance of global development process, scientific research on globalization issues has been searching for positive findings. It has been an appropriate stage in research for several reasons: researchers have put emphasis on potential of globalization to provide opportunities for shifts in investment, technology, and economic growth. There has been a wide range and growth of analytical and promotional type of research. Research in globalization has focused mostly on theoretical methodologies. Research applying global aspects to real examples and with multifaceted analyses and study of variation depending on the combination of economic, political, social, cultural, and environmental structures of a country have not been readily available to the research community. Systematic methods needed for analyzing these very important and complex issues of globalization process are not fully developed. Globalization research has been the individual specialty for economists, politicians, social scientists, and some environmentalists. Few researchers have examined globalization issues as a complex system that should integrate all the fields of study previously mentioned.

Theoretical research on global development processes is primarily based on experience of developed countries; application to real world practice is disjointed. The social science literature supports different definitions about the globalization process without giving advice to practitioners. The literature ranges from developing the idea of how globalization works for the benefit of the state, such as growth and spread of investment (e.g. Väyrynen 1999; Nye and Donahue 2000) and trade and production (Vogel 1997), to the introduction of new technology and the spread of democracy (Harris-White 2002; Kierzkowski 2002; Sandbrook 2003). Recent literature stresses the importance of using the globalization term to show that globalization should also add to modern developments such as the spread of environmental pollution and the emergence of the social and political protection movements (e.g. Schaeffer 1999; Langhorne 2001). These researchers present a methodological approach in countries with healthy economies (i.e. developed countries), but similar research has not been done in developing countries with unstable political economies. Their applications of globalization research fail to recognize or capture the unregulated government structure and corruption on levels of certain state activities in developing countries.

Recently, the literature has discussed globalization as a unique phenomenon that cannot be confused with internationalization (Mander 2001). The internationalization term is used when policies within domestic control search for increased inspection, participation, or power from transnational actors and international institutions, as well as representation of their rules and norms (e.g. Bernstein and Cashore 2000). Increasing economic integration has led to a debate among researchers about whether it leads to environmental standards being reduced or increased. Theory suggests that countries that have embraced globalization have experienced increasing wealth; their production level increases simultaneously because of the introduction of new technology. All these factors have led to negative environmental impacts as a consequence of exploitation of natural resources such as forests, soils, minerals, oil, coal, fish, wildlife, and water. It is well known that after countries become involved in the globalization process that the bulk of their benefits go to the global business organizations that are not highly motivated to transfer their profits back into environmental mediation or protection. These companies tend to reinvest back for further exploitation, or alternatively, they repatriate profits back to their home country without making an effort to benefit the developing countries. This is a typical behavior of profit-motivated companies when countries are involved in global economic integration. If these strategies of globalization are to control, then a high risk in environmental degradation exists in developing countries, and in some cases serious environmental consequences would be difficult to avoid. The current conceptualizations of globalization are too general, need more theoretical foundation and are hard to apply to countries with different economic structures and political regimes.

Some natural resources (e.g. oil, natural gas etc) are not renewable and others (e.g. forests) would take considerable time to bring back to the same condition after exploitation. Research toward solving these issues has changed somewhat in recent years. Researchers whose work is related to environmental issues – particularly those with specialization in economics and policy-making processes – are integrating a variety of useful concepts into their research on globalization, internationalization and domestic policy change, as well as the interaction of these concepts with the environment. Four pathways of internationalization and domestic policy change and their application to ecologically sound forestry in environmental policy have become relatively new topics in environmental policy research. The four pathways of internationalization are following: market dependence, international rules and regulations, norms, and infiltration of the domestic policy-making process. These pathways of internationalization can be defined as follows:

Market Dependence
Market dependence relies on foreign markets as the path along which the transnational actor(s) apply specific strategies (e.g. boycott campaigns) to the global markets with the goal to make policy changes more powerful and enduring.

International Rules and Regulations
International rules and regulation rely on international agreements or policies of influential international organizations (e.g. International Monetary Fund, World Bank) in order to have an effect on domestic policy to the point that they construct required obligations on countries through acceptance of rules of international law.

Norms
Normative internationalization strategies are expected to be stronger compared to other pathways because they create value changes within the target country. They influence domestic policy goals and principles by restating existing norms and ideas, or establishing new ones.

Infiltration of the Domestic Policy-making Process
Infiltration of the domestic policy-making process is the ability of transnational actors to enter the domestic policy networks. Policy networks have three important characteristics: the degree of openness to non-business interests, country independence from business interests and country capability to implement policy options.

The main strength of the research described above is that it creates a distinction between two social categories: globalization and internationalization. They illustrate the influence on domestic policy change by transnational actors and international institutions using four different pathways through which internationalization produces policy change. This conceptual framework is important because it emphasizes that transnational actors and international institutions can reverse the downward effects of globalization on domestic policy, producing increasing versus decreasing environmental policy standards, as well as more robust environmental policy standards.

This paper will review four pathways of internationalization and domestic policy change that focus on ecological forests in British Columbia, Canada. First, it will focus on the basic idea of interpretation of four different pathways and their application to domestic policy change. The role of transnational actors and international institutions will be stressed. Second, the distinguishing process between globalization and internationalization will be made to show how these two social categories may or may not be connected with one another in a process of influencing the country's domestic policy. Third, the focus will be on stating the hypotheses about the effect of transnational actors and international institutions on environmental protection through policy change activities.

The structure of the paper as follows. Section 2 presents an overview of the concept of globalization, four pathways of internationalization and domestic policy change. This section will give the background information that should be considered in future research. Sections 3 through 5 will focus on Ukraine's global integration, current environmental policy situation, and explore the four pathways of internationalization as applied to Ukraine's development. Section 6 will present directions for future research.

2. Four paths of internationalization and domestic policy change

The paper investigates the method by which Ukraine has approached the globalization and internationalization process. Specifically, we use the four pathways suggested by Bernstein and Cashore to investigate if these pathways can result in domestic policy change in Ukraine. Ukraine is already receiving globalization attention with respect to economic and political activity; substantial opportunity and great risk still exist, however, in Ukraine's policy development processes (Ghesquiere 2000). This paper focuses on forest policy change as a case study example. Forest policy change makes for an insightful examination of a country's global transition (Nijnik and Van Kooten 2000). Figure 1 lays out the conceptual model of how the internationalization and globalization processes in the world are traveling between developed and developing countries, how four pathways of internationalization and domestic policy change interact in the entire system and the problems and benefits that can be gained form it. This model implies a continuous process that is dependent on the nature of countries and how fast they can be integrated into the internationalization and globalization process.

It is very common to use the terms global market and global market economy. Economists typically use these terms to explain the process of transforming the national product to be introduced to a broader audience with a purpose of getting recognition around the world (Gibson 1996). Moreover, transnational actors use global markets to force policy responses using boycott campaigns. The effect leads to losing market and consumer interests as well. Governments and companies tend to fear boycott movements. Companies, in particular, worry about losing their image among customers and the fall out of a negative image on their business performance. Governments are under the potential threat of losing their political power and their ability to hold control on policy-making processes. This is due to the impact that boycotts can have on political situations that can result in a decrease in a government's role in the global political arena.

The main goal of transnational actors is to use consumers to force policy change through the education, mass media, application of the brainstorm technique, and targeting foreign suppliers. Policy change can result it in two ways: using the support from domestic coalitions or simply using the transnational actors' own relative power. Domestic coalitions may be

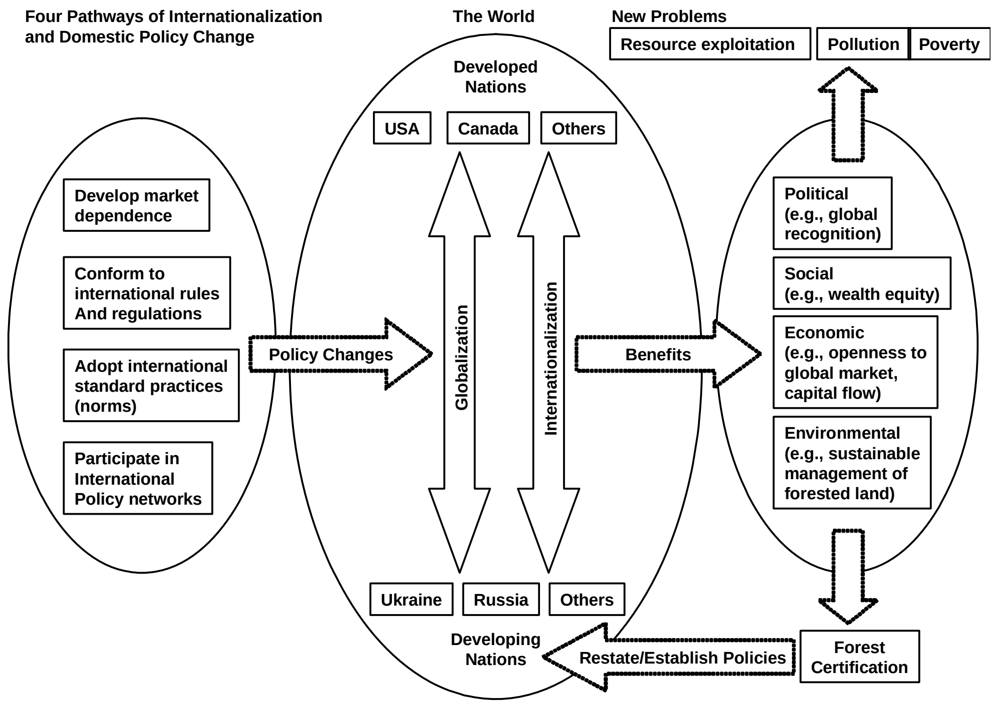

Figure 1. Conceptual model of the globalization and internationalization interaction process.

more effective in terms of supporting boycott campaign because they are more involved in domestic policy processes and internal changes (Langhorue 2001). The key point is that domestic policy change is possible when the environmental or consumer boycott campaigns are taking place on a global scale. The relative dependence on a global market and the success of transnational actors, which influence consumer behavior, are main the aspects to domestic policy change in the market dependence pathway.

The general concept of the international rules and regulation pathway is that policy-making processes, such as trade agreements and policies of powerful international organizations, can effect changes in domestic policy regulations. Non-governmental organizations (NGOs) and organizations that have no representation in a country can also be a source of policy change that a state or company may have to adjust to and accept. Countries that are part of signed international agreements typically recognize the power and prestige of international institutions that are setting rules and regulations. Depending on their decisions, domestic policy regulations or rules can be improved or even changed to reflect a global context. The European Union, the most powerful international institution in Europe, is one example of an international/regional organization having a significant influence on policy-making decisions of countries that joined that coalition. However, conflict can occur when such international organizations dictate to participating countries the manner in which to follow for making policy change operations. Success would be a guarantee if no “forcing activities” are involved in this process.

The term internationalization is appropriate here and can also reflect in powerful international organizations such as World Trade Organization, International Monetary Fund, and World Bank, which can require participating countries to accept environmental or other regulatory standards in order to receive support from the organization. The role of transnational actors is to assist countries and to be either directly or indirectly involved in the process of participation in the development of international rules and regulations. Note that policy-making structures may play important role when states are seeking ratification of international regulatory process and implementing legislation. International trade agreements and the willingness and ability to comply with international rules are two major factors within this pathway under which globalization can take place. Breaking these rules can cause loss of global markets, global recognition and positive international relations.

Domestic policy practices can also be influenced by internationally developed norms. The role of transnational actors and international institutions under this pathway is to stimulate states to follow international norms, which may include different types of political methods, such as information and representation, by using the transnational advocacy networks. Typically, this results in a boomerang effect for domestic policy-making processes. At particular moment domestic policy-making groups, after being excluded from policy-making decisions, start seeking transnational support for their cause. This path works mostly in countries that are aware of the power resulting from being a part of normative community of nations. The main concern of these countries is dependent on global recognition rather than participation in the international political economy. Countries following this pathway focus on policy initiatives rather then policy responses that can lead to changes in the understanding and implementation of policies. No forcing processes are accessible under this pathway; in this sense, it can be viewed as a pathway that is guided in large measure by a moral approach.

The structure and participation in domestic policy networks are two significant components of the fourth pathway of internationalization. The success of transnational actors that are involved in this path depend on the following policy network characteristics: degree of openness, state autonomy and state capacity. Openness captures the interest and opportunity for new organizations to have access to the policy network, as well as the ability to effect change within the network. Problems occur when transnational actors have difficulties entering these systems. Oftentimes, transnational actors are forced to change the policy network in order to be more open, even if it requires applying other pathways technique. For example, state autonomy means independence and separation of policy-making choices by state officials from interests of group of businessmen. Transnational actors play significant role in policy-making change process here even with limitations of openness of policy networks. Transnational actors have some impact on autonomous state policy decision makers but with limited support of domestic partners. State capacity deals with ability of a state to implement policy choices and to be more centralized to achieve success of policy changes. The key point is to provide assistance to domestic policy groups through training programs, resources allocation, financial support, and organizing new domestic coalitions. The globalization process is not an important issue under this pathway because all economic manipulations are left behind.

The study of globalization and the four pathways of internationalization and domestic policy change are based on a British Columbia case of ecological forestry and the resulting upward/downward effect on environmental standards. All of these pathways differ but have some similarities that make it possible to compare their influences. Globalization and domestic policy aspects have differing degrees of importance along the four pathways of internationalization. The role of transnational actors and international institutions can be valuable during the process of domestic policy change. To understand how this system works under different conditions, and to understand the strengths and weaknesses of this process and how it can be applied to countries with different political structures, we use Ukraine as an example.

3. Ukraine's global integration and development

Ukraine is the second largest nation in Europe (Gibson 1996). It has been thirteen years since Ukraine gained political independence as an international state. Ukraine is perhaps the country that is in the most favorable position to achieve economic prosperity among all former Soviet Republics; it has abundant natural resources, a well-educated labor force, and many of the other potential opportunities to be recognized by the global community as a perspective partner. It is difficult for a newly independent country to become a fully engaged participant in the globalization process after having been under the Soviet political economy. It will likely take some time for Ukrainian citizens to change their cultural mindset toward a widely accepted orientation toward global integration and development with the result of increasing domestic economic growth.

Still, some regions of Ukraine yearn for years past under the old Soviet system. These citizens do not know exactly how to accept change and, at the same time, they do not want to make changes. This cultural mindset can lead in slowing Ukraine's global integration process, resulting in it being far behind other developing countries (e.g. Baltic countries, Poland, Russia). Today, Ukraine is oriented to the West. Ukraine looks to build entirely new relations with developed countries, and the country sees that this is an important step toward the Ukraine revival and prosperity. Ukraine will soon join the European Union, and the country is pinning is hopes that membership will result in many new opportunities and a greater diversity of perspectives (Kierzkowski 2002).

All the transition processes in Ukraine should be properly managed. A new generation of politicians should be more oriented toward meaningful democratic changes, economic growth, political stability, and environmental protection. Their incentives should be free of old ideas and persuasions.

Ukraine's effort to become a member of European Union viewed very positively by the global community in that it opens the door for increased international investments, trade, and production, which can lead to economic stability, spread of political democracy and environmental sustainability. As we mentioned above, it also can cause the scarcity of natural resources, power of global institution with some limitations, and environmental pollution to some extent. Furthermore, it is an easy for a country to allow the international community to participate in domestic processes. But in order to be comparable to other countries, it should be recognized by state officials that these processes are necessary to pursue.

The recent economic, political, social, and environmental transformations are very important subject to discuss. A variety of publications by national and international researchers is dedicated to these issues. The famous "orange" revolution demonstrated to the global community the integrity of people, their solidarity and goodwill, the right to have a democratic country with growing economic and political stability. They proved the willingness to become a part of global community with newly built relations and recognition.

4. Development of environmental policy and regulation in Ukraine

Ukraine's awareness concerning the environment and environmental development increased significantly after the Chernobyl nuclear power plant explosion in 1986. Since that time, and despite the increased environmental awareness, the environmental situation in Ukraine has becomes increasingly uncertain. The total area of contamination due to the Chernobyl accident is estimated as 41,000 square kilometers, including a large territory of forested area

(Hardashuk and Nijnik 1994). After Ukrainian independence, many issues related to environmental consequences and trends of this contaminated forest were transferred to Ukraine government. The process of liquidation of disaster consequences required substantial financial backing and changes in environmental policy. Today, the world environmental community assists Ukraine in recovering from this environmental and human health tragedy.

In 1997 and 1998, the first step toward official acceptance of a world strategy of environmental development of norms was made in Ukraine. Specifically, there was the establishment of the National Commission for Environmental Development under the Cabinet of Ministers of Ukraine. Ukraine Parliament adopted the documents of *Major Areas of the State Policy on Environmental Protection* and the *Use of Natural Resources and Provision of Environmental Safety*. As such, the legislative codification of the priorities and strategy for systematic development of industrial and natural resources capacity of the state was made. About 250 national and international projects were developed in Ukraine with 137 directly related to the environmental development (Nilsson and Shvidenko 1999).

The main goal of Ukraine's environmental policy modification process was to reorganize the economic and legislative systems of natural resource utilization, increasing environmental protection with a greater focus on human values, optimizing state control over natural resource utilization, modernizing technological processes according to global standards (e.g. ISO 14000 and 14001), and creating an efficient environmental-economic regulation system.

A substantial number of changes Ukraine made toward sustainable environmental development did not find their incorporation into everyday practice. Currently, environmental policy improvements are rarely implemented and more representation is needed in future to develop policy. These changes will become increasingly required as Ukraine becomes increasingly involved in global environmental integration.

Discussion regarding environmental development cannot be made without making a connection to economic, political, and social processes. Different opinions regarding Ukraine's process toward globalization are currently undergoing among researchers and policy makers. In this paper, we are trying to present our view of how the process of globalization, internationalization, and other related issues might have a representation in a research context.

5. Tracing four pathways of internationalization and domestic policy change

In conducting research on globalization, the four pathways of internationalization and domestic policy change in Ukraine are not readily apparent or easily captured. Since Ukraine has become an independent country, many changes have taken place in the state policy-making process. The strength of these policy changes, however, is not yet strong enough for a country that is orienting itself toward globalization.

It is likely that only states with well functioning market economies can assist Ukraine in achieving more benefits from being a part of global community. These states can generalize quantitative and qualitative investments that are necessary for economic growth and sustained improvement in standards of living. Economies that are oriented for competition can assist in creating profit incentives for the efficient allocation of resources, as well as impose financial discipline that is key in the market dependence pathway of internationalization and domestic policy change.

Another factor that can cause changes in domestic policy regulation in Ukraine is representation of international rules and regulations. Ukraine is a member of the Central European Free Trade Agreement. In 1992, Ukraine became a member of International

Monetary Fund and the World Bank. Currently, the Ukraine is attempting to become a member of the European Union. The representation of the country in such well-known world organizations can impose the international rules and regulation pathway of internationalization.

Since the Chernobyl disaster, it has been necessary to incorporate different normative internationalization strategies, whether by reformulating current norms and ideas, or by introducing new ones. Ukraine is attempting to show to the world community a willingness to be a country that practices sustainable environmental development. The degree of openness of the policy networks in the internationalization process plays a significant role in Ukraine's global integration.

The environmental policy-making process, with particular focus on forest policy, is the main interest of our future research. Eco-forestry in Ukraine is a key concept for study sustainable global environmental development.

6. Directions for future research

The goal of this research project is to better understand how four pathways of internationalization and domestic policy change might assist in promoting an environmentally friendly model of economic development in Ukraine relative to other developing countries (e.g. Russia). More specifically, reformulation of existing policies (e.g. environmental policy, forest management policy) or creating new ones (e.g. forest certification) that foster global economic integration without increasing environmental problems is a goal of this research. The information required for such research includes economic trend data, but also data related to policy development in order to compare Ukraine with other countries in its progress along four pathways. This information can be gathered from different directives and normative documents, and from international and national statistical data. The results of this work will show how factors along each pathway of internationalization experienced success or collapse in influencing Ukraine's domestic policy changes as they relate to forests. These changes may help lead to Ukraine integration into sustainable global environmental development process (i.e. forest certification guides for improvement of forest management practices according to the principles of sustainable forest management).

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Approaches to Providing for Multiple Values and Functions from Forests in Australia

Rodney J. Keenan

Forest and Vegetation Sciences, Bureau of Rural Sciences, Canberra, ACT, Australia

Abstract

Forests in Australia provide a resource base for industry, employment for rural people and a wide range of environmental values and services for urban and rural communities. The role of forests in providing multiple values and services has been formally recognised for more than 100 years. However, forests have also been regarded as an impediment to economic development and extensively cleared for cropping and grazing. A variety of approaches have been used to maintain values and services provided by forests, including state and national policies and legislation, Federal-State agreements, regulation of forest operations and vegetation management, education and awareness programs, direct government funding and market-based approaches to encourage provision environmental services on private lands.

This paper presents an overview of these different approaches and analyses their effectiveness in different settings. Legislation, policies and inter-governmental agreements are effective when goals are clearly stated and implementation mechanisms well-designed. Regulatory and planning approaches have been effective in providing for multiple values from forests on public land. Regulations, plans and codes of practice are appropriate in some circumstances in private forests. Government spending, public education and community-based movements are also effective in providing for multiple benefits on private land. Market-based approaches are proving successful in targeting public spending and in mobilising private capital to maintain forest environmental services or other values.

Keywords: Australia, environmental regulations, market-based approaches

1. Introduction

Australia is a large and diverse country with a wide variety of climatic conditions, vegetation types, development histories, environmental problems, social settings and community attitudes. Since Federation in 1901, Australia has developed from a predominantly rural

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society with an economy heavily dependent on rural commodities to a highly diversified economy and urbanised population, with over 80% of the population living in cities. Forests cover 164 million hectares, 24% of the land area. Forests provide a wide range of economic goods and environmental and cultural values and services. Taller forests in wetter regions that are of highest value for wood production occur on the coastal margin where much of the population now live. Changing social and economic conditions have created a changing set of values and priorities in the community in relation to forests and to the use of forest resources.

Australia is a federation of states. Under the constitution, state governments are responsible for land and forest management. About 60% of Australian forests are under private ownership or management through long-term lease arrangements.

The variety of environments, land management practices and communities in Australia has resulted in a variety of approaches being used in different parts of the country to maintain the production of different goods and services from forests in response to changing community attitudes. This paper presents an overview of these approaches, their benefits and limitations and their suitability for use at different scales, ownerships and to deliver different goods and services.

2. The Australian Environment

Australia has a land area of 7.6 million km^2 and is situated between 10^o and 43^o S. The population of over 20 million is concentrated largely in cities in the east and south around the coast. Australia has the lowest precipitation and run-off of any continent. Climate is highly variable with temperature across a range from tropical to cool temperate and rainfall ranging from per-humid to arid. Rainfall varies considerably from year-to-year. The geology is generally ancient and heavily weathered, there are uplifted areas forming mountain ranges over 2000 m in altitude. Australian soils are generally nutrient poor with low productivity.

Humans have been in the Australian landscape for millennia. Aborigines have been in Australia for more than 60,000 years and have developed a strong spiritual affinity and attachment to the land. Their extensive use of fire shaped the Australian landscape and vegetation composition and structure is still responding to changes in land management associated with their removal from the land in many regions.

European settlers spread rapidly across the continent in the first half of the 19th century, taking up land and often clearing forest and woodland vegetation for grazing and cropping. Clearing of land for agriculture accelerated in the early part of the 20th century and further increased with the development of heavy machinery and population growth following World War II. Significant areas of forest and woodland are still being cleared for grazing and cropping, particularly in northern Australia.

61% of the land area is now under some form of agricultural management. Depending on the season, between 20 and 25 million hectares are sown to crops. The pastoral industry covers about 70% of the continent, with 94 million hectares under improved pastures and 35 million hectares sown to introduced legumes and grasses (Hamblin 2001).

3. Forest values and services

Low and variable rainfall, poor soils and long isolation from other continents have resulted in the evolution of a distinct flora and fauna. Vegetation composition and structure varies considerably with the diversity of climate, geology, landform and disturbance history. Forest cover is dominated by three main genera: *Eucalyptus*, *Acacia*, and *Callitris*. Most forests have an open (50–70% canopy cover) or woodland (20–50%) structure. The total native forest area (defined as land with actual or potential tree cover greater than 20% canopy cover and 2 m in height) is about 162 million hectares (National Forest Inventory 2003). Plantation forests have been established since the 1920s and the total area of plantations is now 1.6 million hectares (Wood et al. 2001). Most older plantations are of exotic pine (*Pinus radiata*, *P. elliottii* or *P. carribaea*). The average rate of plantation establishment in the last 10 years has been about 60,000 ha, largely eucalypt species grown on short rotation for pulp and established on land previously used for agriculture.

Timber harvesting has occurred since the first days of European settlement. Native forests provide a diverse range of products: sawn timber for construction and furniture, poles, posts, craftwood, pulp and firewood. Current forest removals are now about 28 mill. m^3 with 60% from plantations. 108 mill. ha of native forest (including much of the lower canopy cover woodlands) is under private ownership or management through lease arrangements.

Private forests make a significant contribution to wood supply in a number of regions (Ryan et al. 2002). About 85% of the total forest area has no legal restriction on wood production but only around 15–20 mill. ha of native forest is likely to have suitable species and proximity to markets to make commercial forest management economically viable. Much of the remaining privately owned or managed area is used for other commercial purposes such as grazing.

Australia is one of the world's 'megadiverse' countries. 80% of flowering plants, mammals, reptiles, frogs and fish and about 50% of birds are found nowhere else. Habitat destruction, fragmentation and introduced predators has resulted in the loss of over half of Australia's mammals since European settlement. The number of threatened bird, reptiles, frogs and fish species is increasing with principal threats including forest clearing, salinity, altered fire regimes, climate change, disease and invasive species (Australian State of the Environment Committee 2001). Old growth forests, those that have been subject to little or no human disturbance, are regarded as having particularly important conservation, environmental and cultural values (Keenan and Ryan 2004). 13% of public forests, including 70% of remaining old growth forests are in conservation reserves (National Forest Inventory 2003).

Loss of tree cover and inappropriate cropping and grazing practices has resulted in significant degradation of land and water systems . About 50 000 km of streams have been degraded by sand and silt deposition, mainly in southeast Australia. Clearance of native vegetation has resulted in mobilization of ancient salt stores and rising water tables resulting in salt-affected river and land systems. About 5.7 mill. ha in agricultural regions are currently affected or at potential risk from salinity and 2 mill. ha of native remnant vegetation could be adversely impacted (NLWRA 2001). Salinity also affects roads, pipes and building foundations.

Australia has had a history of long history of controversy over forest uses and values. There was considerable early debate about the extent of forest protection versus conversion to agriculture in the interest of economic development (Carron 1985). Following World War II, accelerated harvesting in native forest to meet demand for post-war construction, large-scale conversion of native forest to exotic pine plantations and the development of export woodchip markets, which resulted in more intensive harvesting in many native forests, created a strong reaction in parts of the community at a time when environmental, cultural and recreational values were becoming increasingly important to many people, particularly those in urban areas. There were numerous government inquiries and commissions into the forest industry and forest land allocation from the 1970s to the early 1990s that resulted in significant changes within the industry and greater allocation of land to conservation.

The signing of the National Forest Policy Statement in 1992 gave a clear expression of current social values and a new impetus to provide an acceptable balance of economic, social and environmental values from forests. There is also widespread recognition of the environmental impacts of clearing woody vegetation and unsustainable land management practices which has created an imperative to effectively manage and protect existing vegetation and re-establish tree cover in many parts of the landscape.

4. Approaches to maintaining forest values and services

National and State policies and legislation

A broad range of legislative instruments now exist to ensure the continued supply of a range of goods and services and the protection of environmental values in forests. Given the constitutional arrangements that granted power over land and natural resource administration to state government at Federation, the Australian Government has limited capacity to directly regulate land or forest management.

Environmental legislation

Most states and the Australian Government enacted environment protection legislation in the 1970s. At the national level, a new *Environment Protection and Biodiversity Conservation Act 1999* came into force on 16 July 2000. The Act aims to promote ecologically sustainable development through the conservation and sustainable use of natural resources and biodiversity through a co-operative approach involving governments, the community, land-holders and indigenous peoples. It focuses on matters of national environmental significance such as World Heritage properties, Ramsar wetlands, nationally threatened species and ecological communities, migratory species, national marine areas and nuclear actions (including uranium mining). It puts in place a streamlined environmental assessment and approvals process and establishes an integrated regime for biodiversity conservation and the management of important protected areas.

Committees provide advice on biodiversity. Indigenous issues and threatened species and guidelines indicate those actions that require assessment. Options for assessment include analysis of preliminary documentation, a public environment report, an environmental impact statement, a public inquiry or an accredited process agreed on a project-by-project basis.

Forestry Legislation

Most states enacted legislation relating to forest management in the early part of the 20th century (Carron 1985). These covered matters such as the delineation and management of State Forests for the ongoing supply of timber, control of forest conversion to other land uses, licensing and control of timber harvesting, provision of funding for technical management, and resource protection, particularly from fire. These early pieces of legislation were some of the first aimed at protecting environmental values and most made specific reference to protecting water catchments and aesthetic values and providing recreational opportunities. These Forestry Acts have been amended over time to reflect changing community values and public expectations from forest managers. They continue to define the functions and responsibilities of forest management agencies and regulate activities that can occur on State Forests and other public land. Other state environmental legislation also regulates public forest management and provides for the protection of ecological values and the prevention of soil erosion and water pollution.

Vegetation management legislation

Over the past 20 years, state and territory governments have introduced and progressively strengthened legislation controlling the clearing of native vegetation on private freehold and leasehold land to limit further land degradation and mitigate other environmental impacts. There is also separate legislation protecting threatened species of flora and fauna. While aggregate levels of native vegetation are substantial in many jurisdictions, there is concern about the representativeness of ecosystems formally secured in protected areas and about land and water degradation in particular regions (Productivity Commission 2004).

An example is the NSW Native Vegetation Conservation Act 1997. This applies to native vegetation management on private lands and provides for the conservation and management of native vegetation on a regional basis and encouragement and promotion of native vegetation management in the social, economic and environmental interest of the State.

Native title legislation

The rights and cultural values in relation to land of Australian Indigenous people has been a prominent public issue for nearly 30 years. The Commonwealth Aboriginal Land Rights (Northern Territory) Act 1976, which applied only to public land in the Northern Territory, provided for a communal and inalienable title where continued traditional occupation and use could be proved. The Commonwealth Native Title Act 1993 formally established national arrangements and resulted in the establishment an Indigenous Land Corporation to purchase land for Indigenous groups displaced from their lands. States and Territories have now passed complementary native title legislation.

National Forest Policy Statement (NFPS) 1992

This Statement, signed by the Commonwealth and all state and territory governments, sets out broad conservation and industry goals for forest management. It presents a vision, objectives and policies for the future management of public and private forests. It was a joint response of the Commonwealth, State and Territory Governments to three major reports on forest issues: those of the Ecologically Sustainable Development Working Group on Forest Use, the National Plantations Advisory Committee, and the Resource Assessment Commission's Forest and Timber Inquiry. It also reflects the resolutions of the Intergovernmental Agreement on the Environment.

In the Statement, the Governments share a vision of ecologically sustainable management of Australia's forests with the following characteristics:

- the unique character of the Australian forested landscape and the integrity and biological diversity of its associated environment is retained
- the total area of forest is increased
- there is a 'holistic' approach to managing forests for all their values and uses so as to optimise benefits to the community
- private forests are managed in an ecologically sustainable manner and in close cooperation with public forest managers, to complement the conservation and commercial objectives of public forests
- a range of sustainable forest-based industries, founded on excellence and innovation, will be expanding to contribute further to regional and national economic and employment growth
- forests and their resources are used in an efficient, environmentally sensitive and sustainable manner
- forest management is effective and responsive to the community
- the Australian community will have a sound understanding of the values of forests and sustainable forest management, and will participate in decision-making processes relating to forest use and management.

The Statement recognises the differing responsibilities and interests of the three levels of government in Australia and provides a framework within which pressures for change can be identified and accommodated so as to ensure that the Australian community derives optimal benefit from its forests and forest resources.

Following development of the NFPS the Australian Government was active in development of criteria and indicators (C&I) of sustainable forest management. Australia was a founding member of the Montreal Process (Montreal Process 2003) to develop an internationally agreed set of C&I and put in place national processes to implement C&I at a state and forest management unit levels (Commonwealth of Australia 1998). C&I have formed the basis for national State of the Forests reporting (National Forest Inventory 2003).

National and state government agreements

A key element of the NFPS involved negotiating Regional Forest Agreements (RFAs) between the Australian and state governments. These 20-year agreements provided for a comprehensive, adequate and representative system of conservation reserves and for harvesting and use of forests outside the reserve system to comply with ecologically sustainable forest management (ESFM) principles (Davey et al. 2003). Montreal Process C&I were used as basis for indicators, reporting and review. Specific targets were set for conservation reserves including larger proportions for rare or threatened ecosystems and old growth forests, with some flexibility was allowed in the achievement of these targets where the economic or social impacts were considered unacceptable. The intention was to give resource certainty to industry, ensure that harvesting is at sustainable rates and that wildlife habitats, biodiversity, water quality, soils, heritage and other economic values are protected. Ten agreements were signed with four state governments. They generally applied only to public forests but in Tasmania specific provision was made to achieve conservation objectives on private land.

Regional agreements were underpinned by Comprehensive Regional Assessment of environmental, cultural, economic and social values in each region and extensive stakeholder consultation. This including extensive mapping of regional ecosystems, old growth forests, disturbance history and cultural values. Industry and structural adjustment funding helped forest agencies develop new resource supply options, including plantation development, and forest businesses and workers adjust to reduced resource supply from native forest.

Regulation of forest operations or vegetation management

Formal regulations or codes of practice are now in place across Australia to provide for the protection of environmental, heritage and cultural values during forest harvesting operations. These are generally governed by legislation and enforced by a separate administration. Codes have often been derived from internal guidelines that have been in place for some decades (McCormack 1994). There are now codes covering public forests in all state and territories. Tasmania and Victoria have legislation and codes covering public and private native forests and plantations.

Scientific committees determine appropriate environmental baseline standards and monitoring methods. Some States and Territories, for example, Victoria, incorporate processes for periodic independent scientific review. The development of codes involves extensive public and industry consultation and landowner and public education about responsibilities and consequences of not applying the code. Codes require extensive commitment to training of planning and operational staff in identifying and managing the range of values that are intended for protection and commitment to audit and review.

Codes require the preparation and approval of management plans and operational plans. The Tasmanian Forest Practices Act 1985 was amended in 2002 to require the development of forest practice plans for all relevant forestry operations including forest clearance across tenures, regardless of whether the purpose is timber harvesting or conversion to another land use. Local governments use codes when considering planning permits for forest-based activities. Codes of forest practice have concentrated on timber production but there have been recent moves for codes for nature conservation reserves (National Forest Inventory 2003).

Similar processes are being applied to vegetation management regulations in a number of states in order to manage the clearing and conversion of native vegetation to other land uses. Regional bodies and landowners are required to prepare vegetation management plans to protect vegetation of high conservation value, improve the condition of existing native vegetation, encourage revegetation and prevent inappropriate vegetation clearing.

Education and awareness programs

Governments have fostered development of a conservation ethic in the rural land management community in order to reverse land degradation and promote sustainable land and vegetation management. The Landcare Movement (http://www.landcareaustralia.com.au) has promoted participation of rural landowners in networks of local groups to exchange information on sustainable land management practices and undertake voluntary works to mitigate soil erosion or restore vegetation cover. These groups provide opportunities for learning by doing through interaction with peers and enable participants to discuss conflicting views. They have enhanced social cohesion, increased the capacity of rural communities to attract resources from governments and better equipped them to respond to change. With strong agency commitment to participatory processes, agency staff and Landcare members have established robust, productive partnerships and avoided previous problems in programs aimed at changing community attitudes and behaviours. Landcare participation has also increased awareness of issues and enhanced landholder skills and knowledge and contributed to increased adoption of best management practices (Curtis et al 2003).

While continuing to be important, many consider it is unrealistic to expect that volunteer efforts of individual landowners and community groups alone will result in the scale of revegetation required to address Australian environmental problems (Robins et al. 1996).

Government funding programs

Governments have provided direct funding support for environmental restoration and maintaining the extent and quality of vegetation for some time. Support is also provided through indirect incentives such as tax rebates and deductions for environment and heritage protection or conservation on rural properties, elimination of financial disincentives and creation of enabling frameworks for such investments.

Considerable effort has been put into developing a tree growing ethic among Australian rural landowners through support for farm forestry (Robins et al. 1996) with the goal of diversifying rural production, integrating small-scale growers into timber markets and providing a range of environmental benefits.

The major national vehicles for direct funding of on-ground works and other national, state or regional activities in relation to forests are the Natural Heritage Trust (NHT) and the National Action Plan for Salinity and Water Quality. The NHT was set up by the Australian Government in 1997 to help restore and conserve Australia's environment and natural resources (http://www.nht.gov.au/). Funding is made available for national, regional and local projects that are assessed by technical panels. There is generally a requirement for matching funding (including in-kind resources) from state agencies, regional bodies, community groups or private landowners.

Since 2001, the NHT has adopted a more targeted approach aimed at delivering important resource condition outcomes including improved water quality, less erosion, improved estuarine health, improved vegetation management and improved soil condition. Associated benefits include skilled resource managers, communities playing a key role in their future direction, improved productivity and profitability, enhanced protection and restoration of biodiversity and more people taking an active role in improving the management of natural resources, including those who are not directly involved in natural resource management activities. Key NHT programs providing funds for forest related environmental benefits include the Landcare Program and the Bushcare Program which invests in activities that will contribute to conserving and restoring habitat of unique native flora and fauna that underpins the health of our landscapes.

The National Action Plan for Salinity and Water Quality operates in a similar way, with the Australian Government providing $1.4 billion over seven years for regional solutions to salinity and water quality problems. The aim is for all levels of government, community groups, individual land managers and local businesses to work together in tackling salinity and improving water quality.

Market-based approaches

Government legislation, regulation and spending programs can be successful in maintaining multiples values and services from forests. More emphasis recently has been placed on developing ways to mobilise private capital to address environmental problems and approaches that more efficiently allocate government resources to achieve environmental outcomes. This can include public-private partnerships that involve a mix of commercial and environmental benefits. If well designed and operating efficiently, markets can link values, policy decisions and management actions. Potential sources of capital for investment in such environmental services are government, voluntary private sources, or regulated private investment (Binning et al 2002).

Production standards and certification systems are one form of market driven mechanism being used in Australia. Public forest agencies and forestry companies have adopted independent certification, sometimes in conjunction with environmental management systems. They demonstrate to those who are willing to pay that timber production involves the maintenance of social and environmental values according to agreed standards. These are complementary to codes of practice and other forms of regulation. The Australian Forestry Standard was recently developed as an independent certification process governing both native forest and plantation timber production (http://www.forestrystandard.org.au/). Some plantation forest management companies have sought accreditation under Forest Stewardship Council arrangements (http://www.htrg.com/htrg/).

Other market mechanisms for environmental services can include:

- ‘cap-and-trade’ where point sources of emissions such as nutrients or salinity are known,
- auction or tender systems where services might be provided by a broader range of suppliers,
- non-profit investment banking type fund arrangements that leverage ‘public good’ outcomes through brokering customised financing for individuals and groups who propose to undertake natural resource management activities delivering public and private benefits
- insurance type underwriting arrangements where there is a perceived risk of changing to more environmentally sensitive land management practices that increase costs.

Some examples of the use of market based arrangements in Australia include carbon sequestration, biodiversity and salinity credits.

Australia led the development and implementation of institutional and legal mechanisms aimed at allowing efficient trade in carbon credits. State governments enacted legislation to allow for independent ownership of carbon rights and a number of forest management agencies entered into agreements with local and international energy generators for the purchase of carbon credits associated with plantation development on cleared land consistent with Kyoto Protocol requirements. The ‘Replanting Victoria’ program provides a different model, with the Victorian Government providing A$600 per hectare to small scale plantation growers in return for the rights to carbon sequestered in compliant plantations.

In Australia, biodiversity conservation on private land has generally been implemented through land purchases or agreements with the owners of high quality habitats, in some cases through the use of private capital (Productivity Commission 2001). The ‘BushTender’ provides an example of a system in Victoria that involves an auction approach where landholders are invited to tender for management to improve biodiversity conservation, for example fencing and habitat protection rehabilitation activities, in native vegetation at a given price. Potential benefits are assessed using a ‘biodiversity benefits index’. Successful tenderers are chosen based on an assessment of benefits and price. They enter into a management agreement with the State government to undertake the proposed management for a given period of time.

To encourage reforestation to address salinity mitigation, Forests NSW and Macquarie River Food and Fibre have launched a pilot program to trial salinity control credits in the Macquarie River catchment of the Murray Darling Basin. In this, as in many other salt affected catchments, the salinity impact of land clearing occurs downstream of areas subject to past clearing activity. Owners of cleared land in the upper catchment have little incentive to afforest. To overcome this problem, Forests NSW have entered into an agreement with various landholders to establish and manage new forests on their land. The landholders are paid an annual annuity which is characterised as a ‘salinity control credit’ based on the transpiration level of the planted forest. This transpiration implies a reduction in the water contributing to salt mobilisation and hence downstream salinity. These ‘credits’ are sold to members of Macquarie River Food and Fibre who will be adversely affected by the increasing salt load within the catchment (Walsh et al. 2003).

More recently, investment funds and other types of projects have been established to establish new forests to meet a range of commercial and environmental objectives (Brand 2002, http://www.ffp.csiro.au/KI-CommercialEnvironmentalForestry.asp).

5. Discussion

Legislation and regulation

Well conceived national and state legislation and policies are a necessary enabling component in providing for a range of values and services from forests. They can provide a clear statement of society’s goals and objectives and provide the authority to regulate behaviour or restrict environmental impacts.

However, legislation controlling vegetation management and conversion of forests to other land uses in Australia has often not been as effective as they could have been for a range of reasons (Productivity Commission 2004):

- a lack of clearly-specified objectives
- at times, conflicting pieces of legislation within states
- lack of guidance in legislation about implementation or monitoring of achievement of these higher-level objectives, with monitoring often related to the extent of vegetation which may not always be directly related to the intended environmental outcomes
- acts sometimes create disincentives for landholders to retain and care for native vegetation because it is seen as a liability rather than an asset
- compliance procedures are often complex and assessment processes too time consuming and cumbersome and approval decisions based on the interpretation of individual officers and

- inflexible application of targets and guidelines across regions has led to perverse outcomes such as premature clearing of regrowth and more intensive rotation of paddocks and can inhibit use of new technologies that might have better overall environmental outcomes.

There has been negative reaction to environmental protection legislation in some rural areas where landowners feel that the listing of regional ecosystems on their properties as endangered has limited their capacity for economic use of the land and reduced property values. Payments offered in compensation have generally been regarded as inadequate in comparison to the financial impact on the owner and the community.

Effective legislation requires a clear statement of objectives, assessment and monitoring, minimal duplication, assistance and education of affected parties (particularly private forest owners), readily accessible information on their responsibilities and on acceptable practices and how these relate to environmental problems, provision for analysis of economic and social factors in application (triple bottom line approach) and timely and impartial assessment and appeals processes. Legislation should allow flexible application in regions with differing circumstances (Productivity Commission 2004).

For credible implementation, legislation needs to be underpinned by sound scientific knowledge of the composition and location of regional ecosystems, distributions of rare and threatened species and the implications of different threatening processes.

Legislation and regulation also require commitment to education and awareness-raising in order to give landowners and other affected parties a clear understanding of the rationale for the legislation, knowledge of acceptable approaches and how they will impact on their productivity and profitability. Enforcement officers need to be well trained and clearly understand the objectives of the legislation, the nature of the values being protected and the operating environment.

National policies and inter-governmental agreements have been effective in providing clear statements of shared values and intentions but have their limitations in meeting the expectations of all stakeholders (Mobbs 2003). Regional Forest Agreements are regarded by some as more political solutions than effective processes for public engagement to resolve complex and controversial issues in forest management (Lane 1999). They require ongoing political support from respective parties in order to continue to be effective and changes in government can lead to changing policy priorities and attitudes to such agreements.

Public spending and community-based programs

Public spending programs aimed at maintaining or enhancing the values and services of native vegetation allow for sharing of the financial burden of providing public benefits such as biodiversity conservation, improved water quality, or carbon sequestration from private land assets. Spending programs can be aimed at education and awareness programs to change public attitudes and behaviours, for the purchase of environmental assets for inclusion in public land reserves or for funding remediation and repair works. Public spending has also been used to mitigate the impacts on industry and communities of forest resource planning and land allocation decisions to meet biodiversity or other targets.

While funding is largely provided by the Australian or state governments, experience suggests these are often most effectively utilised at regional or local scales and most major environmental spending programs in Australia are being delivered through regional bodies.

Programs to support community-based knowledge sharing and support networks need long-term funding commitment by government for program management, group coordination and cost-sharing for on-ground work in groups established at a local scale based on social as well as biophysical boundaries, embedded within a supportive institutional framework with broad stakeholder representation. In particular, groups need to have the commitment and skills to build trust and competency amongst citizens and agencies (Curtis et al. 2003).

In order for on-ground works to be effective, spending programs need to be targeted at those activities and areas that will have the most impact and they need to be undertaken at a sufficient scale. This requires a clear statement of goals, knowledge of the current extent and distribution of ecosystems and scientific understanding of the impacts and benefits of different types of management or remediation activities on the values required to be protected or enhanced.

Market-based initiatives

Market-based initiatives can allow for more effective targeting of public spending aimed at achieving environmental outcomes. Market based mechanisms can also harness private capital where there are clear private benefits or where the government creates a market through capping pollution or clearing levels, or in some other way restricts supply of a public good.

Market-based approaches are particularly useful where there a number of potential providers of the service or value. These approaches need to be underpinned by good understanding of the relationship between changes in land use or management and the environmental service being delivered.

Important issues that have restricted the use of market based mechanisms include:

- high transaction costs relative to the price of the service, such as the cost of communicating and establishing relationships between buyers and sellers, legal contracts and assessment and monitoring
- risk and uncertainty in delivery of the service due to scientific uncertainty about the relationship between the benefit or impacts of other factors such as climate, fire or other natural or human disturbances
- the implications of unintended social or environmental impacts, for example the impact of large-scale plantation programs on local communities or other environmental values such as water supplies or biodiversity (Bass et al. 2000).

6. Conclusions

A comprehensive range of approaches is currently being used in Australia that aims to ensure the continued supply of economic goods and to maintain and improve environmental services and heritage and cultural values from forests that meet the needs and expectations of current and future generations of Australian people. It is clear that no single component of the framework is sufficient to meet this objective. Different approaches are needed in different settings and legislative, policy and spending instruments require regular assessment and review to ensure that they are operating in ways that meet their initial objectives, to incorporate new knowledge and to respond to changing community expectations.

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Part 3 – Database and Information Systems for Managerial Economics and Green Accounting

Assessment of Sustainability of Forest-Wood Chains[1]

Risto Päivinen and Marcus Lindner

European Forest Institute

Abstract

Forest-Wood Chains (FWCs) consist of a set of processes by which forest resources are converted into services and products. In this paper, a method to assess sustainability of alternative FWCs is discussed. It is suggested that each production process included in a production chain will be characterised by a set of environmental, economic and social sustainability indicators. The volume of wood material flows through the processes is the basis for assessing the overall sustainability of optional chains.

Keywords: sustainable development; environmental, social and economic sustainability; forest-wood chains; sustainability indicators

1. Background

Sustainability has been the leading principle in forestry for centuries. The goal of forest management has been to organise timber harvesting schedule according to the forest growth potential in order to maintain a continuous flow of timber production. In the 20th century, the multiple use of forest resources replaced the narrow focus on timber production that had dominated as a management goal earlier. Consequently, multi-dimensional aspects of sustainability were included in forest management.

At the global level, the Brundtland report (1987) brought forward the concept of sustainable development which means a development meeting the needs of the present without jeopardising the ability of future generations to meet their own needs. Since the Earth Summit in Rio de Janeiro in 1992 (UNCED), both forests and forestry have been added to the international agenda because of concerns about the sustainability of forests regarding biodiversity and its economic and social contribution to the development of the local communities.

1 Note that this paper has been published also as EFI Technical Report 23, 2006

Luca Cesaro, Paola Gatto and Davide Pettenella (eds.)
The Multifunctional Role of Forests – Policies, Methods and Case Studies
EFI Proceedings No. 55, 2008

As entering into the 21st century, the sustainability paradigm has been extended to include whole economic sectors. Not only the forest production but also the whole set of production chains using forest resources should be evaluated in sustainability impact assessments of Forest-Wood Chains (FWCs). Sustainability Assessment (SA) deals with influence of production technologies or other processes in the FWC on sustainable development, measured by using environmental, economic, and social indicators (see Wilhelmsson 2001). FWCs consist of sets of processes by which forestry resources are converted into services and products. A process is the basic element in the analysis of an FWC. In a process the wood material changes its appearance and/or moves to another location. Processes include planting trees, tree growth, harvesting, transport, sawing, pulping, papermaking, printing, packaging, recycling, energy production etc.

The FWC consists of a number of processes which all will be characterised in terms of sustainability indicators. Based on the forestry statistics and production figures of the forest industries, most European countries have good information on the volumes of wood-material flow related to their FWCs. In Figure 1 an example is given from Finland (Finnish Statistical…. 2003). These statistics, however, only refer to production volumes and do not thus address the indicators of sustainability related to environmental, social or economic issues. However, these particular statistics, possibly converted to carbon flow volumes, could serve as a basis for sustainability assessment of forest-wood chain.

Several methods have been developed to study environmental impacts of technologies, including also quantitative approaches such as Substance Flow Analysis or Life Cycle Assessment (LCA) (see Hytönen 1998).

For the FWC, a comprehensive Sustainability Assessment is still lacking, although the concepts and indicators for monitoring environmental, social, and economic sustainability are very well advanced in the forestry sector.

2. Sustainability indicators

Several international, regional and national processes and fora have resulted in criteria and indicators for sustainable forestry such as Ministerial Conferences on the Protection of Forests in Europe. (General declarations… 1998, Improved Pan-European Indicators for Sustainable Forest Management, 2003). There are ongoing efforts aiming at consolidation of the various developed criteria and indicators (Hecker et al. 1998).

Since the late 1990s, the EUROSTAT and the European Environment Agency have developed sustainability indicators within the framework of the EU strategy for sustainable development, the Sixth Environment Action Programme, and the Cardiff Process on integrating environmental considerations in EC policies. Sustainability indicators have also been adopted in the Sustainability Impact Assessment (SIA) of the World Trade Organisation negotiations. In the SIA of trade policies, various impacts based on the three sustainability principles have been listed e.g. by affected country or group of countries, or by product (see Zhu et al. 1998; Kangas and Baudin 2003; Vasara et al. 2005).

Thus far there has been no attempt to analyse trade-offs between or to study impacts systematically along the entire FWC. The multifunctionality of forests and the sustainability of the whole FWC should be addressed by analysing and selecting sustainability indicators which reflect the multiple benefits of forest resources and all three pillars of sustainability.

The domains of the sustainability of the FWC may include as examples:

- *Environmental*: biodiversity, carbon sequestration, soil fertility, pollutants and wastes, water quality, energy efficiency in production, water use efficiency, change of natural resource stock and degree of recycling;

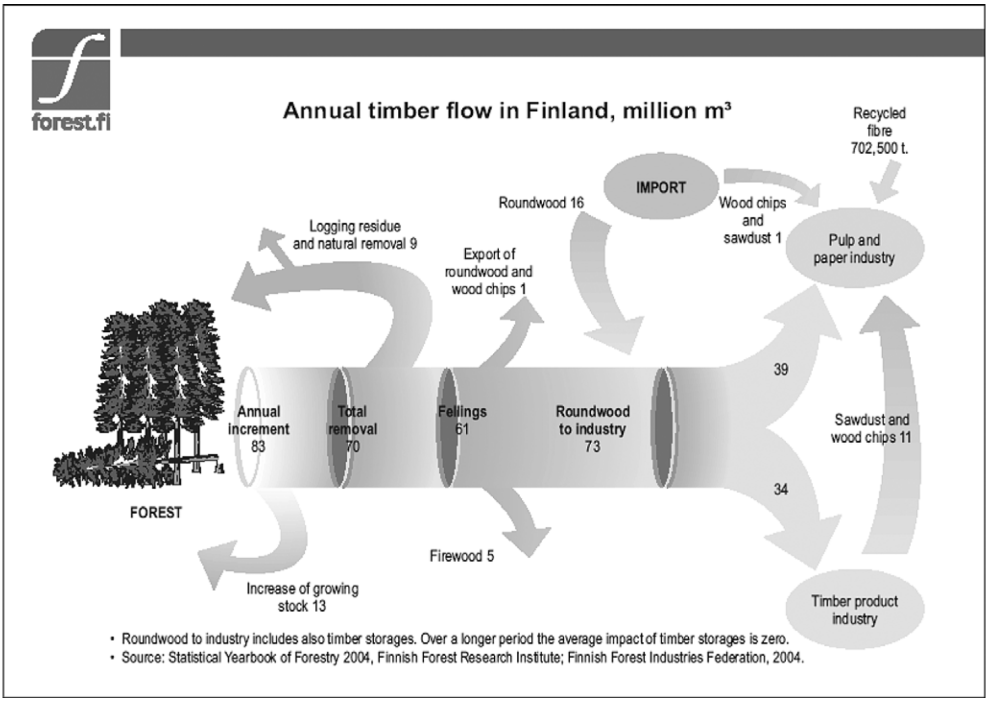


Figure 1. A simplified example of an FWC, the annual timber flow in Finland. Source: forest.fi (original source used by forest.fi: Statistical Year Book of Forestry 2004, Finnish Forest Research Institute; Finnish Forest Industries Federation).

· *Societal:* employment, consumers' requirements and expectations for products and services, cultural values, recreational possibilities, rural development, human health and well-being;
· *Economic*: competitiveness, value-adding, development of existing and new markets, real income, investment capital formation, cost-benefit, energy use and production.

Some of the indicators may be relevant and used to assess processes throughout whole chains, e.g. carbon stocks and flows in the system, fossil fuels and energy balance, return or cost of capital, salaries, taxes or employment. Some others are clearly associated with only parts of the chain, such as biodiversity or recreation in forests, or water pollution in industrial manufacturing.

The purpose of this paper is to suggest a methodology for assessing the sustainability of the whole Forest-Wood Chain.

3. A method to assess sustainability

The proposed Sustainability Assessment of the FWC integrates outputs from different processes. The method will simulate FWCs as chains of value-adding production processes. The boxes in Figure 2 represent processes at various stages of the chain. The chain of arrows in Figure 2 represents one possible FWC. Although in real life the material flows in an FWC are more complex than the ones presented in Figure 2.

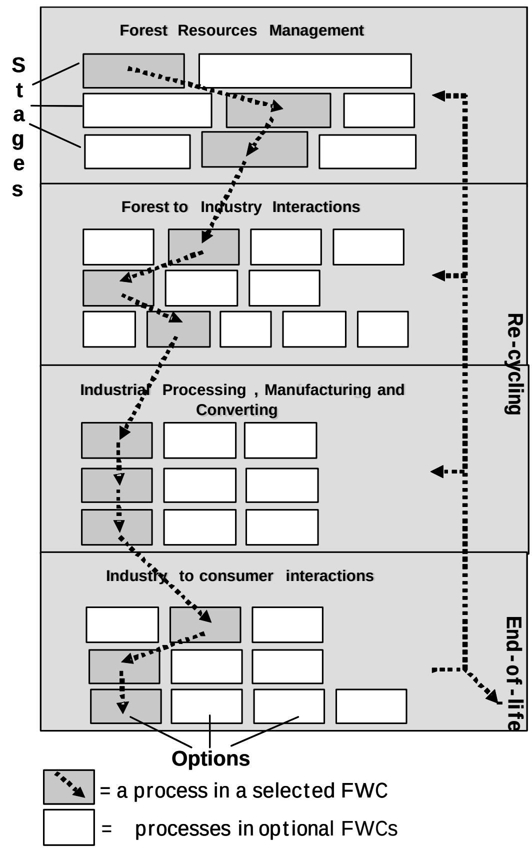


Figure 2. The methodological framework to assess the sustainability of FWCs. The shaded boxes represent processes in one FWC.

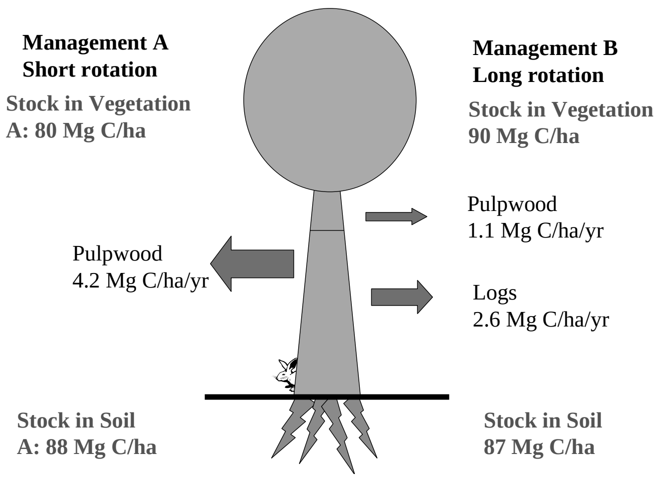
The flow of wood is followed through production processes from forest to consumption and possible recycling. The volume of wood material used in different processes will be inventoried and sustainability indicator values will be attached in each process. The indicators should be selected taking into account both their *relevance* in terms of sustainability assessment and *feasibility*, based on data availability and quality.

4. Assessing sustainability impacts of alternative FWCs

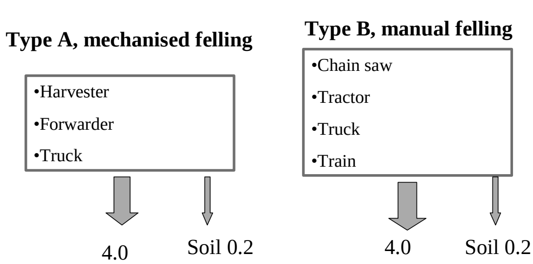
The simple FWC depicted by an arrow line in Figure 2 represents only one of many possible pathways to grow wood material and convert it to a final product. If individual processes in the FWC are modified, the associated sustainability impacts will be directly affected. For example, if a harvester is used for cutting trees instead of manual felling, this process may become more economic, but the number of jobs in tree harvesting will most likely be reduced. Similarly, shifting the transport of wood from truck to railway – as set as a target in the EU strategies towards sustainability – would probably result in improved environmental indicators. By comparing alternative FWCs it is possible to improve the sustainability of FWCs and the trade-offs between different sustainability indicators can be identified.

4.1 Numerical example

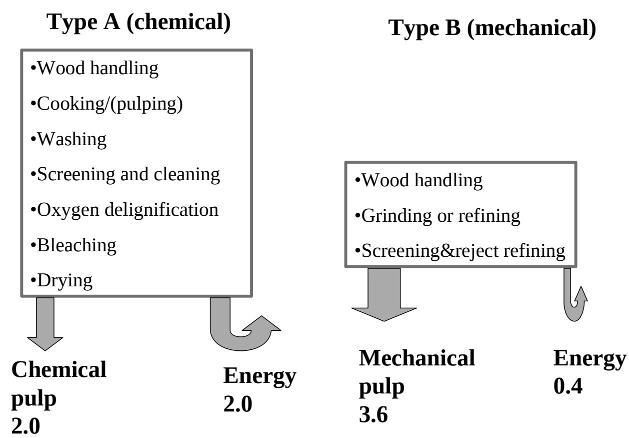
In the following, only one indicator, *carbon contents and releases*, from the processes is followed up throughout the chain. The example compares process options at various stages throughout the FWC, similar to a study by Liski et al. (2001). In each step, indicator values associated with two typical alternative processes have been derived. In this study, the carbon flow is related to the one produced by one hectare of forest land.



1. Different forest management strategies using shorter (A) or longer (B) rotation lengths will result in different annual carbon removals from the forest and in different carbon stocks in woody biomass and soil respectively.



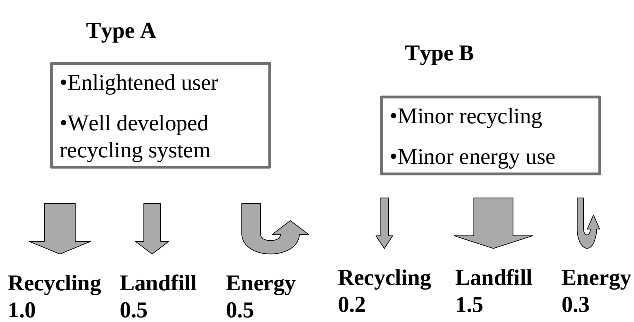
2. Let us now follow only the short-rotation chain producing carbon input from forest to industry 4.2 Mg per hectare annually. Again, there are two optional sets of processes for wood harvesting and transport, mechanised and manual felling. Regarding carbon, both are assessed equal. Regarding other sustainability indicators which may be selected (fossil fuel emissions, employment, impact to biodiversity, or recreation of forests, harvesting costs, etc.), there will most likely be differences which have to be taken into account.



3. In the next step wood is converted into pulp. The two main types of pulping, mechanical and chemical, differ substantially in output of the pulp and energy consumption. Again, the other indicators not discussed here, may differ as well.

4. In the paper mill, production processes of different types of paper do not differ regarding the carbon contents.

5. The same concerns the paper transport chains from mill to market. Only the other indicators except for carbon may differ from truck or truck/ship/train chains.



6. Finally, in the consumption phase, two types of societies may be considered which differ related to recycling rate and wastepaper collection for energy use.

The example accounts only the carbon contents of two optional forest-wood chain. By accumulation – for instance – labour days used in all processes throughout both chains, it would be possible to analyses the trade offs between environmental (carbon) and social (employment) indicators of two chains.

5. Discussion

We have used one example of a simple FWC with a limited number of alternative processes to illustrate how sustainability indicators – in this case carbon storage – can be assessed throughout the FWC. It is relevant to start with one hectare of forest, if the aim of the assessment is to consider carbon sequestration and rotation lengths as done in the study by Liski et al. (2001). The sustainability impacts of FWCs can also be assessed with a focus on a selected up-stream process of the chain. For example, if the goal is to assess the sustainability impacts of a paper mill, there are manifold options both upstream and downstream, as raw material may originate from forest management systems linked with a high number of different processes (including harvesting and transport) and a range of products may thus reach the consumers through alternative value chains.

On the way towards a sustainable society, research can help to assess the environmental, social and economic sustainability of the present production chains and to explore options for alternative chains with improved sustainability impacts. The approach suggested here – mapping the processes within Forest-Wood Chain, following the volume of wood material flows through the processes and assessing sustainability indicator for each process involved – offers a concrete way to study the matter.

There are several questions that need to be considered in the sustainability assessment of Forest-Wood Chains:

- Which indicators to analyse? Depending on the focus – may it be SA of a forest industry company, a forest region, or a special wood-based product, the data availability and quality will vary and this will influence the selection of indicators and the elaboration of the SA approach as well.
- Which processes to select? How in detail do the processes have to be described depends also on the data availability and the potential use of the results. If the policy-maker wishes to know whether it is more sustainable to support natural regeneration of beech than planting of spruce, the land area available for both must be known and sustainability indicators derived for typical spruce and beech chains downstreams. If the focus is to optimise the sustainability of a forest industry branch, it will be necessary to distinguish between many separate processes within the industry.
- Which chains to describe? As the number of optional chains in theory can be high, the most relevant ones with limited number of process combinations should be selected for studying.

These issues have been considered by the ‘EFORWOOD’ consortium, which has submitted a proposal to the EU 6th Framework Programme, based on the principles described in this paper.

The method suggested may serve as a model for society on how to integrate environmental protection, economic growth and satisfying human needs. Using the proposed method, decision-makers will have the option to evaluate ex ante the effect of many different actions or events on the sustainability indicators of the FWC as a part of the European society, be they on social, economic or environmental dimensions.

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Interfirm Comparison and Benchmarking Exercises within the Framework of a Forest Accountancy Data Network

Walter Sekot

University of Natural Resources and Applied Life Sciences, Vienna, Austria

Abstract

Forest accountancy data networks have a long tradition in Austria, serving the purposes of forest management as well as those of forest politics and applied research. The main Austrian network comprises about one third of all private forest enterprises with more than 500 ha of forest area. Due to the broad range of features and ratios available as well as the high degree of representation by the network, this database represents the main source for various kinds of interfirm comparison and benchmarking in the Austrian forest sector. The rising interest in interfirm comparison as a management tool is underpinned by the increasing number of clubs, where groups between two and twelve managers of forest enterprises use to compare, analyse and discuss their results based on a common scheme of cost accounting. In acknowledgement of this trend, new tools and services have been developed in order to assist respective efforts. Nowadays, a set of standardised protocols is available for conducting anonymous as well as direct comparisons, referring to averages of various groupings and benchmarks alike.

Keywords: interfirm comparison, benchmarking, database system, managerial accounting, forest accountancy data network

1. External analysis as a management tool

External analysis and environmental analysis are indispensable prerequisites for strategic management, their synopsis triggering decisions on corporate as well as business strategy. In essence, strategic external analysis is to identify the strengths and weaknesses of a company as compared to its most powerful competitors. Investigating the performance and economic development of the very industry a company belongs to is part of its environmental analysis, indicating upcoming opportunities and threats.

On operational level, interfirm comparison can be a most relevant tool for identifying potentials for rationalisation. Average figures of industry ratios may serve as reference data for a quick-scan, hinting at might-be comparative advantages and disadvantages respectively. Anonymous benchmarks computed e.g. as averages of the best 25% of a sample, indicate the leading edge and as such assist the interpretation of ratio analysis. Any such comparisons of ratios do not immediately imply specific measures of reengineering but help to identify and focus on the most relevant questions asking for an in-depth analysis.

More direct clues for improvements can be derived from interfirm comparison exercises performed with one or several partners. In such cases, the analysis is not restricted to the original set of data but can rely on additional information provided by the participants. Therefore it is possible not only to identify any differences in the results, but also to jointly assess the respective causes and thereby learn from one another, e.g. in terms of technology or organisation. In many industries, however, the availability of partners and hence the prospects for such exercises are severely restricted by competition, cost leadership being one of the main competitive strategies. Benchmarking is a variant of interfirm comparison, where the partner should even represent the leading edge in respect to a particular process but does not necessarily belong to the same industry. A major obstacle for practical application of interfirm comparison and benchmarking is associated with the challenge to ensure a win-win-situation for all the partners involved.

Making reference to data of another enterprise or averages of groupings is always associated with the fundamental question of comparability. Of course one might always argue that each enterprise is unique, given the special conditions of e.g. terrain and structure of the forest. However, such a defensive strategy of immunisation against criticism blocks the way towards a better insight and understanding and ultimately also improvements which should in any case be triggered by respective analytical efforts in the context of comparison exercises. In fact it is one of the tasks of comparative analysis to investigate the economic relevance of those special conditions and to clearly differentiate between tangible and intangible features.

2. Forest accountancy data networks

For most parts of the economy, industry ratios for external analysis are available based on anonymous data provided by the banking industry (see e.g. the data offered by the Austrian Institute for SME Research, KMU Forschung Austria, 2005). Due to the peculiarities of forestry however, it is not possible to derive significant figures characterizing this industry in the same way (Sekot 2005). At least under conditions as in Austria, where the market value of forests exceeds the respective capitalized value of potential earnings from sustainable timber production by far, forestry assets are bound to be financed by equity capital. Hence the few balances available to banks are by no means a reliable reference and characterizing the industry has to rely on alternative sources of information.

Conversely, there is comparatively little competition between forest enterprises: practically all of them are price takers in a polypolistic market, all producers dispose over huge stocks of about 50 times the annual output and growth of the business is generally restricted by prohibitive high market values for forests. Consequently, no market shares can be gained by price cutting and cost leadership does not provide strategic advantages. As a consequence, forest owners and managers of forest enterprises show comparatively little reservation as regards providing their data for monitoring purposes but also for comparison with one another. These pre-conditions explain the special role of interfirm comparison in forestry: on operational level this approach may serve as a tool for improving economic performance and by this for sustaining profitability, whereas the strategic implications of external analysis are of minor importance (Sekot 1998a).

At least in the cases of Germany, Switzerland and Austria, some of the data required for external analysis can be derived from forest accountancy data networks. Such a network is characterized by a sample of enterprises periodically providing standardized accounting data for statistical purposes (Sekot 1990; Hyttinen et al. 1997; Niskanen and Sekot 2001). In essence, such a source of data can provide information for the following two tasks: (1) industry ratios for characterizing the economic development of the forest industry and (2) reference data of individual enterprises or averages for various groupings for performing anonymous or direct interfirm comparison and benchmarking.

From the methodological point of view, accountancy data networks can be seen as an intermediary approach between case studies on the one hand and interviews on the other (Sekot 2000a). The number of cases sampled as well as the quantity of information collected and hence the potential depth of analysis but also the statistical properties as regards inferences are major features stressing this intermediary character. A forestry accountancy data network is no end in itself but has to be evaluated as a tool more or less appropriate for different purposes. In contrast to case studies and interviews however, this tool involves in any case a time horizon of at least a couple of years. Hence, especially monitoring purposes justify the efforts for establishing such a network.

The statistical quality of the results depends to a great extent on the sampling scheme underlying the network (Hyttinen and Kallio 1998). Only statistical sampling would allow for proper statistical inferences. Nevertheless, self selection bias might be significant. Changes in the panel impede the analysis of developments whereas a regular rotation of the sample may be considered so as to limit adverse panel effects which might even be increased due to the management information exclusively provided to the participants. Apart from the statistical setting, the quality of the results depends from the protocols for data gathering. Submission of data by the enterprises is a low cost approach with limited possibilities for quality control as compared to filed work by specialised staff.

In order to successfully establish and run an accountancy network, the following prerequisites have to be met: Voluntary participation based on a commitment of all involved is indispensable. Sufficient incentives, be it subsidies, the provision of specific information or the rendering of special services have to be provided continuously so as to compensate the participants for making their data available. The organizational and financial backing must suffice also in the long run. Unambiguous definitions and protocols must guarantee the validity of the data and hence also the quality of the results. A certain balance of data sampled and information asked for has to be established and maintained for efficiency reasons.

3. The Austrian network of forest enterprises

Already in the 1960s an accountancy network of bigger forest enterprises was established in order to gain insight into and monitor the economic situation of forestry in Austria. The lower limit for participation was defined by 500 ha of commercial forest, the same threshold level applying for the legal requirement to employ a trained forester. This category of bigger, mainly private forest enterprises makes up about 30% of Austrian forestry in terms of area and fellings. Roughly half of the forest in Austria pertains to small scale forestry with a maximum of 200 ha, another 15% being managed by the national forests.

The backbone of the network is the commitment on behalf of the participating forest enterprises on the one hand and the cooperation between the forest owners association, the

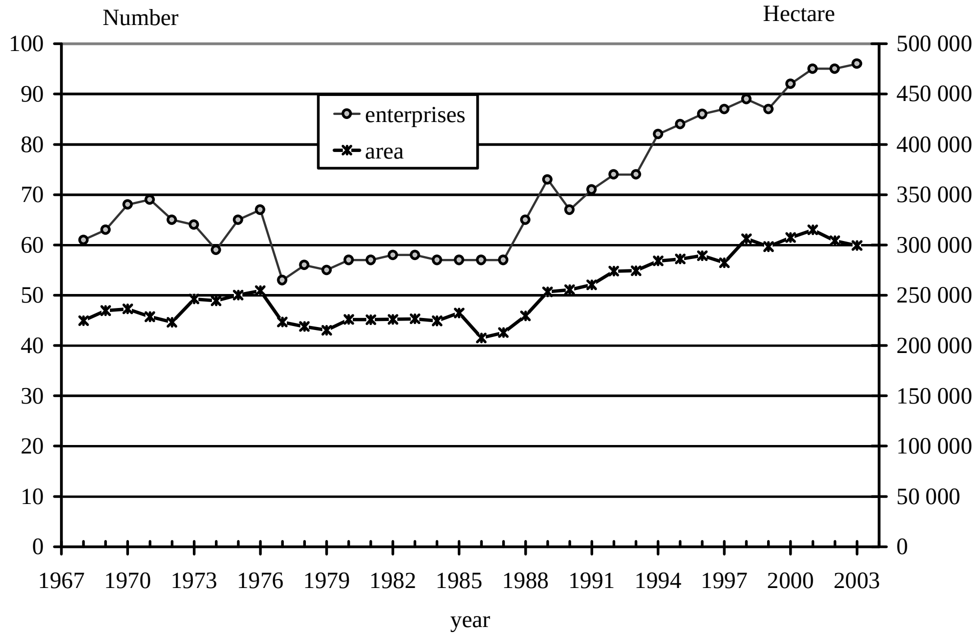

Figure 1. Development of the network in terms of participants and acreage.

Table 1. Characteristics of the sample as per 2004.

Number of enterprises	96
Forest area (ha)	299.311
Fellings (m3)	2,409.000
Sample in % of enterprises	~ 30
Sample in % of forest area	~ 50
Average acreage of woodland (ha)	3.118
Average fellings per enterprise (m3)	25.097

ministry of forestry with its forest research institute and the university on the other. Starting from a purposive sample, the development of the network has been driven by the interest of forest enterprises in becoming members of this club (Sekot 1998b; Figure 1). As a consequence, there is a clear bias towards bigger forest enterprises as indicated by the different sampling ratios in Table 1.

Data sampling relies on field work performed by a small number of specialised personnel at the forest owners association, the forest research institute and the university. Instead of sampling items of compulsory financial accounting, an approach of cost accounting is being pursued, focussing on the full costs of timber production and introducing some calculated items (Sekot and Rothleitner 1999; Sekot 2004). In general, these cost accounting data are not directly available in the enterprises but have to be derived from financial accounting or the companies' managerial accounting. This approach is a prerequisite for ensuring a common standard of the records, precluding influences of taxation and consequently safeguarding the quality of the results. The external elaboration of the standardized master balance sheet is to be regarded as a service rendered to the participants as reward for providing access to their accounting data.

Changes in the value of the growing stock are only indirectly accounted for by means of model calculations referring to the allowable cut. This simple model assumes that the unit values of timber proceeds as well as harvesting costs are not affected by the level of fellings, whereas the totals of all other costs and proceeds are taken as fixed. The result indicates, to what extent the profit of the period may be related to over- or undercutting. Structural deviations between allowable cut and fellings which may well affect the stumpage value of the growing stock are not captured by this approach, however.

At aggregate level the standard output comprises averages and time series for the total sample as well as for groupings according to six production regions and three size classes.

In the course of its 40 years of existence, the forest accountancy network has developed into a backbone of industry statistics. It is an indispensable source of information in the following contexts:

- Economic Accounts for Forestry
- National Accounting (sector statistics)
- national evaluation of the forest resource
- assessing economic sustainability (PEFC, MCPFE)
- forest valuation (e.g. in connection with NATURA 2000)
- deriving guidelines for taxation
- assessing the economic consequences of alternative policies
- informing the public
- arguing on behalf of interest groups (e.g. collective agreements)
- teaching and research in forest economics

As to the availability of the data, several time series date back to the year 1962. Of practical interest are the spreadsheet-based averages from 1977 onwards. The ORACLE-database comprises the data of individual enterprises since 1987 and covers an extended framework of direct measures and ratios since 1997.

4. Practice of comparative analysis based on accountancy data

In regard to the purposes of interfirm comparison, especially the following features determine the practical value of an accountancy network as respective data pool: data framework, topicality, time frame, size of the sample, accessibility, individuality and flexibility. In case of the Austrian network, all of these aspects are continuously being reconsidered and amended so as to serve respective interests as good as possible. Encouraging and assisting interfirm comparison is a major goal of the network, respective information serving as incentive for participation.

Data framework: The data sampled determine which topics may be addressed on this basis. The network fulfilling primarily monitoring purposes, the lack of explanatory items is a natural bottleneck for analysis. For practical reasons, however, it is often not possible to generally introduce additional features asked for by only few of the participants. As a compromise, optional extensions are common, so that those enterprises which are not able or not willing to provide the respective data can stay within the sample, whereas the analysis is restricted to a sub-sample.

Topicality: The longer the time lag between the period covered by the most recent data and the availability of respective results, the less will be the interest in such ‘historical’ data. Collecting the data taking at least nine months, the overall results become available almost one year after the investigated period ended. Respective reference data and rankings may be regarded as outdated then. For this reason, preliminary results are computed and made available to the participants after six and nine months respectively. Since last year, also some individual output including ranking information is available to the participants at these dates already.

Time frame: The significance of development analyses hinges on the length of the time series available in the database. When establishing the Austrian database in 1998, the individual records from 1987 onwards were imported so that time series of at least ten years could be provided already at the very beginning. For the time being, there are two sets of individual standard output of time series provided to the participants: apart from tables covering the latest 10 years, selected time series of ratios keep 1987 as a starting point, so far documenting the development over a period of 18 years.

Size of the sample: Both, the statistical quality of the results as well as the potentials for differentiated analysis depend from the size of the sample. The population comprising only some 300 enterprises and participation being voluntary, sound industry ratios require a high sampling ratio. With every third company taking part in the network, there is a considerable data-pool available for all kinds of comparison.

Accessibility: In principle, the results of all standard groupings are readily available to all participants. Averages for other groupings can be provided on special request. The availability of individual data of other companies depends on explicit consent for each single case.

Individuality: The more user-friendly the reference data are provided, the more readily will they be utilized. In the Austrian network, the participants are provided with individual output confronting their own results with the respective averages of all standard groupings. Also the ranking lists are specifically formatted, so that each participant can easily recognize his own profile of ranks.

Flexibility: In addition to the reference data pertaining to standard groupings, the analysis may be assisted by rearranging the reference data in terms of special groupings, thus restricting and thereby focussing the number of references. Such sub-samples may be defined referring to features such as the share of forest area not accessible for skidding (and hence requiring cable yarding) or the share of sanitary fellings.

Besides the standardized master balance sheet, the participants are provided with industry ratios and reference data for anonymous external analysis (Sekot 2000b). Ranking lists for various ratios document the distribution of the individual data and shall provoke further analysis. However, many participants tend to focus too much on the ranks as such, interpreting a favourable position on the ranking list as proof of good performance which is, however, not necessarily the case. There has even been one single case where the manager of a forest enterprise considered ending his participation in the network, the owner repeatedly criticising the poor results in terms of ranking.

Benchmarks as extreme values or computed as averages of e.g. the best 25% of the sample are no standard output so far but use to be published along with the main results (e.g. Sekot 2005). Like ranks, benchmarks can be severely misleading when interpreted as target values without any further consideration. In fact, one might even consider a cut-off eliminating the very extreme values as they are most likely to result from special conditions and therefore are not suited as indications of the true leading edge. For instance, extremely low unit costs of harvesting can result from a concentration of the fellings on final cuts at easily accessible sites and as such do not represent best practice under average conditions.

In order to avoid the pitfalls of such general comparisons and to gain deeper insight into economic performance, several groups were established where between two and twelve enterprises openly and jointly compare and analyse their results as documented by the standardised master balance sheets provided by the accountancy network (Loidl 1999). Such activities are further assisted by the network in terms of specially designed output. The major ratios of all the enterprises of the group are directly confronted with one another as well as with the average figures for the respective sub-sample. Time series of the selected ratios are arranged in the same way so that comparative development analysis can be performed right away. The tables are supplemented by respective graphs. Based on this material the discussion and analysis within the group can and at least in some cases definitely does go into detail.

There is, however, a certain danger also for such club meetings to become a mere ritual without any deeper meaning. Taking notice of general differences and continuously referring to the same standard explanations won't lead to real improvements. Furthermore, the leading edge is restricted to the best practice within such a small group and alternatives not practiced within the group might not be considered.

Conversely, such jointly performed analyses have the potential to trigger considerable improvements. In order to achieve this, the analysis should go beyond a general comparison and concentrate on selected topics, the various ratios just providing a starting point for a comprehensive evaluation of all underlying aspects including technology and organisation. In acknowledgement of the limitations of the approach, additional benchmarking with external partners should be performed.

An outstanding positive example in this respect is the cooperation of twelve bigger forest enterprises in Styria which emerged to some extent out of the common participation in the accountancy network. The yearly exercise of comparative analysis within the group is still an integral part of the cooperation.

5. Outlook

There are two main strategies for further increasing the significance of the data-pool provided by the accountancy network. One approach is to extend the framework by recording additional items in response to upcoming specific interest. Respective examples typically pertain to requests on behalf of groups of enterprises engaged in direct interfirm comparison, such as the breakdown of harvests according to different technologies for felling or hauling. Likewise, additional functions have been designed and implemented just recently which allow handling alternative levels of allowable cut. Hence it is possible to perform model calculations referring to e.g. a regional average level of allowable cut, the average level of a specified group of enterprises or the company's average level of ordinary fellings.

The second possibility for enhancing the benefits to be derived from a comparative analysis with pooled reference data refers to the data already available, utilising them in a more comprehensive way. For instance, the stepwise calculation has been modified lately, so that the costs and proceeds associated with the forest road network are documented explicitly also in this very context. So far, these elements were integrated with the data on buildings and other real estate. This adaptation followed the argument, that the costs of road maintenance are closely related with harvesting activities, so that the margin after correcting for the associated costs (and revenues) is of interest.

Furthermore, it is planned to supplement the rankings by a development analysis, indicating the performance of the individual enterprise in relation to the sample within a reference period of ten years. Figure 2 shows a prototype of such an intended output, providing information on the rank (computed by referring to a fixed total of 100 enterprises) as well as on the relation of the enterprise's figures to the overall average and to the respective benchmarks (defined as the average of the best 25%). In principle, all the necessary data for such computations are available in the database.

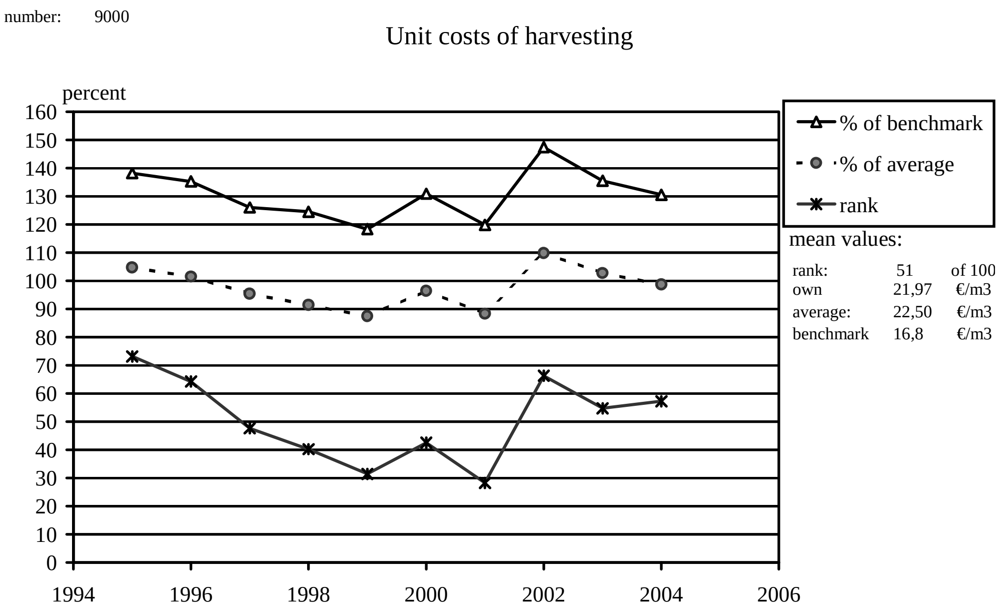

Figure 2. Prototype of development analysis.

Both of these approaches are being pursued systematically. In this way it is intended to maintain if not improve the practical value of the application for the enterprises involved.

6. Conclusions

At least in Austria, forest accountancy data networks serve as major sources for industry ratios. Consequently, external analysis relies directly or indirectly on the networks' database as far as such ratios are concerned. In case of the bigger forest enterprises, the availability of reference data is known to motivate participation in the network. The continuously extended provision of respective material is designed so as to ensure the commitment on behalf of the forest enterprises involved.

Nevertheless, it is necessary to keep in mind and even stress the limitations of autonomously performed interfirm comparison based on such data. In spite of a considerable extension of the features recorded and ratios calculated, the database may provide just the basis for an in-depth analysis. When looking for indications and inspirations in which fields an improvement might be possible, you will be served well, whereas the data by themselves won't provide direct clues for explaining the results or for how to improve your own performance. Assessing respective information requires direct cooperation with individual partners providing additional explanatory information. The database of an accountancy network may provide the basic information and serve as starting point for such jointly performed exercises. However, the outcome also of such an approach and hence its practical relevance depends on the focus and depth of the analysis.

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Accounting Models for the Economic Management of the Forest Enterprise

Adelfino Frison

Dept. TeSAF, University of Padova, Italy

Abstract

Financial accounting remains the basis of the economic balance sheet, emphasising both the value of assets and the results of the transactions undertaken during the financial year. For this purpose, accounts are kept to record administrative issues. The functioning of these accounts is established so as to formulate an annual balance, even if the productive cycle comprises many years.

The accounts, organised under an Account Plan, are based on management requirements, enterprise structure, forest systems, silvicultural activity, etc. Forests are classified according to accounting methods and systems as well as according to the Account Plan. They form homogenous groups which can be used to construct a database upon which statistical analysis can be performed and the results compared.

Keywords: forest accounting, financial accounting, model functioning, economic management

1. Forest financial accounting

A detailed information system has been developed for forest enterprises, based on various types of accounting, in order to manage the relevant economic and ecological functions typical of the forest (Jöbstl et al. 1997). Such a system, in addition to its contribution to the management of public and private bodies, can become a database for territorial monitoring and the gathering of statistical information, indispensable for planning purposes (Hitting et al. 1997).

The system increases in validity the more it is integrated with actual economic results founded on real social and physical data rather than on estimated or averaged data of a territory (Hakkarainen et al. 2001). In addition, the importance and quantity of physical and social data makes a wide and valid series of economic indicators possible, derivable from the

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balance sheet and used for inter business comparisons, according to entrepreneurial choice and the economic policy.

The starting point of every accounting system is the traditional financial accounting that must be ensured, on to which the remaining accounts can be added (as *addenda*) to complete the range of information (Defrancesco et al. 1998). Financial accounting is also useful when the forest is not orientated towards timber production, or when this production plays a marginal role in the formation of the total business income. The revenue obtained from timber remains the main principle of a forest accounting system, because it constrains all the choices, even if it is low and of relatively little importance with respect to other sources of income in the enterprise. The calculation of this income is problematic for the forest enterprise, mainly due to two fundamental aspects that complicate the recording of information (Frison 1983):

- the difficulty in distinguishing between capital and product;
- the long duration of the production cycle.

In the forest enterprise every type of financial accounting that goes above the simple cash income and expenditure, derived from monetary transactions, involves some estimates that should be based on precise guidelines and agreements.

The enterprises, which are mainly distinguished according to the relevance of the timber income, should keep accounts. Initially the accounting should be simple, from which solutions more useful to the entrepreneurial choices and economic policies can be derived. The type of accountable income, related to timber, remains the fundamental datum that must be the object of applied study and research. The financial accounting should not allow doubts to arise regarding the reliability of such income, not even for reasons of irregularity and variability occurring in the income. In addition the enterprises may occasionally detain an income potential that is not exploited or not exploitable, but that would be useful to understand, as in the instance of public enterprises.

A classification of private enterprises, connected to silvicultural activity, is not only useful to initiate and maintain the monitoring of expenditure and revenue in a database (Hyttinen et al. 1997), but can become an instrument for choosing the accounting model to apply. The comparability between the different results, indispensable to the economic analysis of the sector, must be based on similar businesses and on similar accounting systems and methods, but adaptable to the business. The public enterprises can also have different problems from those strictly managerial, even though they remain connected.

This paper will illustrate a foundation model for financial accounting and its potential implementation to determine timber revenue, as close as possible to reality. The various accounting phases use a single Account Plan and balance sheet from which one can choose either those of monetary flows or those suitable for also registering the assets. In these accounting implementations the change in the standing value of the trees needs to be estimated and the fixed capital re-valued until the timber is actually used (Penttinen and Hakkarainen 1998). According to the accounts used an understanding can be gained regarding the timber income based on a different point of view.

The use of financial accounting, for the valuation of assets, contributes to the solution of the two difficulties mentioned above. However, also these solutions remain valid only if they do not interfere with the estimation method, in particular of the forest assets. The methodology presented, adaptable to every normative and environmental situation, would be preventively sieved at the statistical level, in order to verify the utility of application and the best solution. These aspects should be developed in detail because of their importance to the governance of the enterprise. The Italian forestry situation, mainly based on public bodies and low levels of timber incomes, lends itself with difficulty to be examined in statistical detail.

Table 1. Example of a balance sheet applicable to a forest production enterprise. Assets and liabilities accounts.

1–9	Fixed assets
1	Intangible assets
2	Depreciation fund intangible assets
3	Revaluation fund intangible assets
4	Revaluation depreciation fund intangible assets
5	Tangible assets
	500 forest land
	510 forest buildings
	520 silvicultural improvement
	530 reforestation
	540 plant and equipment
6	Depreciation fund tangible assets
	610 forest buildings
	620 silvicultural improvement
	630 reforestation
	640 plant and equipment
7	Revaluation fund tangible assets
	710 forest buildings
	720 silvicultural improvement
	730 reforestation
	740 plant and equipment
8	Revaluation depreciation fund tangible assets
	810 forest buildings
	820 silvicultural improvement
	830 reforestation
	840 plant and equipment
9	Forest assets
	910 initial quantity – value
	920 quantity of fires, breakage and landslides
	930 correction initial data (quantity – value)
	940 allocation to entitled parties
	950 utilisation
	960 planned removal
	970 increment – decrement of quantity – value

2. General accounts plan

2.1 Asset accounts

The example of the accounts plan refers to a double entry bookkeeping principle. The accounts presented concern only those necessary to develop the three accountancy phases or models. A complete series of accounts for a forestry business can be found, for example, in Hakkarainen and Sekot (2001). The accounts are divided into two groups. The first group comprises accounts that refer to the items of the forest assets (Table 1).

2.1.1 Description and function

The accounts specifically related to the three different accounting phases or models, described in part three, are discussed in the following section.

- Tangible assets (accounts 510–40): these accounts are used in the instance where there is an effective expenditure for an investment or when the cost of the work that the owner has carried out and the value of the used materials can be estimated. Reforestation costs (not natural regeneration) are inserted in the asset accounts (recorded in ASSESTS) when they exceed normal renewal or maintenance costs, otherwise, if they are always carried out by the same body they can be inserted directly with the management expenditure.
- Depreciation fund tangible assets (accounts 610–640): this fund is registered in the LIABILITIES of the depreciation rates of the investments inserted in the assets, and are easily calculated, dividing the total value to the number of years.
- Revaluation fund tangible assets (accounts 710–740): in these accounts the annual revaluation of the investments are registered in ASSETS, calculated on the basis of current financial knowledge, for the whole duration of the investment; the fund is activated at the beginning of the year after the investment was made and is updated every year.
- Revaluation depreciation fund tangible assets (accounts 810–40): the depreciation rate of the annual revaluation of a fixed capital is registered in LIABILITIES; the rate is easily calculated, based on the length of the revaluation period.
- Forest assets, initial quantity – value (account 910): this concerns the standing timber, estimated or taken from the inventories, referred to a measurement unit that remains constant over time, which is registered at the beginning of the year in ASSETS of the accounts sheet; just the quantity or also the value can be recorded, and consequently all the other accounts of the forest assets must be confirmed as such.
- Forest assets, the data of fires, breakage and landslides (account 920): only the amount of physical damage produced from these adversities is registered in LIABILITIES, since the decrease of value is recorded in the final result.
- Forest assets, correction initial data (account 930): this account is used when errors are found in the initial data due to controls undertaken throughout the year; corrections related to increases are registered in ASSETS and decrease in LIABILITIES.
- Forest assets, allocation to entitled parties (account 940): this refers to the assigning of timber from the public bodies for actual public use; which is equivalent to the self consumption of private enterprises; the product extracted is registered in LIABILITIES.
- Forest assets, utilisation (account 950): this concerns the timber sold or self consumed and is registered in LIABILITIES.
- Forest assets, planned removals (account 960): this concerns the timber to be cut according to the forest management plan; the data must be registered in LIABILITIES. This data can substitute the forest increment (account 970) which can be valued through the understanding of the final assets.
- Forest assets, increment – decrement (account 970): is the account used at the end of the management period to switch the inclusion of the variations arising from assets in the economic management (see Table 2, Management economic accounts, account no, 1000); the increment (positive) is registered in ASSETS and the decrement in LIABILITIES. The increment or decrement can be obtained from the following algebraic calculation of the forest assets:
  Increment = Final value – (Initial value + Utilisation value)

All the accounts can be completely referred to the internal assets of the enterprise, or can be referred analytically to each individual part of the production process, while maintaining the rest of the activity of forest production separate. In the case of an analytical account, the management assets must be precisely attributed to each production process, selected as cost centres, including only the relevant expenditures and revenues.

2.2 Economic management accounts

The second group of accounts of a general plan concerns the registration of all the expenditures and revenues that make up the commercial transactions of the forest enterprise (Table 2).

These accounts (excluding those for family labour) constitute the financial accounting of the enterprise. Normally they are accompanied by the extra accounting data in order to understand the quality and quantity of all the resources used, the characteristics of the business structure and the silvicultural operations. The management accounts could also be used in a single entry accounts sheet, without the inclusion of the asset accounts.

When these accounts refer only to monetary movements, they do not include and value the opportunity costs such as labour and the management activity of the owner (account 15). These opportunity costs must be estimated in order to obtain the valuation of the complete management costs of the enterprise.

3. Phases – models of financial accounting

3.1 First phase: expenditure – revenue model

This first phase represents the base model of the financial accounting in which some valuations of the forest assets are not calculated and also the fixed capital investment costs, such as machines and fund improvement, can be managed as current expenditure attributed to the year of activity in which they occur. If necessary the forest assets can be considered, registering only the physical quantities in the appropriate asset accounts (Rochot, 1984). Obviously this model must be used only at the beginning of the accounts keeping process or when the undertaking of the accounts is questionable due to the low and occasional timber income and when the forest management costs are very limited, where the business may use other more relevant sources of income. From this account indicators of the physical productivity of the forest and workers can be obtained. In fact the absence of the asset values does not allow elaboration of the performance of the income.

Balance sheet examples, derived from this accountancy model, are presented in the appendices. The results only concern timber production. Throughout the 2004 accounts the balances of two businesses have been reclassified, one on the Veneto Mountains, in the province of Belluno (enterprise A) which consists of 634 ha of conifer woodlands (spruce and larch) and one on the plain, in the River Po delta in the province of Rovigo (enterprise B), with 118 ha specialised in poplar production.

The accounts of enterprise A were implemented with the second phase, as described in the following section 3.2. The derived balance can be read alongside the first in order to compare the results that have been included in the appendices. The accounts of enterprise B have been implemented with the third phase (section 3.3). Both businesses show an important income variation passing from the expenditure – revenue accounting to that of the assets. In the first case, enterprise A, the income (profit for the year) diminishes by almost 70% (from € 157,000 to € 47,300). In the second case, enterprise B, the income diminishes by almost 40% (from € 42,700 to € 26,400).

Table 2. Example of a balance sheet applicable to a forest production enterprise. Economic management accounts.

10–12 Revenues		
10	Timber	
		1000 Sales – Growing stock – Planned removal
		1010 Self consumption
		1020 Plants
11	Public subsidies	
12	Different revenues	
		1200 Rent
		1210 Hire
		1220 Manual labour services
		1230 Various
13–18 Expenditures		
13	Raw materials	
		1300 Plants
		1310 Construction materials
		1320 Various
		1330 Depreciation rate of replanting
		1340 Depreciation rate of revaluation funds
14	Personnel	
		1400 Fixed labour
		1410 Casual labour
		1420 Managing personnel
15	Family Labour	
		1500 Owner labour
		1510 Family labour
16	Plant and equipment	
		1600 Fuels, lubricants, electricity.
		1610 Maintenance
		1620 Depreciation rate
		1630 Depreciation rate revaluation fund
		1630 Insurance
		1640 Hire
17	Land improvements	
		1700 Materials
		1710 Manual labour
		1720 Construction depreciation rate
		1730 Depreciation rate silvicultural improvement
		1740 Depreciation rate of revaluation fund
18	General administration costs	
		1800 Post and telephone
		1810 Insurance
		1820 Intermediate consulting and association's rate
		1830 Travel
		1840 Bank costs
		1850 Tax
		1860 Rent
		1870 Depreciation rate of intangible goods
		1880 Various

3.2 Second phase: annual timber increment model

Through this second phase the forestry asset accounts are used in order to value the gross profit (or loss). All the accounts of the forest assets foreseen in the general accounts plan must be used (Table 1; nos. 910–970). The accounting method is very similar to that used for animal rearing and is defined as ‘cowshed gross profit’ (see Elisei 1965; Openshaw 1980; Merlo 1983; Hyder et al. 1994).

The difficulty in estimating forest assets depends on both physical and economic aspects, such as the price given to the quantitative aspects of the forest surveyed (standing timber, growing stock, self consumption, replanting programme, etc.). In order to estimate these monetary values it is preferable to use as a base the minimum market prices or even lower prices, for reasons of prudence, which should be kept fixed in the initial and final inventory. In addition to the forestry assets the asset accounts surveyed in the investments accompanied by the respective funds of depreciation are also used (Table 1; nos. 1–2 and 5–6).

This phase or model can be applied to those enterprises which have the potential to make valid estimates of the forest assets. The criteria for these estimates must be previously fixed and kept constant, at least for long periods of time. The criteria can be modified only if the silviculture system, production cycles or structure substantially change. The model mainly lends itself to enterprises which have very long production cycles, where the utilisation is not constant over the years and does not correspond to the annual growth. Through the valuation of the forest assets, one greatly improves the annual knowledge of the forest revenues (monetary and estimated), rendering them homogeneous in time.

The indicators obtainable from this account particularly concern the performances in terms of income with respect to the different types of assets (net assets: ROE indicator; invested assets: ROI ind.; assets: ROA ind.). It is important that the economic indicators are accompanied by cash flow analysis, as monetary transactions can be different compared to similar incomes, from one year to the next.

3.3 Third phase: revaluation fixed capital model

This phase can be used as an alternative to the second phase. In fact, in the case of a very long rotation length (40–80 years), the reforestation should be re-valued for time periods that do not realistically allow the results obtained in the initial year to be compared to those obtained in the final year. However, it is worth evaluating when the two phases are combined or only one is chosen.

This phase is applicable particularly to the businesses that cultivate rapid growth forest species, such as poplar, or nurseries. In these businesses the revenues tend to be spread over an even time scale, and also occur in each financial year. In addition, the useful net growth, which no longer has a market as they are not saleable as intermediate products and will be sold as soon as they are mature, can not be realistically valued. The opposite of which often happens with slow growing species that take a long time to grow after reaching the minimum commercial level.

Therefore, in the businesses with a short production period, a suitable revaluation of the costs concerning the depreciation of all the fixed capital and in particular reforestation becomes much more important, rather than a ‘more or less’ valuation of the annual revenue. The revaluation of the depreciation costs, directly made in accounts and not in an extra accounts context, spread such costs evenly over the different years of the activity, making the respective incomes more comparable .

Without the revaluation of such costs, the income is derived from the difference between the concluded activity and the depreciation costs of acquired capital in the preceding years. This is particularly evident when considering the high costs involved in planting fast-growing species.

In practice for this accountancy phase the relative accounts of the forest assets are not applied (Table 1 nos. 910–970).

4. Classification of the accounted business

Every classification technique must be imposed on the object to be examined. In this case the countable income of the timber is the principle object. The group of businesses to be classified in a database must initially consider the variables in physical size and organisation of the entrepreneurial activity. This information concerns:

- the business structure and the land which it is on (area, altitude, slope, etc.)
- the silviculture regime (woodland, nursery, forest fruit, hunting and fishing, etc.) and the functions of the forest (recreation, landscape, hydrological, etc.)
- the activity carried out in every regime that makes up the productive processes on which the cost centres can be imposed (e.g. the processes of planting, log wood, sawn wood, fire wood, woodland improvement, etc.).

After the accountancy application, the same enterprise must be classified according to the economic results and particularly through the income, in respect to the following three categories:

- the accounting financial model selected
- the profit or loss level
- the proportion (%) between the timber profit and that of the remaining productions.

When the same business applies different accountancy models at the same time, a useful classification can arise that allows a synoptic comparison between the different types of income.

5. Conclusion

In forestry enterprises aimed at timber production the financial accounting is complicated by the difficulties in valuing the forest assets. These problems do not only depend on the accountancy methods and systems that can be employed for the recording of administrative facts. Rigorous methods use double entry accounting, to ensure that the recording is controlled. The accountancy systems vary according to the manner in which the income can be identified from the business activity. Coming from a single general plan of accounts for the recording of administrative facts and selecting only the suitable accounts, an accounting is obtained that can identify a precise type of income. The same accounting can be re-elaborated according to different accountancy models, in which income and the consequent performances can be compared in order to improve the managerial activity. The three financial accounting models presented here show a first phase that includes only cash expenditure and revenue, which can be considered as a starting point. The other two phases use control of the assets and are valid in distributing the variability of proceeds and costs equally over the years of the whole production cycle.

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APPENDICES

2004 Year End Account (Euro[1])

	Enterprise A		Enterprise B	
	First phase	Second phase	First phase	Third phase
1) Profit and loss Account				
A) Revenue from operating activities	**179,800**	**179,800**	**105,200**	**105,200**
Sales and owner's utilisation	179,800	179,800	105,200	105,200
B) Expenditure from operating activities	**70,700**	**75,400**	**68,100**	**79,600**
Raw materials and consumables	22,900	2,400	35,500	18,800
Services	32,700	32,700	12,600	12,600
Rent	2,500	2,500	-	-
Wages, salaries, social security costs	7,100	7,100	6,400	6,400
Depreciation of fixed asset	-	25,300	-	27,800
Variation in stocks of raw materials	-	- 100	-	400
Allocation to provisions	-	-	200	200
Other operating charges	5,500	5,500	13,400	13,400
OPERATING RESULT (A-B)	**109,100**	**104,400**	**37,100**	**25,600**
C) Financial result	**- 600**	**- 600**	**- 300**	**- 300**
Financial revenue	500	500	600	600
Financial costs	1,100	1,100	900	900
D) Value adjustments in respect of financial assets				
E) Extraordinary profit or loss	**- 2,000**	**- 107,000**	**-**	**- 4,800**
Extraordinary income (growing stock[2])	-	- 105,000	-	-
Extraordinary charges	2,000	2,000	-	-
Extraordinary charges (rise of depreciation of fixed assets)			-	4,800
PROFIT/ LOSS PRE TAXES/ COMPENSATION (A-B+C+D+E)	**106,500**	**- 3,200**	**36,800**	**20,500**
Taxes	3,000	3,000	5,300	5,300
Compensation (grants, subsidies and incentives)	53,500	53,500	11,200	11,200
PROFIT OR LOSS FOR THE YEAR	**157,000**	**47,300**	**42,700**	**26,400**

1 Value in € rounded up to the nearest hundred (e.g. 0.00 to 50.00 = 0 ; from 50.01 to 99.99 = 100).
2 The value of the bare soils and buildings are not indicated.

APPENDICES

2004 Year End Account (Euro)

	Enterprise A		Enterprise B	
	First phase	Second phase	First phase	Third phase
2) Balance Sheet				
Assets		**10,904,500**		**162,900**
A) Fixed assets		**10,762,800**		**122,800**
I – Net Intangible assets (improvements' value)		-		500
II – Net Tangible assets[3]		10,761,100		122,300
1) High standing forest (ha 634, enterp. A)		10,600,000		-
(ha 118 , enterp. B)		-		215,300
2) Buildings		630,000		8,400
3) Plant machinery and other equipment		5,400		26,200
4) Rise of value of tangible assets		-		48,800
Depreciation provisions of fixed assets		- 474,300		- 146,200
Depreciation of rise of value of fixed assets		-		- 30,200
III – Financial assets (shares in participant undertakings)		1,700		
B) Current assets		**141,700**		**40,100**
I – Stock		100		1,400
II – Debtors		94,300		12,300
III – Current financial assets		-		-
IV – Cash at bank and in hand		47,300		26,400
C) Prepayments and accrued income				
Liabilities		**10,904,500**		**162,900**
A) Capital and reserves		**10,867,800**		**134,900**
I – Subscribed Capital		10,820,500		108,500
II – Profit or loss for the year		47,300		26,400
B) Provision for liabilities and charges				
C) Provision for pensions and similar obligations		**35,200**		**9,500**
D) Creditors		**1,500**		**18,500**
a) Amounts payables within one year		1,500		4,800
b) Amounts payables after more than one year		-		13,700
E) Accruals and deferred income				

3 The value of the bare soil is not included.

Can Traditional Forestry Accounting Contribute to Measuring the Sustainability of a Forest Enterprise?

Hans A. Jöbstl

University of Natural Resources and Applied Life Sciences, Vienna, Austria

Abstract

Since Rio (1992) various sustainability processes on the international level have been aiming at securing sustainability on national and/or regional levels. Criteria and indicator indices for sustainable forest management, for instance, were established as a result of the so-called Pan-European Process. As forest management takes place in the institutional framework of forest enterprises, which have – at least in Central Europe – a long tradition of sustainability, it is necessary to define the indicators also at the operational level. Sustainability on the operational level has always been focussed on resources; however, it has substantial deficits, in particular, with regard to the value aspects of the forest assets and the non-market products.

Thus, the following questions arise: Which of the Pan-European indicators are of relevance for securing sustainability in an enterprise, and which can be provided by the accounting system (being the fundamental instrument for information supply and controlling)? Which data does accounting supply? What can it contribute to? How would it have to be developed further?

A study at the Vienna Institute for Silviculture, including expert inquiries and case studies in forest enterprises in connection with the L2 project, assessed 43 indicators on the basis of different properties. Its outcome could be used to establish a catalogue of indicators for the individual company. The main problem of an accounting system is the lack of consideration of annual changes in forest assets and the dissatisfactory recording of the environmental services. These problems are aggravated by serious weaknesses of forest surveys in practice. In this paper a list of operationally relevant criteria and indicators is presented, the shortcomings of the accounting system are briefly addressed, and concepts for their overcoming are dealt with.

Keywords: forest accountancy; sustainability control, performance measurement; forest assets; management accounting

1. Introduction

Since the United Nations Conference on Environment and Development in Rio 1992, several processes have been initiated to develop indicator systems (C&I) for sustainable development. The concept of sustainability in forestry, which had manifested itself until then in the principle of not harvesting more timber than would regrow, has been extended decisively, and the integration of social, economic and ecological elements has been requested. In order to solve the problems of operationalisation that have arisen in this context, six criteria have been selected for the forest that cover both the classical sustainability as well as the social and economic aspects and ascribe an important role to the biological conditions of the forest ecosystem. The determination of indicators on the international level was followed by numerous studies on the national and regional levels. After all, it was a matter of narrowing down the criteria to the individual organisation unit of forest management: the enterprise. The enterprise level has hardly been thought over and covered so far, although it is originally the sole centre of sustainability. It is there where sustainable forestry management is taking place – originally with a view to the sustainable yield of timber, and today with a wider view considering aspects of multiple use, etc.

2. Objective

Our deliberations are focussed on the forest enterprise, the requirements of management and the questions of what is needed by the individual enterprise to determine its goals, to operationalise them, and to implement them in practice, and what is needed to monitor the attainment of objectives and control it continuously.

The following questions need to be clarified: Which criteria of sustainable forest management (SFM) are of interest to the individual enterprise? Which criteria do forest and environmental policies want to have fulfilled on the enterprise level? Which data are needed from the enterprise for its management and reporting tasks? Which data do the authorities require from the enterprise, which of these data can be provided by accounting? How can the fulfilment of the requirements for sustainability be proved? Operationalisation requires the definition of goals, the determination of criteria, the derivation of indicators, and the examination of the means necessary for obtaining the required information. Thus, the questions arise as to what accounting can contribute and which improvements are necessary, or which possibilities do exist.

One can depart from the following assumptions:

- SFM takes place within the institutional framework of forest enterprises.
- Enterprises should be managed in a target-oriented way. Managerial decisions require clear targets and operational criteria or indicators.
- Targets and plans need to be controllable and to be controlled. Measurability is necessary; where no quantifiable targets exist they need to be compensated by indicators.
- The accounting system is the core instrument of the internal information supply.
- Reporting to the public gains increasingly in importance especially in connection with the concept of multiple use.

The following goals are aspired at:

- Key figures as tools for sustainable management of forest enterprises.
- Correct statements about the success of management in any one period.
- Reporting on sustainability by the forest enterprise (internally and externally).

These goals shall be achieved by the following means:

- Establishment of a set of indicators on the basis of SFM criteria for the individual forest enterprise from the point of view of the management while considering at the same time the expectation of the public.
- Analysis of the state of data availability and of proposals for its improvement (accounting system, forest inventory).
- Drafting of an internal sustainability report of the individual forest enterprise.
- Drafting of an external sustainability and performance report of the individual forest enterprise.
- Analysis of the deficiencies/problems of the current annual accounting (profit & loss and operational statements) and reporting, and proposals for an improvement (change in forest assets).
- Completion of existing studies in terms of managerial economics.

3. Criteria and Indicators (C&I)

Indicators are used to measure the objectives defined by the criteria and are, thus, the operational elements of these criteria. They are a strong tool to collect and report information within a system (e.g., SFM), which is usually characterised by a lack of knowledge, uncertainties and missing information about impacts, dependencies and feed-backs (Rametsteiner 2001). The criteria catalogue of the Ministerial Conference on the Protection of Forests in Europe (MCPFE) includes six criteria with 35 indicators in total. Each criterion is characterised by several indicators (MCPFE 2003). They aim at the maintenance (and enhancement) of forest ecosystems and their contributions to the quality of human life, and include forest resources, health and vitality, productive functions, biological diversity, protective functions and socio-economic functions.

Based on these six criteria, the Pan-European Operational Level Guidelines (PEOLG) have been elaborated to further promote sustainable forest management in Europe by translating the international commitments to the level of forest management planning and practices. They have also been adopted in the framework of Resolution L2. They represent a common framework of recommendations to be used on a voluntary basis and as a complement to national and/or regional instruments to further promote sustainable forest management at the field level, on forest areas in Europe (MCPFE 1998). Within Resolution L2 European countries commit themselves, inter alia, to promote the PEOLG and to adapt them to the specific national, sub-national and local economic, ecological, social and cultural conditions.

Apart from these guidelines, there are several individual studies on an operational level such as the PEFC study and the L2 study of the Vienna Institute for Silviculture, in particular, and a case study by Giugni (2005). These studies form the basis for the establishment of the set of indicators.

The study at the Vienna Institute for Silviculture assessed 43 indicators on the basis of different properties. By means of a Delphi survey, an expert panel consisting of representatives from science, administration, forest enterprises and non-governmental organisations evaluated the C&I set with regard to validity, practicality, relevance and importance of indicators. Possible threshold values for the quantitative indicators and the relative importance of the indicators had been derived from expert opinions. The results show that several indicators are easy to derive, but insignificant, whereas others are important but difficult to derive. (see Table 1). Finally, a set of 12 key indicators has been selected from the whole list (see Table 2).

Table 1. List of indicators with expert ratings and results from three case studies (based on Wolfslehner et al. 2004).

			Delphi-Study		Case studies		
No.	Indicator	Criterion	Relevance	Practicality	Importance	Availability	Measurability
1	consideration of SFM in forest management objectives	C 1	medium	medium	high	high	high
2	evaluation of forest management plans	C 1	high	high	high	high	high
3	monitoring of forest resources	C 1	high	medium	medium	high	high
4	mapping of forest resources	C 1	high	medium	high	high	high
5	controlling of forest resources	C 1	medium	medium	medium	medium	high
6	harvest plans and rotation period	C 1	low	medium	medium	high	high
7	amount and change of growing stock	C 1	medium	high	high	medium	medium
8	balance of growth and harvesting rates	C 1	high	high	high	medium	medium
9	composition of tree species	C 2	high	medium	high	high	high
10	use of suitable tree species	C 2	medium	medium	high	medium	medium
11	*use of soil-fertilizing methods*	*C 2*	*low*	*low*	*low*	*low*	*medium*
12	*prevention of waste deposit*	*C 2*	*medium*	*low*	*low*	*low*	*medium*
13	amount of damaged wood	C 2	low	medium	high	high	high
14	*use of pesticides and herbicides*	*C 2*	*medium*	*low*	*medium*	*low*	*medium*
15	*activities of biological pest prevention*	*C 2*	*medium*	*low*	*low*	*low*	*medium*
16	stems damaged by harvest	C 2	medium	medium	medium	high	high
17	stems damaged by bark peeling	C 2	medium	medium	low	high	high
18	*impact of grazing*	*C 2*	*high*	*medium*	*low*	*low*	*high*
19	*forest management practices causing bare forest soil*	*C 3*	*medium*	*medium*	*low*	*low*	*medium*
20	*amount of full-tree harvesting*	*C 3*	*low*	*low*	*low*	*low*	*high*
21	net present value	C 3	medium	low	high	low	low
22	returns from wood production	C 3	low	medium	high	high	high
23	non-wood products and services	C 3	low	low	medium	medium	medium
24	access to forests by forest roads	C 3	medium	high	low	high	high
25	final opening up by skid tracks	C 3	medium	medium	medium	low	medium
26	*laying-out of drainages*	*C 4*	*high*	*medium*	*low*	*low*	*medium*
27	amount of natural regeneration	C 4	high	medium	high	low	medium
28	use of local provenances	C 4	high	medium	high	medium	medium
29	vertical structure within stands	C 4	medium	low	medium	medium	medium
30	*number of old trees*	*C 4*	*medium*	*medium*	*low*	*low*	*low*
31	percentage of coarse woody debris	C 4	high	medium	low	low	low
32	consideration of key ecosystems in SFM	C 4	high	medium	low	low	medium
33	*consideration of rare species (trees, shrub) in SFM*	*C 4*	*high*	*medium*	*low*	*low*	*low*
34	damage of regeneration by browsing	C 4	high	medium	medium	medium	medium
35	*use of soil preparation methods*	*C 5*	*low*	*low*	*medium*	*medium*	*low*
36	*quality of forest infrastructure*	*C 5*	*medium*	*medium*	*medium*	*low*	*medium*
37	training of staff with regard to SFM	C 6	medium	medium	low	medium	medium
38	safe working conditions	C 6	medium	medium	medium	high	high
39	*willingness to join cooperations*	*C 6*	*medium*	*medium*	*medium*	*low*	*medium*
40	consideration of specific sites in forest management	C 6	medium	medium	low	low	medium
41	*use of traditional forest management practices*	*C 6*	*medium*	*medium*	*low*	*low*	*medium*
42	role of local staff for regional employment	C 6	low	medium	medium	medium	medium
43	meet legal regulations	C 6	medium	high	low	medium	high

Table 2. Key indicators for an SFM analysis (Wolfslehner and Vacik 2004).

No.	Indicator	Description
1	NPV	annual net present value
2	growth/harvest	balanced ratio of timber growth/harvest
3	non-wood	economic returns from non-wood products in relation to total incomes
4	Browsing	area of natural regeneration damaged by browsing
5	Damage	timber volume of damaged wood in relation to the total timber production
6	forest roads	density of forest roads
7	natural regeneration	area of natural regeneration in relation to total regeneration area
8	tree species	forest area with a close to nature tree species composition
9	woody debris	amount of coarse woody debris of standing volume
10	Planning	quality and extent of planning instruments and tools
11	Ecosystem	area with conservation measures for ecosystem protection
12	Training	amount of money spent for professional training

4. Data sources and deficiencies

The central instruments of information in an enterprise are the accounting system and the forest inventory.

The accounting system is the principal quantitative information system in any company. It can be broadly classified into financial accounting, cost and management accounting. Financial accounting records flows of money, goods and services from and to the enterprise in monetary terms, and the resulting state and changes in assets and liabilities. Monetary profit is the basic measure of results. Cost accounting analyses internal processes, factor consumption and performances in detail, and is characterised by efficiency criteria. Both systems of accounting cover the production of goods and the provision of services as far as they contribute to monetary profit. Management accounting comprises all accounting activities aimed at providing data relevant for management purposes. Environmental and social accounting have emerged recently – all these facets of accounting together result in the so-called extended management-oriented accounting.

Forest inventory serves for recording the properties of forest stands relevant for planning, controlling and assessing purposes. It is partly carried out as stand inventory, and partly as sampling inventory at larger intervals.

Accounting and forest inventory as measurement tools and control instruments of sustainability have to provide information on such criteria and indicators that are suitable for characterising sustainability.

In practice, the major part of the desired data for the representation and proof of sustainable forest management is missing. There are weaknesses and deficits with regard to the condition of the forest (inventories), present and future performance (products and services) and the indicative figures. Apart from missing physical data to be provided by forest inventory, there is a lack of adequate values for profit and forest assets in financial accounting. In any case, the customary measure of the undifferentiated cubic meter over bark is insufficient without considering tree species composition, timber quality, assortments, qualities and terrain conditions. Basically, financial accounting can only contribute to the certainly important sustainability goal of *liquidity*. However, forest enterprises usually have a big share of assets that can be liquidated in the short run, which implies that this financial key figure is not really important in the forest enterprise. A well developed cost accounting system can, however, deliver a great number of interesting indicative figures. The Austrian forestry accounting data network, for instance, has provided an abundance of data from financial and cost accounting of forest enterprises for 40 years, but their shortcoming is the lack of non consideration of the changes in forest assets. As a first step, the so-called adjustment to the allowable cut has been practically introduced.

The main shortcomings of forestry accounting consequently are: neglecting or incorrectly registering changes in growing stock, and not or inadequately representing other services, especially with respect to the environment in a wider sense. The consequence is that results shown by accounting are to a certain extent incomplete or wrong.

Many approaches have been proposed over time to evaluate forest assets and to consider changes in forest assets, but none of them has been accepted in practice so far. Currently, there are several new and promising approaches to solve these problems. Whereas there are hardly any legal regulations concerning forest asset records in external accounting, it is indispensable for internal accounting to have correct records of forest assets and to examine if targets have been reached. With regard to the non-market or environmental benefits that cannot actually be assessed with a monetary system, so-called *performance reports* that show primarily physical factors are being examined.

The approaches can, for instance, be roughly classified into balance sheet and calculatory approaches. Balance approaches try to quantify changes in forest assets like a balance sheet or profit and loss account. They are known from public forest enterprises in Great Britain, New Zealand etc. Recently, scientists from Central Europe have also dealt with the attempt to fully integrate forest assets into financial accounting. The approach of a German research group (Borchers 2000) has been developed on the basis of IAS and the local commercial law. Forest assets appear as “growing stock” in the balance sheet. A similar study was recently presented for Scandinavian forest enterprises. Joint-stock companies that are publicly quoted are to show forest assets in their balance sheets. Enterprises run by state and provincial governments also strive at this goal. For smaller forest enterprises, however, it is more reasonable to opt for calculatory approaches that avoid the evaluation of assets. In the following, a calculatory approach for the periodical performance assessment shall be presented that considers changes in forest assets, avoids the problem of evaluation, and integrates environmental services.

5. A two-stage calculatory approach to improved economic performance assessment of the forest enterprise

In Central European forest enterprises the so-called allowable cut calculation has been generally introduced. The allowable cut is used instead of annual increment as a measure and benchmark of the sustainable timber production potential. Deviations between allowable (AC) and actual cut (AH) are considered to be an expression of changes in the value of growing stock.

$(AC - AH) _* CP$ = change of forest assets

where CP is the contribution margin (stumpage price) per m^3 of the actual harvest.

This AC-calculation is only one step into the right direction, which has to be improved by other means for the following reasons:

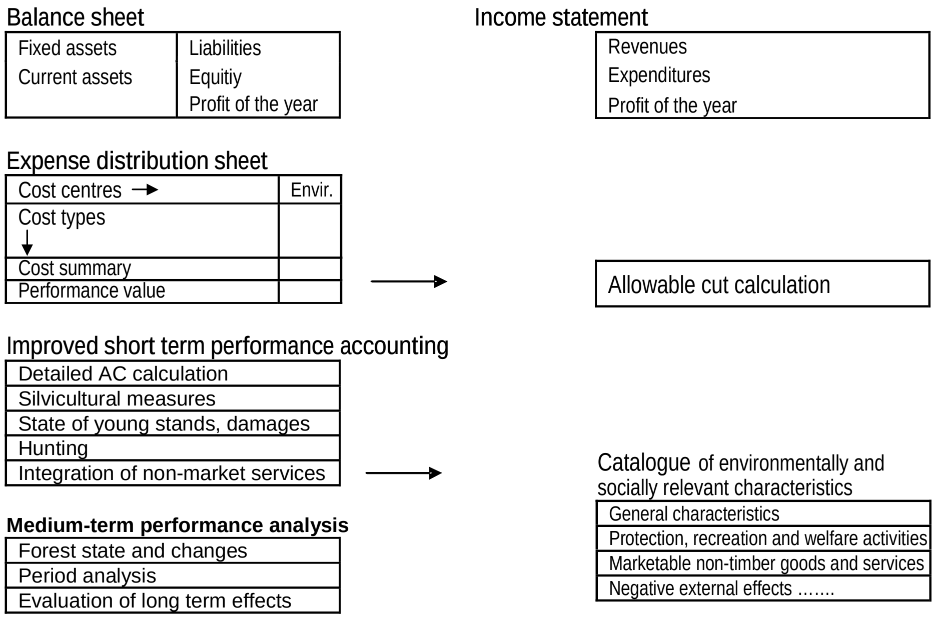

Figure 1. Outline of the calculatory approach to an improved periodical performance assessment.

- problematic determination of allowable cut (average of different formula)
- re-calculation of the actual felling quantity – disregarding tree species, timber quality, logging site etc.
- lacking consideration of the execution of silvicultural operations
- proof of changes only in relation to the management plan (allowable cut)

In order to improve this calculation, a calculatory approach for a better periodic performance assessment was developed by Jöbstl (1981, 1996) – starting from the balance sheet and the income statement (see Figure 1).

Stage 1. The Improved Short-Term Performance accounting approach
It comprises – starting from the allowable cut method – the following components/ assessments:

- Deviation of actual cut (AH) from allowable cut (AC) subdivided into tree species, assortments, logging sites, etc. (i)

  $(AC_i – AH_i) * CP_i$ = change of assets $\quad$ $_i$ = timber species, …
- Deviation of planned (p) and actual (a) silvicultural measures (FM)

  $(FM_p – FM_a) * c_m$ = change of assets $\quad$ c_m = standard cost of measure m
- Changes in the state of young stands and tending areas (FS)

  $(FS_p – FS_a) * c_s$ = change of assets $\quad$ c_s = difference in standard contribution margin of s

- New damage caused by calamities and game
- Maintenance of forest roads and buildings
- Long-term effects of allowable cut on forest assets
- Loss of timber production due to hunting, recreation, etc.

In order to eliminate or separate the influence of fluctuations in market prices, standard prices and standard costs are used. Expenditures and receipts from infrastructure services (IS); non-timber services etc. are separated by proper cost centre accounting and adequately loaded with overhead costs. Losses and damage caused by calamities and game and the provision of IS are calculated on the basis of opportunity costs. While environmental economists have developed a number of techniques to estimate the value of non-market goods and forest services, we consider these techniques as difficult to apply and usually not useful on the enterprise level in their current form. My approach works without monetary evaluation of IS services. However, a quantitative and qualitative description of environmentally and socially relevant facilities and services of the forest holding is proposed to be presented on a separate sheet.

Stage 2. The medium-term performance analysis
In combination with the forest inventory (carried out only at greater intervals in the course of forest management planning) a comparison of the states of the forest (actual state t_o - actual state t_1) and further analysis can be carried out. The process concept for medium-term performance analysis is essentially based on the fundamental ideas of an actual-actual- and a target-actual-comparison as well as an analysis of deviations and causes. It comprises the following components:

1 Comparison of two consecutive inventories (Actual – Actual; Target – Actual)
2 Analysis of the past medium-term planning period (period analysis – control of plan execution and analysis of financial results)
3 Medium-term plan assessment and long-term development preview (forecasting)

Preconditions for this approach are a purpose-oriented design of the forest inventory, derived from a carefully created evaluation model, and the determination of the requirements to be covered by book-keeping (recording of physical and financial quantities). The results of the analyses are a table of physical and monetary characteristics of the forest state and the periodic results (absolute, relative and differential figures). Their combination allows an assessment of the value-creating effects of the expired period. As far as possible and reasonable, the physical data will be complemented by monetary values. This approach is supported by a set of calculation and development simulation models.

Perspectives for the Future: A promising future approach for a continuous internal audit of forest assets changes has been developed by Karisch (2003): a forest stand data base with annual updating of forest inventory data. Combined with plan-actual comparisons for harvesting and tending, simulation of forest stand development as well as monetary valuations, the annual observation of forest assets development should be made possible.

6. Steps to forestry environmental accounting

A step-by-step approach to environmental accounting on the enterprise level in forestry and agriculture was proposed by Merlo (1996). It starts with conventional financial statements: balance sheet, profit and loss account of the forest enterprise following conventional accounting principles. The second step separates environmental/recreational activities from conventional ones, i.e. agricultural products and timber, from recreational environmental services. A third step outlines near market values as perceived by the entrepreneurs. These are hidden values – assets and liabilities (changes in growing stock, risks due to natural hazards, …). A fourth step aims at incorporating non-market benefits and costs (externalities), or, at least, providing a framework for their incorporation, as far as they can be shown in monetary terms, or by other means. Therefore satellite accounts and addenda including physical/ biological aspects can be used. A related approach with examples from two forest enterprises was presented by Merlo and Jöbstl (1999).

Several publicly owned enterprises, e.g. the Austrian federal forest estate, are concerned with the elaboration and publication of so called "Environmental Performance Reports" that have been expanded recently to Sustainability Reports, including different aspects of SFM (ÖBf AG 2004).

On the international level, first Guidelines to adjust National Accounts in order to provide data on the real social costs and benefits of forestry for society were provided in 1968 and renewed and improved in several steps (SNA, SEEA, EEAF). The basic idea here is to take the environmental services and the changes in forest assets in physical dimensions and describe them in annexes or on satellite accounts, respectively, as in the enterprise model described above. The SEEA includes both physical accounts and, to the extent possible, monetary accounts. The EEAF follows the SNA and SEEA, but expands the presentation of forest accounts to non-market forest products, forest services to non-forestry sectors, distribution of forest benefits, and accounts at the regional and forest level.

7. Some comments

Finally, it has to be admitted that the traditional accounting system is not even able to provide sufficient information for the Sustainable Timber Management and that adequate further developments with regard to forest resources are needed. The traditional accounting system cannot contribute much to meeting the new major challenges of SFM such as recording other forest services apart from providing information about expenses, costs and direct revenues. Therefore, it needs to be complemented by new approaches. In this context, forest inventory plays a central role. Currently, there is a lack of data, especially of those that allow a monetary assessment. Forest inventories are planned inadequately. More mental input is needed. Data collection and processing are expensive and not feasible for small enterprises. Models and calculation aids are missing. Financing the further development of existing models has a very low priority, since they seem not to be indispensable for the current management. Nevertheless, further efforts are necessary, since the provision of information about the state of the forest, forest services and economic outcomes relevant for sustainability is the manager's duty, whereas the stakeholder needs to go and get the information.

8. Concluding remarks and summary

1. Accounting has for a long time been an important information instrument for enterprises both internally (management – controlling) and externally (reporting). Beyond that accounting provides information for the national income estimation and policy.
2. The picture of the actual conditions, processes and results of a forest enterprise as shown by forest accounting in physical and financial dimensions is incomplete, and partly even

wrong and misleading. The periodic changes of forest assets and the environmental achievements of the forest enterprises are missing in particular, while wood harvesting is relatively well captured. An extension is necessary for internal and external purposes.

3. Though the forest, which constitutes the centre of forestry activities, covers 80-90% of the assets of the forest enterprises, it is to a large extent ignored by traditional financial accounting. Yet, planning and control of forest management require to observe and to judge the stocks and their changes with a view to the future yields.
4. In National Accounting, which also shows serious shortcomings, international organisations are elaborating proposals of procedures that aim at standardisation, harmonisation and, thus, comparability – including the natural resources, forest development and the non-market benefits of forestry.
5. While first suggestions on the valuation of the changes of forest assets (physical sustainability) are more than 100 years old – but have never attained acceptance in general practice – proposals for the inclusion of the environmental benefits into management accounting (sustainability in a wider sense) are hardly 10 years old.
6. Approximation solutions are commonly used: on the one hand, improved performance estimation without evaluation of the forest assets on the basis of comparisons of planned (standard) and actual values (e.g. actual cut – allowable cut), and, on the other hand, the creation of so-called performance reports, recently extended to sustainability reports.
7. In enterprise accounting we have preferences for the calculatory method of accounting for changes in value. Environmental services as well as changes of forest assets are not to be entered into financial accounting directly, but recorded in satellite accounts and/or described in the appendix to the balance sheet. This avoids the mixing of different qualities of information.
8. The criteria and indicators of the various SFM processes can be used as a basis for the assessment of the necessary contributions of accounting to further support the measurement of sustainability. This concerns mainly physical data made available by carefully planned and accomplished forest inventories and based on development prognoses. In the ideal case monetary evaluations can be added.
9. It is a fact that the majority of the forest enterprises do not have any systematic accounting system, while others maintain the bare legal minimum. In addition, also the accounting systems of progressively led enterprises do not cover substantial aspects. Significant development is still ahead.

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Evaluation of Forest Management Planning Approaches within the Context of Multifunctional Role of Forests in Turkey

Fatih Sivrikaya, Günay Çakir, Sedat Keles, Uzay Karahalil and Selahattin Köse
Karadeniz Technical University, Trabzon, Turkey

Abstract

Forests in Turkey provide a range of goods and services such as wood for heating, construction, manufacturing, a home for wildlife and jobs for the forest related community. As a result of numerous problems such as increasing population, environmental pollution, shortage of raw materials, soil erosion, global warming and forest utilization, people's expectations of forests have inevitably changed and more attention has to be given to modern forest management. One has to understand that forests are not only a timber resource but also offer many other values like recreation, aesthetic and social health. In Turkey, forest management planning studies were launched in 1917. Yet, first forest management plan within the context of modern forest management was prepared in 1963. Until the 1990s the main management objective was maximum timber production. Forest values were not taken into consideration in preparing forest management plans. Turkey started some sustainable forestry activities and carried out projects, including different planning approaches focusing on multiple-use values of forests, after signing the biodiversity agreement in 1992. These projects are the Mediterranean Forest Use Project, Forest Resource Information System (FRIS) and Global Environment Facility (GEF II). In this study, planning approaches used in Turkey are explained and studies carried out focusing on multiple-use approaches are evaluated. Criteria and indicators for determination of forest values in Turkey are identified and criticized for sustainable forest management, as well as the practical principles for their implementation.

Keywords: forest management plan, forest values, planning approaches, sustainability

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1. Introduction

Turkey occupies a unique geographical and cultural position between Europe and Asia. It is bound by the Black Sea to the north, the Mediterranean Sea to the south, and the Aegean and Marmara seas to the west. The topography is generally very rough and steep. The average altitude is about 1,250 meters. About 56% of the country's total land area is more than 1,000 meters a.s.l. and 62% has areas with a slope of more than 15% (Konukçu 2001).

There are 21,056,443 hectares of forest in Turkey. They are generally located in mountainous areas and are usually semi-natural with high biodiversity value. The country has 9000 plant species, of which 3000 are endemic. Most of these plants grow in forest areas (GDF 2005a).

The annual sustainable yield of Turkish forests is 1.96 m^3/ha, while annual increment is 3.42 m^3/ha for productive coniferous high forests and 0.28 m^3 for degraded coniferous high forests. For the deciduous forests these amounts are 3.66 m^3/ha, 5.16 m^3/ha and 0.51 m^3/ha respectively. Average annual increment for the high forests is 2.02 m^3/ha, for the productive coppice forests 2.39 m^3/ha and for the degraded coppice forests 0.20 m^3/ha. These figures indicate that the present increment and productivity of Turkish forests is considerably low and below their potential.

For the 21.05 million ha of forests, 99.9% of the forest land base belongs to the state, and the remaining 0.01% is privately owned by 277 landowners and 51 public organizations. The administration and management of almost all these forest areas have been carried out by the state forest organization called "Turkish Forest Service" or "General Directorate of Forestry" (GDF), under the Ministry of Environment and Forestry. Forest management activities have been the task of the 1339 forest district rangers under 242 state forest enterprises (Konukçu 2001).

2. The historical development of forest management plans in Turkey

The forest management planning system is a very prestigious discipline in Turkish forestry. All forests have to be managed according to management plans. Since the first management plan in 1917, the planning system has evolved in terms of techniques used. Over the history of forest management planning, a number of planning approaches have been used in Turkey. These are: conventional planning approach, Mediterranean forest use project (Mut-Gazipaşa), Turkish-German collaborative model/pilot, forest resource information system (FRIS), global environment facility (GEF II) and multiple-use planning (functional planning) approach.

The Mut-Gazipaşa model has resulted in satisfactory outputs, but it was only applied to certain places and has not been replicated. The German GTZ project "Management of Broadleaved Forests in the West Black Sea Region" aimed to solve silvicultural problems of broadleaved forests and gained a lot of support from forestry quarters, but the intense inventory and planning cost brought about difficulties in expanding the implementation. Another model was developed through a Finnish Project (FRIS). This model introduced effective use of GIS in planning developed on a GTZ planning system. The project is continuing to integrate it to the classic planning system. After a long period of forest management plan practices which are wood production oriented, GDF has initiated functional planning (Başkent and Köse 2004; Köse et al. 2002; Foweca 2005).

2.1 Conventional planning approach

Turkish forests have been managed since the early 1960s under traditional forest management plans which are prepared and revised on a 10- or 20-year cycle. Management plans typically cover one or two watersheds, and most management plans concentrate on the silviculture and utilization of the forest resources, with less attention to the social development of forest villagers as actual and potential co-managers of forests and rangelands. The classical area regulation approach has been widely used across the country for even-aged forests (95%) comprising mainly light demanding trees such as pine and coppice forests. Hufnagel's size class method has been used for uneven-aged forests (5%) comprising mainly shade tolerant species such as fir. Management plans are prepared at forest planning unit level (discussed in later sections) where a district ranger is responsible for plan implementation (Başkent and Köse 2004).

Management planning periods are determined based on the silvicultural needs of the species. The process starts with a full forest inventory to determine stand sizes, growing stock and increment. The combined forest inventory approach is used across the country. Characterization of stand types and determination of their sizes are carried out through 1/15,000 infrared aerial photos and forest cover type maps are thus created. Stands are discriminated based on three criteria only: species, development stages and crown closure. Growing stock and the increment are determined based on a ground survey. Statistical procedures are used to design sample points to conduct the ground forest survey (Başkent and Köse 2004).

The disadvantages of this planning approach are: forest values are not taken into consideration during the planning process and the management objectives are primarily based on wood production.

2.2 Mediterranean forest use project (Mut-Gazipaşa Model)

The Mediterranean forest use project was prepared by the Forestal International Company in 1972. According to the feasibility report paper, cellulose and timber factories can be built in Antalya. But the factory location altered to Silifke-Taşucu in 1975 and the feasibility report prepared for Manavgat was revised for Taşucu. Apart from Antalya, Adana, Mersin and Kahramanmaraş regional directorates of forestry were determined for alternative raw material resources. This study was called the "Mediterranean Forest Use Project" in 1975. The Gazipaşa management plan (1978–1982) was the first plan prepared as a model in Turkey and second model plan was Mut (1980–1984). Both management plans were prepared according to the Mediterranean Forest Use Project. The Denizli-Eskere and Adana-Karaisalı management plans are similar to Gazipaşa and Mut ones.

Management objectives of the model plans were protection, improvement and expansion of forest resource to obtain more products by means of forest villagers and utilize the forest effectively. Planning was carried out at forest enterprise level. An industrial forestry approach based on plantation was taken into consideration in a high quality site which is suitable for fast growing species and mechanical land preparation (Soykan 1984; Asan 1999). The management approach used simulation techniques and clear cut with highly mechanized silvicultural prescriptions. After an initial planning period, some planning principles changed for different reasons and the Mediterranean Forest Use Project was abandoned in 2002 (Asan 1999).

2.3 Turkish-German collaborative model

Forest management plans in the western Black Sea region were renewed/revised in 1987 and silvicultural failure in the regeneration of hardwood forests became a current issue. It was therefore decided to prepare a project in collaboration with Germany, which came into effect in September 1988. Seminars were held (GDF 1989; GDF 1990; GDF 1991) and it was decided to change the forest management planning approach. In 1990, the international project began in the western Black Sea hardwood dominated forest areas called the Turkish-German collaborative model/pilot management plans. This approach is based on successful regeneration effort using various silvicultural prescriptions on a stand level.

The objectives of the project were determined in two phases. For one phase, the objectives are to offer hardwood products for sale in the long-term, deal with conflict between agriculture and forestry in the long-term and manage resource sustainability taking into consideration ecological conditions. Increasing forest supply obtained from hardwood forests was decided as main objective. So far, nearly 110 management plans have been prepared and implemented in Zonguldak, Sinop, Bolu, Kastamonu and Trabzon Regional Directorates of Forests.

The stand level approach to management planning under the Turkish-German initiatives differs from the classical approach in a number of respects, such as longer rotations and regenerating periods, forest cover type map scale of 1:10 000, concept of continuous forest cover (a sort of uneven aged stands), stand/sub-compartment description and management plan format. The approach favors tending/thinning harvest (70%) to regeneration harvest level (30%). While the approach focused on successful regeneration efforts, it left the foresters with great problem in determining the spatial layout of harvesting activities (i.e. size, location and timing of actions on the ground) and undetermined future structure of forests (Baskent 1999).

2.4 Forest Resource Information System (FRIS)

FRIS has been carried out in Turkey as an International Project. The Forest Database Management System (FDBMS) was established to obtain and to store all aerial data and parameters such as tree species, age, volume, increment, crown closure etc. Digitizing of data makes the planning process shorter. FRIS was started in 1998 and supposed to finish in 2001. The main objective of FRIS is utilization of the information system on a vast scale for forest management planning processes. It is a tool for multiple-use in natural resource management. FRIS project contains new methods such as Geographic Information System, Database Management System, Remote Sensing, Decision Making Techniques and Data Processing and Reporting for users (Köse et al. 2002).

FRIS acquired data by remote sensing with 1:15 000 scale air photos and inventory, data analysis with GIS, and decision-making using operations research techniques (simulation). Sample plots were determined by computer with definite x and y coordinates. It was used to find sample plots using GPS. These sample plots will be used in the next inventory, which will contribute to establishing a National Forest Information System (NFIS).

This project will be finished by the end of 2008, including digital and orthophoto maps, and cadastral surveys. Finally, the FDBMS will be set (Başkent et al. 2002). The FRIS project is important for sustainable forest management because forest values were taken into consideration in the planning process. But there are problems on how to integrate and balance different forest functions in a plan, design a function map for a planning unit, determine management goals and goal combinations according to the function map and perform a functional inventory.

2.5 Global Environment Facility (GEF II)

This project supports a strategy-process-design for effective incorporating of biodiversity into forest management plans for sustainable use of biological resources by building institutional capacity and implementing multiple-use forest management plans focusing specifically on the protected areas. The main goal of the project is "to prepare a strategy design to incorporate biodiversity conservation in the forest management planning process at three of the four project sites". The project, which started in 2000 and planned to finish in 2006, has been supported by GEF (Global Environment Facility) and GDF.

The purpose of the project is sustainable conservation of the biological diversity and ecological integrity of selected forest, wetland, steppe and alpine ecosystems that are representative of Turkey's four major biogeography zones. These include the Black Sea and Caucasian mountain region; the Central Anatolian plateau; and the European and Mediterranean regions. The project development objective is to establish effective, intersectional, participatory planning and sustainable management of protected areas and natural resources at four selected biodiversity conservation demonstration sites, and build capacity at a national level to facilitate replication of these activities at priority conservation sites throughout Turkey (GDF 2005b).

The planning approach is similar to a multiple-use planning approach. Forest values are taken into consideration in the planning process; a forest values map (function map) is prepared and a functional inventory done. Participation was taken into consideration in these plans. Information systems are used almost every step in planning process. Allowable cut is calculated using the classical approach, i.e. the operations research techniques not used in decision making.

2.6 Multiple-use planning approach (functional planning)

Forests host very a rich variety of flora and fauna species, conserve biodiversity and forest ecosystems and the genetic diversity of many native and endemic species which should play vital environmental and economic roles for the present as well as future generations at local, national and even global levels. Amenity and recreation functions of forests areas have also gained importance for the rapidly urbanizing populations of the country and are expected to become the prime management and utilization objective of significant areas of forest in the near future. Protective and environmental functions of the forest resources are even more important than productive functions in most parts of the country.

Around large cities such as Ankara, Istanbul, Izmir and Bursa in particular, recreational demands for jogging, hiking, and fresh air have also been increasing. This social pressure forces foresters to change the management objectives in some areas of the productive forests for recreational and community health usage. On the other hand, more than half of the forests are on steeply sloped, high-altitude regions in Turkey. Water supply, erosion control, and nature conservation have great importance in such mountainous areas (Asan et al. 1996).

Although 27% of the country is covered with forests, Turkey is not in a good position compared to European countries because of unsuitable distribution of the forest over the land. For this reason, multiple-use forestry concepts have been gaining importance with the increasing demand for hydrological and erosion control and the amenity and recreational use of forest resources. The traditional planning techniques used up to now are suitable for forests managed for timber production only. New planning tools should therefore be added to the existing system in order to realize a rational utilization of forest resources (Asan 1990; Asan 1992).

Multiple-use management of forest resources could not be realized until 1998, although it is considered among the basic principles to reach the national forestry objectives. Some forest areas were allocated for recreational usage or for watershed protection or as a national park, but no technical practices were suggested and these areas were left to nature. However, that kind of allocation cannot be accepted as multi-functional usage, so a new approach to the multiple-use concept is needed in the country. A new planning procedure based on forest function maps has been offered by researchers (Asan et al. 1998).

Multiple-use planning of forest resources is needed in order to facilitate the best possible choice, or at least an approved mix of several inputs and outputs in an extremely complex production process. In any comparison of decision alternatives, the goals and objectives for the utilization of the forestry production process have to be known. This approach uses numerical optimization procedures and choice models at both strategic and tactical level. Nowadays, the most crucial problem in applying analytical multiple-use planning approaches is the lack of production functions, or other models which could be used to measure and evaluate different products and benefits – quantitative as well as qualitative ones – not only at national or regional but also at forest holding and tree stand level.

Since 1998, various forms of multiple-use (locally called functional planning (FP)) planning approach have been used in some forest districts in Turkey. Although its framework has not been fully determined and formulized, the approach has been determined as the future planning approach by the Department of Forest Management and Planning (DFMP) under GDF. The Multiple Use Forest Management Planning approach started in Bahçeköy research forest in Istanbul region and was generalized in Kahramanmaraş, Trabzon, Muğla and Eregli forest regions (Başkent and Köse 2004).

In this system, management units are separated according to forest values, or forested areas that will be managed according to value groups are separated from other management units. Intensity and technology density differs according to expected forest values/functions. In functional planning, the form and intensity of silvicultural treatments can differ for the same stand type. Basic stages of the plan preparation are explained in five articles (Köse et al. 2001; Köse et al. 2002):

1. Designing forest value and forest value map/function map for the planning unit
2. Determining management goals and goal combinations according to the function map
3. Performing functional inventory
4. Harvest Scheduling
    4.1. Rotation length and target diameter limit,
    4.2. Forest values and management objective and forest structure
    4.3. Regulated forest
    4.4. Decision on allowable cut
5. Inspection and control

Expected utilities and values from those stands were determined taking into consideration the whole planning unit to manage for which goals and which silvicultural treatments will be applied to stands. Areas, allocated according to determined utilities and forest values were mapped, in this way the function map was completed. To allocate management units according to the functional planning approach, function groups that met by each compartment and stand were determined on the basis of the function map. Then, which of these functions are main and which are sub-functions was designated. Forests that have the same main objectives are allocated to the same management unit. Some management units, allocated using the FP approach, are: Timber Production (round wood production in different diameter and quality), Soil Conservation (prevention of water and wind erosion, landslides, rock and stone rolling), Recreation (natural landscape in Zonguldak - Istanbul road and conserving road), Timber Production With Social Conflict (problem areas related to forest-public relationships. In Turkey the land survey is not yet finished. The owner is unknown, especially in forested regions. This situation leads to conflicts between forest administration and people), Nature Protection (monument trees, old growth forests, ecosystems that are rich in biodiversity, forests that are in need of conservation because of poor site management). Some forest values used for the planning process in Turkey are shown in Table 1 (Yolasığmaz 2004).

Table 1. Some forest values which are used for the planning process in Turkey.

Forest values (functions)		Forest value & objective	
1-Economic forest values	1. Forest product protection	a. Timber production	
		1. Saw timber	3. Pole timber
		2. Fiber and paper wood	4. Stake wood
		5. Fuel wood	
		b. Non-wood forest product animal products	
		1. Vegetable products	2. Water & mineral products
2-Ecologic forest values	1.Erosion conservation	1. Avalanche prevention	2. Landslide prevention
		3. Soil conservation	
	2. Climate conservation	1. Climate conservation	
	3. Nature conservation	1. Alpine zone	14. National park
		2. Nature reserve areas	15. Energy transfer line
		3. Ecological corridor areas	16. Ramseur areas
		4. Gene conservation areas	17. Windbelt
		5. Critical ecosystem	18. Fog protection
		6. Coastal dunes and sand dune ecosystem areas	19. Specific purpose conservation areas
		7. Riparian forest	20. Wetland
		8. Special environment conservation areas	21.Lagoon (alluvial forest ecosystems) protected areas
		9. Nature reservation area	22. Natural park
		10. Natural monuments	23. Peat areas
		11. Fire prevention forest	24. Poor site
		12. Wildlife conservation areas	25. Road protection
		13. Old growth forest	
	4.Hydrology	1. Water resource conservation	3. Drinkable water conservation
		2. Flood conservation	4. Potable water conservation
3-Social forest values	1. Community health	1. Noise prevention	3. Air pollution conservation
		2. Health institutions conservation	
	2. Esthetic	1.Aesthetic areas	
		2. Road conservation for esthetic	
	3. Recreation	1. Rafting	4. Recreation
		2. Sport area	5. Hunting
		3. Forest area for tourism	6. Tracking area
	4. National defense	1. National border and strategic area	
	5. Scientific forests	1. Forests for education	3. Forests for research
		2.Forests for faculty research	4. Arboretum research forests
	6. Social conflict areas	1. Social conflict areas	

Whereas volume inventory was done at stand type level, planning was at stand level in planning units. Sample plots, distributed in productive forest were measured and evaluated according to the classical approach. Discrimination of stand type and volume and increment calculations were the same as the classical approach. Generally, age class method was the main method in harvest scheduling and high forests were planned according to this. Long rotation (300 years), long regeneration period, and small coupe version of age class method are fundamentals of planning in high forests. Annual cutting area method was used in the coppice and management units were put in village cutting series. Social conflict was considered when determining location and size of regeneration area (Asan 1999).

In beech and black pine species of pure and mixed management units, whose main objective is timber production, the age class method is used and age is used for harvest scheduling. In the same species of pure and mixed management units, whose main objective is conservation and social attributes, the management method of use in all forest forms and based on silvicultural principles is used and target volume is used for harvest scheduling. Sustained forests are places where, at least, continuance of volume and condition must be kept to a minimum level. In these forests soil conservation, water conservation, recreation, nature conservation, climatic, society health, and scientific etc. values gain priority over timber production. Criteria of "Target Volume" were the basis for controlling sustainability of stand conditions of continuous forest management units.

Annual allowable cut of stands to be harvested is designated comparing silvicultural allowable cut determined according to stand type in each sample plot, with increment taking into consideration factors like site condition, stand crown closure type, trees per hectare, volume and increment, stand age, distribution of volume to age classes, slope, main and sub-objective of the management unit. Compartment size, numbers and boundaries of the renewed plan were taken exactly the same as the old plan. Stand sizes are designated as 30 ha in even aged forests, 40 ha in uneven aged forests (continuous forests) and 70 ha in conservation forests. A maximum 20% increase is allowed from these proportions. Intermediate and final cutting plan is made for 20 years and interim revision of the plan is suggested after 10 years. Rotation age was 120 years for beech in conventional plans, but this was increased to 180 years in this plan. It can be understood from these explanations that functional planning carries out many of the criteria required for sustainable forestry (Asan 1999).

Collecting data and evaluating methods of functional planning are not very different from the classical approach. Stand type discrimination, establishing interior boundaries, evaluating sample plot data, calculating error and statistics could be done both according to the classical approach or at stand level like Kerpe and Istanbul City Forests. The management methods used in functional planning are also not very different from the classical approach, but the management methods of "A special form of uneven aged stands" assumed in conservation and service production management units can be changed related to performance capacity of the site and biological characteristics of the tree species appropriate to both single tree selection and large group or small area selection.

3. Discussion and conclusions

Despite the growing recognition of the multiple dimensions of forest resources, Turkish forestry has remained concerned about timber production. This single focus is in marked contrast to (i) rapidly growing "new" demands for forest recreation, nature conservation and other forest values from an increasingly affluent and urbanized population; (ii) recognition of the need for greater sensitivity to the needs of poor rural populations for fuelwood, forest-based grazing and fodder, non-wood forest products and employment; and (iii) government commitments to globally significant forest values under arrangements such as the conventions of Biodiversity, Desertification Control, Climate Change, and Ramsar (wetlands).

The ecological health and integrity and spatial control of forest activities are not currently part of forest management plans. Economic input is not incorporated into management plans. No decision-making techniques are used.

In Turkish Forestry, plans prepared according to a functional planning system are much better than conventional plans and these models are presently being developed. Digitizing values, except for timber production, and realizing function enumerating when there are more than two values objectively are not completely solved in practice. Like all planning systems applied in Turkey today, the most important deficiency of functional planning is lack of economic feasibility.

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Spatial Scale and Aggregation Level Considerations for Forest Resource Impact Evaluation in the Context of Sustainable Forest Management

Vassiliki Kazana[1] and Angelos Kazaklis[2]

[1]Department of Forestry, Technological Education Institute of Kavala, Drama, Greece
[2] Centre for Integrated Environmental Management, Kalamaria, Thessaloniki, Greece

Abstract

Criteria and indicators have often been developed as tools to promote sustainable forest management and as a basis for monitoring and reporting. However, these criteria and indicators are not suitable for use by forest planners and managers or other interested stakeholders to assess forest resource impacts. This is mainly because they lack integration in terms of different spatial scales and different levels of aggregation/detail. This paper discusses the role of the spatial scale and aggregation level within the MEDMONT integrated project evaluation framework with reference to its forest resource evaluation base.

Keywords: expert opinion, spatial entity, Borda score

1. Introduction

Much effort has been devoted since the declaration of the Forest Principles at the Rio Conference in 1992 to developing tools, particularly in the form of criteria and indicators to assess sustainability of forest management.

Among the first attempts to define criteria and indicators for the measurement of sustainable forest management was that of the International Tropical Timber Organization in 1992 for natural tropical forests. The Smartwood Programme in 1993 followed by establishing generic guidelines to assess sustainability and impacts of logging operations applying to be certified by Smartwood.

At about the same time several other regional country groups also worked to establish and in some cases test criteria and indicators to suit their own conditions. The Soil Association

Marketing Company Ltd – Responsible Forestry Programme in 1994, the Amazon Cooperation Treaty in 1995, the Scientific Certification Systems in 1995 and the African Timber Organization a little later in 1996 are some of those aiming mainly at timber certification and labelling with respect to tropical forests.

For boreal and temperate forests a broad consensus on principles, guidelines, criteria and indicators for sustainable forest management (SFM) was achieved at the Ministerial Conference on the Protection of Forests in Europe (MCPFE) held at Helsinki in 1994, which thirty-eight European countries signed. The work of the Dutch Working Group of Experts in 1994 for evaluating sustainable forest management was on the same lines as the MCPFE. Twelve non-European countries including Canada and USA were involved in developing criteria and indicators for conservation and sustainable management of temperate and boreal forests, which were approved through what is known as "the Montreal process". Later efforts involved the Principles and Criteria for Forest Management by the Forest Stewardship Council A.C. in 1996 and the CIFOR's Criteria and Indicators for sustainable forest management published in 1998 by the Rural Development Forestry Network of the Overseas Development Institute.

Improved Pan-European Indicators for sustainable forest management were adopted by the MCPFE Expert level meeting in Vienna in October 2002 and signed in the Vienna Living Forest Summit Declaration at the Fourth Ministerial Conference on the Protection of Forests in Europe a year later in 2003. Finally, indicators of interest to sustainable forest management are included in the recently published European Environment Agency (EEA) core set of indicators (EEA 2005).

All these reported sets of indicators have been established with the aim of serving as tools to promote SFM and as a basis for monitoring and reporting. However, they can hardly be used as tools for operational purposes by forest planners, managers and other interested stakeholders to assess impacts on forest resources within the context of sustainable forest management. The following reasons, some of which have also been to some extent pointed out by other researchers in the field (Lammerts van Bueren and Blom 1997; Lautenschlager 2000; Mendoza and Prabhu 2000) account for this.

- These criteria and indicators do not form part of an integrated evaluation framework and are therefore not suitable for use at different spatial scales and different levels of aggregation (detail) by forest planners and managers or other interested stakeholders.
- Forests are not treated functionally as an integral part of the landscape.
- There is a lack of understanding with regard to linkages of indicators with different spatial scales and different levels of detail or aggregation.
- There are no clearly established links between the aggregation scales and decision-making operational levels.
- Indicators are not spatially referenced and spatial indicator model ratings are completely lacking, so in many decision-making environments detailed and costly quantitative measurements have to be made, which are not always justified.
- There is no spatial relatively rated natural evaluation base, which the users can base their evaluation process on.
- There is no appropriately established expert opinion approach, including use of local expertise, to modify indicator ratings, whenever there are important impact processes of concern at local level.
- They have not been constructed through a systems approach and therefore, any new indicator models are difficult to add in.

These issues were successfully faced through the MEDMONT integrated project impact evaluation framework within the context of sustainable development of Mediterranean mountain areas. The MEDMONT framework is briefly presented and discussed in the following section.

2. The MEDMONT evaluation framework

The MEDMONT evaluation framework is a methodological integrated framework and tools (indicators) for project (investment) evaluation complying with sustainable development of the Mediterranean mountain areas. The methodological framework involves:

- A natural resource base and capability evaluation for forestry, agriculture, grazing, wildlife, recreation and water/soil
- A socio-economic evaluation
- An institutional evaluation
- A green accounting evaluation
- A social preference evaluation
- An integrated evaluation based on Multiple Criteria Analysis

The MEDMONT evaluation framework and tools were developed through an EU DG-Research funded project within the 5th Framework – Quality of Life and Management of Living Resources and is based on data collection and analysis from case studies located in five European Mediterranean countries, which were also involved in the project, namely, Greece, Italy, France, Spain and Slovenia.

The MEDMONT project evaluation framework interrelates the target groups with the project evaluation and monitoring processes and tools by integrating three dimensions: spatial scale, level of aggregation (or level of detail) and method of approach (top-down and bottom up). It is thus possible to fulfil the following features: i) be consistent with sustainable mountain development, ii) be uniformly applied to all levels of decision-making, iii) be applicable to a wide variety of project (investment) categories and iv) incorporate local actors in the evaluation process.

With regard to spatial scale the MEDMONT analysis for development of indicators is based on the concept of spatial entities, i.e. spatial units meaningful for development and management analyses. These entities are formed to reflect the dynamic relationship between the spatial patterns of natural resources and the socioeconomic spatial activity patterns for any given geographical location. These generally exhibit homogenous human impact history and present similar development opportunities and/or restrictions and also respond in similar ways to development changes. MEDMONT applies a four level hierarchical spatial system, the landscape region, landscape system, landscape type and ecotope, and at this stage of development it addresses three of these levels, landscape system, landscape type and ecotope. The landscape system type involves minimum mapping units 1–5 km^2 and a pattern of ecosystems and physiography. The landscape type involves land use/cover as major defining parameter and minimum mapping units of 200 m^2, while ecotopes are recognizable subunits of an ecosystem type with minimum mapping units of some m^2 (Kazaklis and Karteris 1993).

The level of aggregation (or level of detail) in MEDMONT is expressed in the form of a hierarchy of processes and a measure of process aggregation. At this stage of development MEDMONT addresses two levels of aggregation (or detail).

Two types of meaningful for development analyses spatial entities are identified and mapped with GIS technology: generic (landscape system, landscape type, ecotope) and specific. The generic landscape systems and types, which are identified for the entire European Mediterranean mountain region, are used to construct natural resource evaluation models (natural resource suitability models) through expert opinion modelling (Kazaklis and Kazana 2004). The specific spatial development entities are based on the generic spatial entities and their interaction with any spatially referenced indicator and these can finally take the form of thematic maps.

In terms of the natural resource indicators two approaches are adopted. The first corresponding to high level of detail (or low level of aggregation), landscape type and ecotope spatial scales and the bottom-up method of approach is based on field sampling and spatial data collection procedures. At this stage of development it includes only wildlife suitability models and in particular habitat suitability models for woodpeckers, selected as ecological indicator species and habitat suitability models for the wild hare selected as management indicator species.

The second approach, corresponding to low level of detail (or high level of aggregation), landscape system and landscape type spatial scales and the top-down method of approach includes Natural Resource Evaluation Models (NREM) developed for forestry, agriculture, grazing, recreation, water/soil and wildlife, through expert opinion modelling. A specifically designed approach was used to elicit the expert opinion.

In terms of the institutional indicators, socio-economic, green accounting and social preference indicators, their development process is based on data collected and analyzed for real projects selected in each country study area and are also spatially referenced.

For integrated evaluation, MEDMONT includes a Multi-Criteria impact trade-off model based on fuzzy logic and Compromise Programming.

It becomes clear from this description that the MEDMONT framework is suitable for use in order to assess impacts from different activities on forest resources within the context of sustainable forest management, also distinguishing between spatial scales and aggregation levels. The concept of spatial entity is holistic and therefore includes forests and forest areas as constituent functional parts of the mountain landscapes. Forest resource capability and impact indicators including socio-economic, green accounting, institutional and social preference impact indicators for 20 landscape systems and 9 landscape types rated for combinations of all landscape types per landscape system are in ready-to-use form for the entire Mediterranean region. On-going research in Greece funded partly by the EU and partly by the Ministry of Education (EPEAK, ARCHIMEDES I) is focused on developing forest resource indicators at finer scales and aggregation levels.

3. Spatial and aggregation scale considerations in relation to forest resource impact evaluation indicators

Forest Resource Evaluation Models were produced as part of the Natural Resource Evaluation Models within the MEDMONT framework through expert opinion modelling, as described above. A specific approach was designed to elicit expert opinion.

At first, a monitoring group of four persons was formed all based in Greece (one country). A two-hierarchical level network was then established by assigning one coordinator per country participating in the model building process and a group of natural resource experts recruited from each member country of the MEDMONT project, one per resource (forestry, agriculture, grazing, recreation, wildlife, water/soil), thus giving six experts per country and 30 experts for the five countries involved in the process. The moderating team decided to use an iterative DELPHI like process to gradually construct the models.

A free-response questionnaire was prepared in Round I to capture the structure of the causal assertions of each expert with respect to the particular resource domain under concern and thus

Table 1. No. of indicators generated by the forestry expert panel- Round I, no spatial scale and aggregation level considerations.

	Expert academic ID	No. of forest resource impact indicators	Expert's field experience*	Expert's academic experience*
	1	60	VH	VH
	2	32	VH	VH
	3	29	H	M
	4	74	M	M
	5	19	VH	H
Total	5	214		

* L: Low, M: Medium, H: High, VH: Very High

generate indicators, which could follow from the structure of the questionnaire. The questionnaire was sent by e-mail to the country coordinators. Each country coordinator then had the responsibility to contact his/her country group of experts and communicate the questionnaire after translating it into the native language, as only some of the experts were English speaking. A strict 15-day period was decided as the period within which each country coordinator should obtain the completed questionnaires, translate them into English and e-mail them to the moderating team. During this period, there was an open line of communication for clarifications and advice on the procedure, while much emphasis was placed on the moderating team to secure free-wheel thinking through the Round I contact. No spatial scale, nor aggregation level considerations were imposed on the expert panel. Table 1 shows the number of indicators generated by the forestry expert panel, along with their field (extension services) and academic experience competence rated qualitatively based on their CVs.

The main search of the data processing of Round I was based on structuring cognitive maps of collectivities by comparing all the different indicators generated by the group of experts. This was obviously a rather difficult task, certainly requiring much experience from the monitoring team, as certain criteria were inferred to group the knowledge expressed in the questionnaires at different levels of aggregation (levels of detail). Two types of indicators, the Mediterranean forest resource suitability/capability indicators for products and services and the modifying factors, i.e., indicators which influence positively or negatively the forest resource suitability/capability indicators were identified by the monitoring team, when processing the total of 214 indicators provided by the experts. Furthermore, for each type of indicators two aggregation levels (levels of detail) were distinguished. Table 2 shows the total number of indicators for each forest indicator type and level of aggregation after processing the information derived from Round I.

Three more Rounds were carried out for the entire panel of natural resource experts, through a plenary session, following very shortly after the deadline placed on Round I. During all Rounds each expert was allowed to communicate with the members of the monitoring team, but not with the other members of the expert panel, in order to reduce any bias caused in eliciting each expert's knowledge.

In Round II, a questionnaire was prepared for the expert panel with the purpose of limiting the number of indicators and modifying factors. Experts were asked to rate the importance of the indicators by using an "overall importance" rating and a "relative" importance rating. The overall importance was assigned to each indicator and modifying factor on a 7-point scale, 1

Table 2. Number of indicators per type of indicator and level of aggregation – results from Round I, forestry expert panel.

Type of indicator	No. of indicators	Level of aggregation (or level of detail)
Forest Resource Suitability/Capability	15	1
Modifying factor	11	1
Forest Resource Suitability/Capability	27	2
Modifying factor	39	2

meaning "very little or not important" and 7 "very important". The relative importance of each indicator and modifying factor was assigned on a scale 1–100. Each expert assigned the value of 100 to the most important indicator and modifying factor and all the rest of the indicators and factors were assigned values relative to the most important one on a scale 1–100. Relative rating was performed for both levels of aggregation. The results of Round II, in terms of number of indicators per type of indicator are presented in Table 3. Only one aggregation level is included.

In Round III, experts were asked through a new questionnaire to again provide overall and relative ratings on the importance of the forest resource suitability/capability indicators and modifying factors processed from the responses of the Round II questionnaire. The purpose of the Round III questionnaire was to achieve consensus on the indicators and modifying factors and/or further limit their number by rating their importance. Table 4 shows the final number of indicators per type of indicator and level of aggregation.

To find the collective preference ordering of the indicators presented to each expert for evaluation in any subsequent round the TOPSIS approach was used (Hwang and Lin 1987). This approach involves four distinct steps:

a. Determining the ideal and negative-ideal ratings. These are interpreted in terms of suitability ratings.
b. Separation measures are then calculated from the ideal and negative-ideal ratings.
c. The relative closeness to the ideal rating is calculated.
d. The collective preference ordering for any indicator is ranked.

In Round IV, the forest resource suitability indicators resulting from the processed responses of the Round III questionnaires were spatially referenced at two spatial scales: landscape system and landscape type. Experts were asked to relatively value each of the 11 indicators for each landscape system and landscape type. Twenty landscape systems and nine landscape types were used, which had been previously identified and mapped through a variety of case study areas in the five Mediterranean countries involved in MEDMONT. The collective ratings in the final evaluation models are based on the Borda criterion score.

The possible value range for the final Borda criterion scores are from 0 to 20 (20 representing the highest possible suitability/capability/impact possibility). The Borda scores represent the relative capability/suitability of a spatial entity characterized by a particular landscape type/system combination, to sustain a relative level of any of the selected indicators for a particular resource. It can also be assumed to represent the importance of possible

Table 3. Number of indicators per type of indicator and level of aggregation – results from Round II, forestry expert panel.

Type of indicator	No. of indicators	Level of aggregation (or level of detail)
Forest Resource Suitability/Capability	15	1
Modifying factor	16	1

Table 4. Number of indicators per type of indicator and level of aggregation – results from Round III, forestry expert panel.

Type of indicator	No. of indicators	Level of aggregation (or level of detail)
Forest Resource Suitability/Capability	11	1
Modifying factor	16	1

negative or positive impacts for a particular resource/indicator/spatial entity combination from the construction, and/or operation stage of a project under evaluation. The underlying assumption is that for any given indicator in a relatively more suitable area, the same project will produce more significant impacts than in a less suitable area.

The methodological process of Round IV was also used to spatially relate socio-economic, institutional, green accounting and social preference project impact indicators with regard to forest resources. These indicators were derived through statistical analysis of data based on real projects selected from the Mediterranean country case study areas involved in MEDMONT.

4. Discussion

In Round I, a serious concern of the moderating team was related to the different levels of individual expertise of the expert panel members. This concern however was nullified, when the responses of the Round I questionnaire were received, as is shown in Table 1.

Processing of the Round I questionnaire responses was a very challenging task for the moderators as the aggregation (detail) level was not consistent in all the experts' responses, and this was the main reason for the wide range of responses. Spatial scale differentiation was also either non-existent or not referenced properly. Some experts attempted to produce a form of indicator or modifying factor independence hierarchy, but this was not consistent.

These results were as expected, and are the issues that NREM attempts to ameliorate. Each successive Round introduced a higher aggregation level in a hierarchical structure of the submitted indicators. After Round II, it is worth noting that a pattern emerged, which was similar for all six natural resources under investigation in MEDMONT. This was an unexpected result, and illustrates the robustness of the approach for this level of aggregation, as well as the importance of establishing some order of aggregation level or spatial scale hierarchy in any forest list as well as all the other natural resource impact indicators.

The Round II and III questionnaires processing was successful in reducing the rather large number of indicators and modifying factors produced from Round I. The number of indicators/modifying factors was very significantly reduced after the Round II processing, but Round III only justified the removal of a few indicators/modifying factors (Tables 2, 3 and 4).

Rounds I, II and III of the NREM development process were designed to produce two aggregation/detail levels. The selected indicators were intended to represent one level, while the modifying factors that could apply to and modify any of the selected indicators were intended as the second of intrinsically higher detail level, i.e., lower level of aggregation. The results from Rounds I, II and III nevertheless introduce at least one more level of aggregation/ detail. The highest level of aggregation or the lowest level of detail is represented by the Round III results (or equally likely the Round II results). However, the Round I results, as processed by the moderating team, represent another level of aggregation/detail concerning the evaluation indicators. This list is included as part of NREM, to be used in the initial consultation phase of the Medmont framework, in order to assist with the planning requirements of a particular project or activity within the context of sustainable development and management of mountain areas, which to a great extent consist of forest lands.

The NREM user is provided with a list of indicators and modifying factors to assist in his process of identifying possible impacts at a finer level of detail than the indicators/factors of Round III. This procedure can be used as a first step in aiding with the selection of appropriate indicators from Round III. Or, it may be used to select other more detailed indicators than those of Round III, if the user assesses that the considered project or activity has impacts at such a detail/ aggregation level as to demand the use of at least some indicators from a finer level of detail/ aggregation.

NREM was designed to provide relative impact spatially referenced ratings only for the indicators of Round III. To select other than those indicators the user must provide new spatially referenced ratings. These ratings will then have to be reviewed as to their degree of subjectivity, since they can simply be estimates provided by the user, or through a procedure similar to the NREM model structuring process.

It is possible that a user may be required to select indicators at an even finer level of detail than that identified in Round I. Indeed, some of the NREM expert panel members, as shown in Table 1 for the forestry panel, provided long and detailed lists of indicators. In this case, the NREM is used outside the scope it was designed for, and the user should provide all the necessary arguments to support his choice of indicators/modifying factors, as well as the direction and severity of expected impacts in a hierarchical and spatially referenced manner. In such a case, the Rounds I and IV indicators should at least provide helpful guidance.

Interdependence of selected indicators and modifying factors was a target of the selection procedure in all three rounds. The likelihood of intercollinearity between selected indicators factors diminishes with successive rounds, so the Round III indicators should represent the least intercorrelated list. The use of two rating criteria, an absolute and a relative importance criterion were selected to this effect.

The robustness of the procedure for obtaining, processing and integrating the opinion of the participating experts, and it is believed to be so, is that by using the NREM lists for indicator selection, a user is guided towards much less subjective choices. This is evident, if one compares the variability of responses in Round I, as it pertains to the number of indicators/ modifying factors proposed by each of the experts, but also, and more importantly perhaps, as it pertains to their relative importance, possible intercollinearity, aggregation degree and spatial scale reference.

It is possible however, that a certain project or activity within the context of sustainable forest management manifests significant impacts at a finer (higher aggregation) scale than the landscape type, (i.e. at the ecotope level). The user is therefore given the option to produce more detailed maps for the specific project or activity and use any available method to produce relative ratings for the ecotope level spatial entities, based on the NREM ratings for the landscape type(s) that have to be subdivided into ecotopes. The NREM user's guide provides details as to how the impact evaluation process can proceed.

The modifying factors can be used to change the NREM final Borda suitability/ capability possible impact scores at a lower aggregation spatial scale, and so affect larger areas, i.e., at the Landscape System or even Landscape Region level. The modifying factors may also manifest their influence at a finer spatial scale, and their impact can be very localized and important in some cases. The NREM user should therefore always take them into account.

Further development could be attempted in two directions. Since some suitability/ capability models exhibit different local behaviour, NREM should be modified by a group of local experts to better describe the local conditions. Alternatively, spatially referenced ratings need to be generated for indicators at all aggregation levels.

The attempt to develop a similar spatially referenced model at the ecotope level, is perhaps counterintuitive, because of the possibly very large number of generic ecotopes existing in any landscape system. If needed, such models should be formed on a specific project basis.

5. Conclusions

Through the MEDMONT integrated evaluation framework for sustainable development and management of mountain areas, forest and natural resource stakeholders/decision makers can be guided in their project or activity evaluation efforts with the selection of appropriate indicators through three aggregation levels of indicator lists. They can also be helped by using for the selected indicators ratings spatially referenced to spatial entities on two scales. These spatial entities are relatively straightforward to identify and map for any selected project or activity evaluation effort, based on basic landscape ecology principles.

The NREM indicator models of the MEDMONT framework are not intended to replace detailed statistical or mathematical suitability/capability models, which may provide more precise and detailed impact estimations. However, their use can be justified in terms of cost and time in the specific decision-making environment, where a project or activity is being evaluated.

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Part 4 – The Market for Wood Products

Is There Enough Wood for the Age of Renewable Resources? – Methods to Document Wood Volumes and Trade Flows

Udo Mantau

Dept. of Wood Science, University of Hamburg, Germany

Abstract

New demands for energy uses have rapidly changed the structure of the wood market in recent years. Since 1999 the section of economics of forest products at the University of Hamburg has carried out different studies for the determination of sales potentials on a regional level. At the beginning single markets were analyzed. In the meanwhile, the research concentrates more on the connections of markets. Thereby chances and risks of the resource situation become clear for the forest products industry as well as for political decision makers. Every market is local. For this the locations of branches of the forest products industry were respectively examined. By means of the obtained data it is now possible to carry out a balance sheet or a regional analysis for wood raw material as well as national resource balance sheets or resource flow analysis.

Keywords: renewable resources, methods of site analysis, resource balance sheets, trade flows, carbon dioxide storage

1. Introduction

In 1999, a press release stated that two million cubic metres of post-consumer wood was exported from Germany to Italy and to be re-exported as panels. At the same time, the renewable energy sources act (Erneuerbare-Energien-Gesetz; EEG), which became effective in 2000, was heavily discussed. In the EEG, a minimum compensation was fixed for the production of electricity from renewable primary products and thus also from biomass. This minimum compensation exceeded market prices and gave investors a long-term perspective and highly intensified the demand on wood resources.

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The German lumber industry feared heavy changes in raw material flows. First a study of the gigantic exports of post-consumer wood to Italy was launched. In cooperation with Davide Pettenella from Italy, we found out that the Italian panel industry could not process so much post consumer wood, and the actual exports added up to little more than 500 000 m³.

This was the starting point of a research project on wood based resources which is now a constant monitoring activity in Germany and is the methodological basis for an EU-project on biomass potentials and flows. It is financed by the German Timber Council (Holzabsatzfonds, HAF) and the Association of the Paper Industry (VDP). Three times a year the project plans and progress is discussed in the working group "Sawmill By-Products" which includes sawmills and the paper industry. The working group functions as the project advisory board. This is a very effective co-operation between research and industry.

2. Relevant sectors of wood biomass

The analyses of sources and uses of wood biomass should be done in separate segments, because each segment has its own specific market and industrial structure and therefore its own way of analysing biomass quantities. The following segments have proven relevant and specific.

A. Sources
1. Cutting of logs and pulpwood
2. Other cuttings
3. Potential of forest biomass
4. International trade of raw wood
5. Wood processing residues – sawn by-products
6. Wood processing residues – industrial rest wood
7. Bark
8. Post-consumer wood
9. Landscape care wood
10. Energy plantations

B. Uses
- Chemical and mechanical pulp industry
- Panel board industry
- Saw mill industry
- Other material uses
- Biomass Power and Heating Plants (> 1MW)
- Biomass Power and Heating Plants (<1 MW)
- Energy wood in private households

Forestry (A. 1–3) should be divided in these three sectors because of data availability. Cuttings of logs and pulpwood are in general recorded by cutting statistics or by the amount used in industries. "Other cutting" is normally not included in statistics because a lot of it happens in private agricultural households and other activities. However, it has nothing to do with illegal cuttings. It is just more complicated to quantify. Finally, the growing stock is important information for any potential uses.

Wood processing residues should be separated into sawn by-products and industrial rest wood because of their different composition and quality and because of the different way of analysing these sectors. A forester may argue that bark is not wood. However, it is so clearly linked to production and use of wood that its inclusion is quite obvious in this context.

More or less new markets of wood based resources are post-consumer wood and landscape care wood. Energy plantations have not been included so far in our considerations but will be in the next actualisations.

On the side of uses we have the traditional wood industries and a summary of markets with minor quantities in the sector of “Other material uses” (Veneer, plywood). For the purpose of quantifying the energy uses, it is fruitful to separate the energy use into three segments. Biomass Power and Heating Plants are in general segmented in those with more than one megawatt and those with less than one megawatt. The first category produces, aside from heat, a large proportion of energy while the purpose of the second category is mainly heat. In Germany air pollution laws are linked to these sizes as well. The new bigger plants built after the renewable energy act were between 5 and 20 megawatts. Finally the big plants, about 350 in Germany can be recorded by location while the smaller ones can only be analysed by estimation or modelling. One of the big surprises in the project was the huge amount of energy wood used in households which are definitely a separate category. We analysed them by a mail panel of 10,000 households and a projection on the known universe population.

3. Methods of data collection (Weimar and Mantau 2004) – Approaching the unknown universe

A general problem of analysing new markets is the lack of available data. On the other hand the focus of the project was always on a regional level. To be able to display the results at a regional level, it was necessary to carry out a location-oriented data survey. In turn, this required the observation of the parent population for the examined industry branches.

If the parent population is not known, the best sample cannot give any answers on market volumes and potentials. Mantau developed a data collection method which is suitable to solve this problem for industrial branches. It can be subdivided into seven fundamental methodical steps:

1. Enquiry of all addresses and address sources
2. Consolidation of the address/data stock
3. Development of a questionnaire as a location survey
4. Field work with mail questionnaire with only basic information
5. Telephone after and full survey of all those addresses not reached
6. Detailed questionnaire after the parent population is evaluated
7. Projection from the partial return sample on the parent population

With these steps it should basically be possible to be able to state the parent population of a business branch. In the course of the examination for a single branch, variations or redundancies can arise. During the processing steps new information will almost certainly appear, which requires the completed processing steps to be repeated (e.g. new address sources). In the following section the course of the surveys will be displayed in more detail for the individual branches of industry.

After recording the parent population there are different possibilities to deepen the analysis by further surveys, e.g. by means of interviews. Whether one decides in favour of a sample examination or a full survey depends on to what extent the examination can or must be carried out. The following section also explains which method of extended data-collection was used for which business branch.

4. Execution of the evaluations

A "recording of regional capacity aims at a full survey of the parent population. In this lies the attraction as well as the difficulty." To be able to solve recording problems of this kind, a high degree of systematics and recording logistics is prerequisite. In highly concentrated business branches such as the chemical and mechanical pulp industry and the panel board industry, full surveys are a realistic goal.

Gaps in the data collection can be filled by enquiries. However, unlike these two business branches, the saw mill industry, the post-consumer wood industry (disposal industry) and the biomass power and heating plants industry are characterized by numerous enterprises of different sizes.

As a first step the enquiry of all addresses and address sources is always done. This should be at a wide scale in the first stage. Thereby the probability of not including important address sources can be reduced. First contact persons for enquiries are associations, representations of interests or other forms of associations of the investigated business branches. To some extent further sources can be found by means of governmental institutions. Databases of commercial address suppliers can also be consulted. Important resources can be e.g. the "yellow pages" or reference lists of companies which do trade with the questioned business branches.

Since the basis for the success of the full survey is set in this first step, the pre-considerations for the enquiry should be as broad as possible. The principle "better to include an address too many than to delete a relevant one" is valid here.

As mentioned already, it takes less effort to carry out a full survey for highly concentrated business branches, since the locations of the business branches are already partly described in the literature or other sources. For industrial branches with multi locations there are usually no complete sources available. The addresses must therefore be brought together from different sources. It is recommended to always implement the source of an address in the data. This makes a future check of the addresses much easier. Additionally it is possible to deal with the address sources with different priorities during the consolidation.

Problems during the collection of a first address stock can appear if cooperation with the associations or common interest groups of the business branches cannot be agreed on. This is definitely relevant if e.g. association interests collide with those of the survey or the political orientation is contrary to it.

As the second step, the address material is consolidated after completion of the first recording process. This primarily serves the purpose of identifying address doubles. Companies no longer working, but which are included in the address stock cannot be filtered at this time. The balancing of the address doubles could not be done with a standardized program due to the complexity of the address information (e.g. office address – business address; differences in company name, if e.g. the owner has changed, small mistake in the spelling) there was the danger of receiving a wrong solution. The investigated address files therefore had to be checked manually.

As could be seen during the evaluations of the questionnaires, that even with intensive checks before sending out the first written questionnaire it was not possible to sort out all doubles or faulty addresses. The development of a branch-specific questionnaire was carried out parallel to the first two steps. The decisive criterion of the examinations was reaching all enterprises. The questionnaire was therefore reduced to the necessary, not to exceed the size of an A4 page. Part of it was to firstly identify the status of the address (meaning that whether the address was operating as part of the business or not or whether the business had been shut down in the meantime). The address details were updated at the same time.

Furthermore, with the help of the questionnaire location-specific characteristics concerning the raw material wood were to be investigated. The procedure for this step was quite different for the individual branches of industry. For the saw mill industry the main emphasis was put on recording the volume of sawn softwood and hardwood. Further data on the production and sales of sawmill by-products was collected. Besides the capacity and production of the plant, the panel board industry and the chemical and mechanical pulp industries were asked about the amount of wood raw materials processed and the segmentation of the different assortments.

Since these two lines of business are quite easily comprehensible, this questionnaire was designed to contain more detail. The questionnaire for determining the quantity of post-consumer wood emerging in the disposal industry also contained detailed questions on marketing structure. The questionnaire, however, was bipartite. The first part for recording the status and the recorded amount of post-consumer wood was obligatory. The second section on the regulation of the marketing structure of the post-consumer wood was described as being an optional part, thus meaning that the questioned persons could choose whether they answered only the first or also the second part. By this at least the collection of the basic data was guaranteed. The more sensitive data were voluntary, to not deter any participant from the start.

The first questionnaire for biomass use in energy plants referred to the essential characteristics, the observation of the status and the biomass need, as had the one for the sawmill industry. Unusual for this survey was the placing of two addresses at the top of the questionnaire. This was necessary since the operator of an energy plant often had no office at the location of the plant. Furthermore many plants were under construction or still at the planning stage and therefore had to be addressed by way of the plant operator or planner.

The survey for investigating individual business branches was conducted with written questionnaires, sent out by mail. A letter was enclosed with every questionnaire, explaining the background and reason for the interview. The letter also expressed the importance of answering the questionnaire. To increase the returns of completed questionnaires, a reminder was sent out after about 4-8 weeks (e.g. depending on the progress of returning questionnaires and the date of dispatch e.g. a longer waiting time is necessary during vacations) to addresses which had still not answered. A free report on the investigation was also offered to be sent to the answering companies, to increase the readiness to participate in the interview.

The recording quota for the first interviews usually ranged between 40% and 80%, depending on the business branch. This does not only include participants of the branches to be examined, though. Since the choice of address sources was very broad, the share of locations which were not part of the relevant economic sectors was relatively high during this first evaluation.

To bring the full survey to a conclusion, it was necessary to identify the addresses for which no information was available even after the evaluation of the returned questionnaires. Therefore a telephone follow-up was done in order to collect the missing data. For this a special, somewhat shorter, questionnaire was developed. Besides the status only one other value referring to the raw material should be investigated, which is particularly suitable for later projections. For the sawmill industry the volume of sawn wood, for the disposal enterprises the amount of recorded post-consumer wood were included. For the energy plants, at first only the status was recorded.

During the telephone interview it was not possible to receive further details besides the observation of the status for all enterprises. The denial of a further-reaching answer was justified by lack of time, by the prohibition on handing out internal data or by lack of interest. it should also be mentioned, however, that the project could only be carried through in this form with the cooperation of the outstanding majority of enterprises.

5. Example of industry survey – Sawmill Industry (Weimar and Mantau 2004)

A good example of the-above mentioned method are our studies on the sawmill industry. A survey of the sawmill industry was done in 2003, which aimed to include the current amount of sawn round wood as well as the production of sawn wood and sawmill by-products. A first full survey of all German sawmills was already completed in 2001. 3,038 sawmills were identified. The new interviews were done based on this examination.

925 questionnaires were evaluated in 2003. The recording degree of 28% was in the expected area of a written questionnaire. Consequently, the results from the interview were completed with data from official statistics. By combining these two databases, a broad overview of sawn wood production, as well as the amount of sawmill by-products produced and its current marketing structure was guaranteed. The following table shows the amount of sawn round wood and the amount of sawmill by-products in size-classes.

Structural differences in production methods become clear in this table. The yield on sawn wood is considerably higher in smaller sawmills than in the larger ones. The main quantities of the total of approx. 11.2 mill. m³ sawmill by-products are produced in the large sawmills. This strong concentration of the branch is also an important aspect for the marketing structure for sawmill by-products.

Table 1. Sawmill industry by-products.

Size Class by	Cut		Share	Saw Mill Residues	
Annual Cut [m³]	[1,000 m³]	[%]	[%]	[1,000 m³]	[%]
< 1,000	389	1.3	26.5	103	0.9
1,000-2,499	1,141	3.8	29.4	335	3.0
2,500-4,999	821	2.7	29.8	245	2.2
5,000-9,999	2,234	7.5	29.9	668	5.9
10,000-19,999	1,844	6.2	31.9	588	5.2
20,000-49,999	2,533	8.5	34.5	874	7.8
50,000-99,999	3,155	10.5	37.0	1,168	10.4
100,000-499,999	9,918	33.1	43.0	4,266	37.9
>= 500,000	7,893	26.4	38.1	3,005	26.7
Sum	29,928	100.0	37.6	11,253	100.0

Examination of the sales and utilization structure showed that the main customer of sawmill by-products is trade (32%). Significant quantities also flow into the panel board industry (27.1%) and the mechanical and chemical pulp industry (18%). Sales to other buyers were remarkably high (17.9%). At 2.7%, the energy enterprises only take a quite small amount of sawmill by-products directly. Adding the amount of pellet production (1.5%) to this, about 5% flows into the generation of energy. However, it can be assumed that the final distribution to energy plants is much higher, since trade as the largest buyer may be in a better position to fulfil the needs of the energy industry.

6. Balancing the wood biomass

Each single wood resource is subdivided into use areas. First the domestic availability is determined. The domestic supply is extended by imports and reduced by exports. Inventory modifications also affect the domestic availability. Unfortunately, only a few data are available on stock levels. The amount of the domestically available wood raw materials is finally assigned to the use sectors. The information on this is picked up in the interviews. For this purpose the distribution structure and/or procurement structure is asked in the questionnaire. The following figure shows the results for sawmill by-products. Similarly to the sawmills all other sectors are analyzed and quantified by product sector. All sectors can lastly be summarized in a matrix of resource flows.

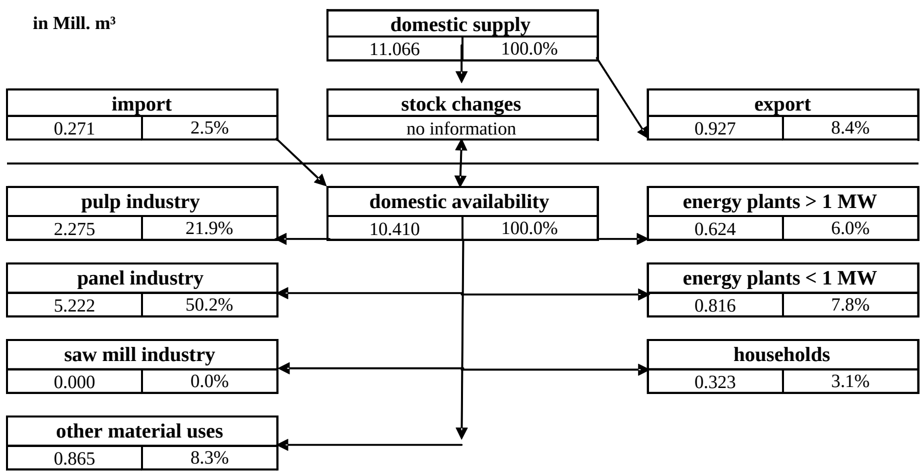

Figure 1. Flow chart of sawmill by-products in mill. m³ (2002).

To receive correct answers it is important to question people in the measurement units corresponding to those used in their daily business life. Post-Consumer wood is measured in t atro (air dry) while logs are measured in m³. A corresponding conversion matrix has to be built to change different measurement dimensions into one comparable measurement unit for drawing up a balance sheet. In case of the wood resource balance this was tons (absolute dry) and m³.

Table 3 includes the conversion factors for absolute dry tons (t atro) and m³. These are the most common measuring units for comparisons of volumes and masses.

The resource matrix in Table 4 is converted in cubic metres. Sums can be calculated after conversion. The sums of lines and columns are taken to build a summary balance.

The wood resource balance summarizes the most important results of different studies and thereby provides a good overview on the actual sources and uses.

For decisions on political means as well as for entrepreneurial investments the question on potential reserves is of high value. No forecasting has been done in the project so far because the main problem in many areas was to quantify the volumes. Furthermore, no time series are available in many sectors. To gain some basic information on the resource situation the

Table 2. Sources and uses of wood resources in different measurements (2002).

Uses		domest.	material uses				energy uses		
Wooden resources	unit	availa-	pulp	panels	saw m.	other	>1MW	<1MW	househ.
Sources	in Mio.	bility							
logs	Fm	30.3	0.0	0.0	29.9	0.4	0.0	0.0	0.0
Industrial wood	Fm	17.2	4.1	7.2	0.0	0.3	0.2	0.0	5.4
forest rest wood	Fm	7.6	0.0	0.0	0.0	0.0	0.4	1.9	5.4
sawmill by products	Fm	10.4	2.3	5.5	0.0	0.9	0.6	0.8	0.3
bark	SRm	6.7	0.0	0.0	0.0	3.6	3.1	0.0	0.0
other industrial restwood	m³	3.4	0.0	1.8	0.0	0.0	1.4	0.2	0.0
post-consumer wood	t lutro	6.4	0.0	1.5	0.0	0.2	3.8	0.2	0.8
landscape care wood	t atro	0.3	0.0	0.0	0.0	0.0	0.2	0.1	0.0

Fm (Festmeter) = used in forestry – equivalent to m³; pulp = pulp industry; panel = panel industry; saw m. = sawmills; other = other material uses;
> 1 MW = power plants bigger 1 MW; < 1 MW = power plants smaller 1 MW; househ. = energy wood uses in households

Table 3. Conversion factors into t(atro) – absolute dry tons and m³.

Uses		conversion	conversion
Wooden resources	unit	factor	factor
Sources	in Mio.	in t(atro)	in m³
logs	Fm	0.48	1.00
Industrial wood	Fm	0.48	1.00
forest rest wood	Fm	0.48	1.00
sawmill by products	Fm	0.48	1.00
bark	SRm	0.20	0.33
other industrial restwood	m³	0.48	1.00
post-consumer wood	t lutro	0.75	1.55
landscape care wood	t atro	1.00	2.07

Table 4. Sources and uses of wood resources in million m³ (2002).

Uses		domest.	material uses				energy uses		
Wooden resources	unit	availa-	pulp	panels	saw m.	other	>1MW	<1MW	househ.
Sources	in Mio.	bility							
logs	m³	**30.3**	0.0	0.0	29.9	0.4	0.0	0.0	0.0
Industrial wood	m³	**17.2**	4.1	7.2	0.0	0.3	0.2	0.0	5.4
forest rest wood	m³	**7.6**	0.0	0.0	0.0	0.0	0.4	1.9	5.4
sawmill by products	m³	**10.4**	2.3	5.5	0.0	0.9	0.6	0.8	0.3
bark	m³	**2.2**	0.0	0.0	0.0	1.2	1.0	0.0	0.0
other industrial restwood	m³	**3.4**	0.0	1.8	0.0	0.0	1.4	0.2	0.0
post-consumer wood	m³	**10.0**	0.0	2.3	0.0	0.2	5.9	0.3	1.3
landscape care wood	m³	**0.6**	0.0	0.0	0.0	0.0	0.3	0.3	0.0
total		**81.7**	**6.4**	**16.8**	**29.9**	**3.0**	**9.8**	**3.4**	**12.3**

available data on inventories and investment plans were used to make an expert estimate on potential reserves. However, Table 6 includes a broad basis of empirical data. Inventories have been actualized in the “Bundeswaldinventur” for the year 2002. In many questionnaires the interviewees were asked on their future investment plans. In other areas, like post-

Table 5. Sources and uses of wood resources in million m³ (2002).

Wooden resource balance in Mio. m³

sources	Mio. m³	in %	**uses**	Mio. m³	in %
logs	30.3	37.1	pulp industry	6.4	7.8
Industrial wood	17.2	21.0	panel industry	16.8	20.6
forest rest wood	7.6	9.3	saw mills	29.9	36.6
sawmill by products	10.4	12.7	other material uses	3.0	3.7
bark	2.2	2.7	energy plants > 1 MW	9.8	12.0
other industrial restwood	3.4	4.2	energy plants < 1 MW	3.4	4.2
post-consumer wood	10.0	12.2	energy use in housholds	12.3	15.1
landscape care wood	0.6	0.7			0.0
total	**81.7**	**100,0**	**total**	**81.7**	**100.0**

Table 6. Sources, uses and potential of wood resources in million m³ (2002).

Wooden resource balance and potential reserve in Mio. m³

sources	**actual**	**poten-tial *)**	**reser-ve**	**uses**	**actual**	**poten-tial *)**	**future needs**
logs	30.3	70.3	22.8	pulp industry	6.4	8.9	2.5
Industrial wood	17.2			panel industry	16.8	17.0	0.2
forest rest wood	7.6	44.0	36.4	saw mills	29.9	33.1	3.2
sawmill by products	10.4	11.6	1.2	other material uses	3.0	4.7	1.7
bark	2.2	2.4	0.2	energy plants > 1 MW	9.8	13.7	3.9
other industrial restwood	3.4	4.8	1.4	energy plants < 1 MW	3.4	3.9	0.5
post-consumer wood	10.0	13.5	3.5	energy use in housholds	12.3	13.5	1.2
landscape care wood	0.6	1.4	0.8	***potential reserve**)***		***53.2***	
total	**81.7**	**148.0**	**66.3**	**total**	**81.7**	**148.0**	**13.1**

*) as far as information is available.

**) potential reserve = potenzial (148.0) - actual use (81.7) - future needs (13.1)

consumer wood and industrial rest wood the possible development scenarios are limited. Thus, Table 6 gives a good estimate on the wood resource situation in Germany.

It is quite obvious that the main reserves of wood biomass are in forests. All other sources reserves are marginal in comparison. Thus, almost the entire reserve of 66.3 mill. m³ is located in forests. However, this is a technical reserve of wood biomass. Under current circumstances it would not be possible to activate this potential. Technical, ecological, social and economic limitations reduce the feasible reserve:

- Natural: not all biomass can technically be harvested.
- Ecological: biomass can only be removed as long as forest nutrition isn’t harmed.
- Social: the owner structure and targets of owners, as well as their ability to set limits to the mobilization of the resource.
- Economic: at current prices it is not possible to remove most of the reserves.

However, even if it is possible to mobilize only one third of the reserve in the next years, all current investment plans and more can be realized. The wood resource balance is therefore a helpful instrument for politicians and entrepreneurs to make their decisions on the use of wood resources.

Table 7. Consumption of wooden goods in Germany by sectors and CO² relevance in mill. t lutro.

2002 in Mio. t lutro	Wooden goods total in Mio. t lutro	in %	from it: stored in use in Mio. t lutro	in %	from it: disposed in Mio. t lutro	in %
construction	10,235	100.0	6,880	67.2	3,355	32.8
furniture	6,473	100.0	4,298	66.4	2,175	33.6
packaging	3,145	100.0	0,578	18.4	2,567	81.6
others	0,880	100.0	0,163	18.6	0,717	81.4
Summe	20,733	100.0	11,919	57.5	8,814	42.5

7. Future developments

On the basis of the above research question a further step was undertaken in 2004. In co-operation with experts in the disposal market a study was carried out to determine the amount of wood stored in use. Thereby the relevance of wood products for CO² reduction could be quantified.

A total of 31.8 mill. m³ of finished wood products and 35.8 mill. m³ of semi-finished wood products are used in the sectors of construction (49.0%), furniture (32.0%), packaging (14.8%) and others (4.3%). The difference (4.0 mill.m³) corresponds to the arising industry rest wood at the finished product production. The share of the domestic production in finished products is 84.9%. 15.1% of the finished products is the consumption share by net imports. Net imports amount to 7.8 mill. m³ (r) in roundwood equivalents. For the question only the imported amount of wood is of interest because the saw by-products remain in circulation in the export country. This reduces the net import volume to 4.8 mill. m³.

The wood consumption of wood finished products (without industry rest wood) in the amount of 31.813 mill.m³ of wood volume corresponds to 20.733 mill. t lutro mass. 57.5% of all wood uses are stored in the form of wood products in use. 42.5% are disposed of.

The outstanding international reputation of our friend Maurizio Merlo should be an obligation for our work as well. Thus, I would finally like to raise the question about the international relevance of this work. The more we know about wooden products by quantity and by their role in the age of renewable resources as well as climatic change the better we can develop concepts and visions for wood. Wouldn’t it be interesting to know the worldwide wood resource quantities and uses in order to value their contribution to important economic and political issues? A world model on wood resources from the growing stock over the different stages of production, uses and disposal will develop the information basis that is needed to strengthen the economic and political role of forests and forest products.

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Biomass Energy Production Opportunities From Large Scale Disturbances in Western Canada

Brad Stennes, Alec McBeath and Bill Wilson
Natural Resources Canada, Canadian Forest Service, Victoria, BC, Canada

Abstract

A variety of economic and policy vehicles have been deployed in European and North American jurisdictions designed to facilitate investment in biomass energy production. This paper discusses a number of these vehicles and their impact on investment decisions. The biomass energy options of direct fired feedstock, co-firing of thermal energy production and fuel pellets are discussed in detail. The potential for carbon credits to encourage investment in biomass energy is examined. The context for much of the analysis presented is the large mountain pine beetle epidemic in British Columbia. This forest pest outbreak, which has spread through an area of almost 10 million hectares of mature pine forests, may be a leading indicator of the scale of future natural disturbances supported by a more benign climate.

This paper provides an economic perspective to the financial feasibility of biomass energy, an overview to a selection of public policy vehicles used to promote biomass energy production, and an examination of the economic potential for biomass energy to serve as option to capture value from the legacy of standing dead timber from a large mountain pine beetle epidemic in British Columbia. The paper concludes with a brief discussion on select barriers to biomass energy.

Keywords: bioenergy, biomass energy, mountain pine beetle

1. Introduction

The use of woody biomass for commercial energy production has considerable physical potential on a global scale – commercial is defined here as an industrial process converting wood to energy or heat. The key impediment to increased production has generally been economic, with the costs of gathering and centralizing feedstock being uncompetitive with comparable fossil fuel energy sources. Northern Europe, choosing to stimulate investment

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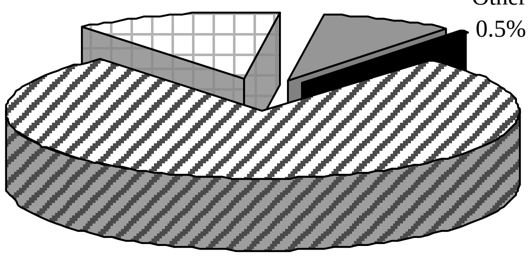

Figure 1. Total renewable energy capacity in Canada (2003) by resource type (percentage of total 93,000 MW). Source: Nyboer *et al.* (CCIEEDAC) 2004.

through a wide array of economic incentives, likely has the most advanced biomass energy production sector. Canada also has significant biomass energy capacity in place but the bulk is integrated within established forest products manufacturing – most notably for energy production in pulp mills and heat for dry kilns in sawmills.

The most important constraint to the economic feasibility in biomass energy production is the cost associated with the collection, handling, transportation and storage of feedstock. Variability in procurement costs between feedstock sourced from mill residues versus some form of market purchase contributes to a wide range in cost estimates. For many of the energy investments integrated with mills the opportunity cost of the feedstock is zero or even negative (benefit) as tipping fees (i.e., disposal) or treatment costs are avoided. The aggregate cost of collecting, treating and transporting feedstock for an independent energy production facility are generally prohibitive given the market price for energy.

Renewable energy capacity in Canada is 93,000 MW if large-scale or “conventional” hydro projects are included (Figure 1). In this definition, biomass energy comprises 8.5% of renewable energy in Canada (Nyboer et al. 2004). It is worth noting the small contribution of the ‘Other’ sources – wind, biogas, municipal solid waste, solar photovoltaics, tidal, solar, thermal, biodiesel, earth energy, geothermal and ethanol. Of the total biomass energy produced, most is produced by forest product companies for their own use – mostly as cogeneration in pulp mills. The feedstock is either in the form of residues (bark, shavings and sawdust) or black liquor, a by-product of the pulping process at kraft pulp mills.

2. Review of Feedstock Costs – Western US

There is an increased recognition in the western US, although not without opposition, that large areas of public forest are in need of hazardous fuels reduction to minimize the risk of wildfire (NFP 2001, etc.). This shift to so-called “proactive” wildfire management has led to numerous studies on options to utilize this often sub-commercial source of fibre, usually small diameter forest thinnings. This research provides useful information on examining certain alternatives is biomass energy production. The estimated biomass feedstock costs from a number of these studies are summarized in Table 1 (converted to Canadian $/Bone

Table 1. Biomass Feedstock Costs – Western US in 2002 $BDt^{-1}.

	Roadside			Delivered		
	Low	High	Mean	Low	High	Mean
Ince et al. (1984)	56.81	137.83	74.60	72.76	154.39	90.08
McNeil (2003)	39.45	65.39	55.95	-	-	-
Zachritz et al. (2000)	-	-	-	50.40	59.11	54.75
Whittier and Hease (1994)[a]	-	-	-	50.40	71.69	61.05
Lynch and Mackes (2002)[b]	93.59	145.76	119.68	-	-	-
Klepac and Rummer (2002)[b]	96.99	130.91	113.95	-	-	-

[a] As reported in Zachritz et al. (2000)
[b] As reported in McNeil Technologies (2003)

Dry tonne [$BDt^{-1}]). These estimates are generally provided as a range of costs, and estimate the roadside costs, the delivered costs or both. The distribution of costs and the average costs are provided in the table.

The cost estimates are the result of forest thinnings, with the exception of Ince et al. (1984), which examined the costs of salvage harvesting Lodgepole pine following a mountain pine beetle (MPB) outbreak**.** In order to equalize across the two types of costs $10 BDt^{-1} is added to the roadside cost for transport and the simple average across roadside and delivered costs in Table 1 is $87.60 BDt^{-1}.

3. The Mountain Pine Beetle Epidemic in British Columbia – Feedstock Potential

Early estimates of the potential impact on fibre supply (beetle killed timber) resulting from the MPB epidemic are approximately 500 million m^3 (mill. m^3) of timber killed in the short- to medium-term (BC Ministry of Forests 2004). In addition to large this volume, the outbreak is spread over a considerable area as illustrated in Figure 2. It is anticipated that existing processing mills will use much of this timber volume, but approximately 200 mill. m^3 of the total killed is expected to remain unsalvaged in the absence of creative (new) options to utilize this fibre. Although this indicates a large “potential” supply of feedstock for biomass energy, the question on the economics of investing in this potential remains to be tested. The supply potential of this feedstock will be defined by two economic margins – the intensive and extensive margins. Supply availability at the intensive margin is defined as that arising from more fully utilizing fibre on a given area of land (i.e., increase utilization). Supply availability arising from the extensive margin refers to expanding the area harvested. Most of the available “economic” supply of feedstock for energy is that available at the intensive margin, including post processing co-products (i.e., residuals), and low-valued timber within stands with a mix of higher quality stems not of sufficient grade to justify manufacturing activities. Supply arising from extending the extensive margin is still more financially challenging.

A further complication is that the longer beetle-killed timber remains standing, the less options are available for using the fibre. In other words, the decomposition of this dead

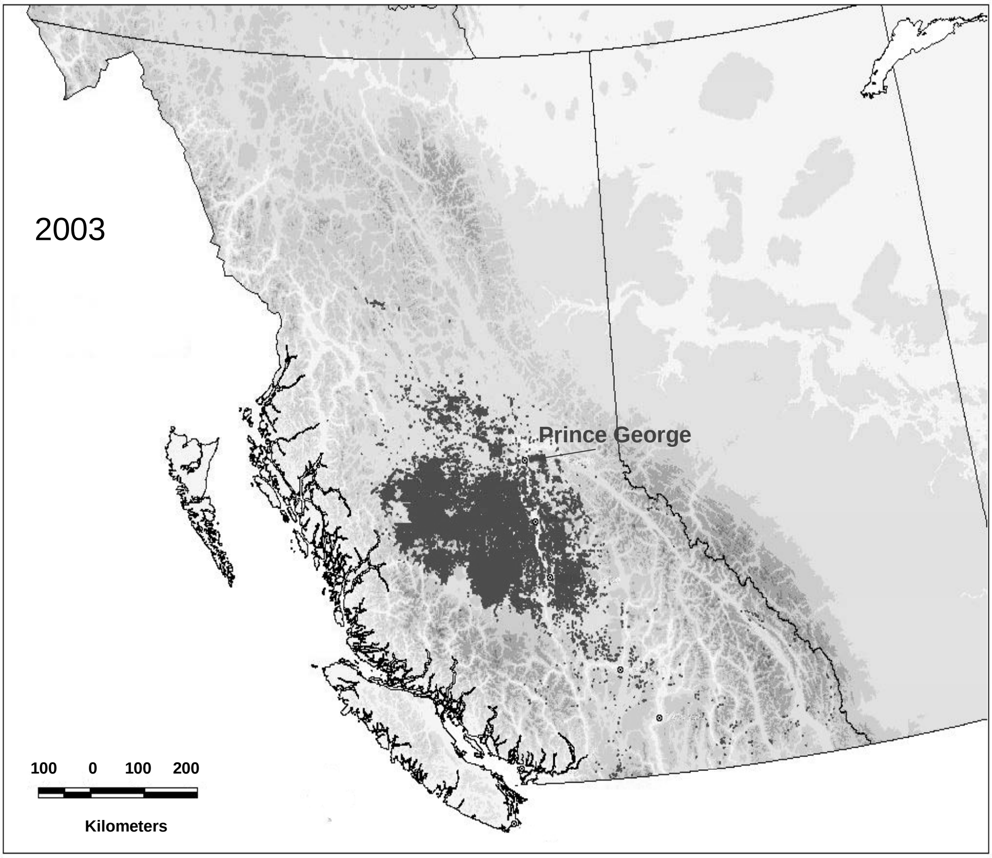

Figure 2. Area affected by MPB in British Columbia. Source: Natural Resources Canada/Canadian Forest Service.

timber renders it commercially useless after a period of time, even for energy production, the notion of 'shelf life'. Therefore, as stands are salvage harvested over time for processing into lumber or other traditional forest products, the supply of non-suitable timber per hectare will increase as higher proportions of trees within a stand degrade beyond merchantability.

In response to the shelf life constraint the allowable harvests on public lands in the most heavily impacted regions of BC have been increased with a focus on existing forest firms and "traditional" manufacturing activities. The harvest increase to date is 5.3 (mill. m^3) or 42% of the pre-outbreak base of 13.2 mill. m^3 (BC Ministry of Forests 2004(a)). There have also been increases outside this region. This up-lift volume is supplying a combination of increased capacity at existing sawmills (i.e., adding a third shift to mills) and increased capacity from a number of new investments. There are a number of constraints on how much additional commodity can be produced including the price impact on markets. The residuals associated with this manufacturing increase are the lowest cost fibre because they have already been transported to and concentrated at sawmill locations. At this point in time (2004) much of these residuals are in surplus, in fact, some are still burned in beehive burners, a cost with no associated benefit in terms of heat or energy produced.

It should be noted that increases in the supply of residuals are a temporary source of feedstock that is only available as long as the harvesting up-lifts remain. BC Ministry of

Table 2. Estimated Wood Pellet Production Costs - $Cdn.

Cost Category	$/tonne Pellets
Energy	14.94
Labour	8.16
R&M	4.61
Other	0.53
Carrying Costs	2.67
Total Variable Costs	30.91
Total Fixed (Capital) Costs	13.03
Pellet Costs pre Feedstock	43.94

Source: Hirsmark 2002, Converted to $Cdn at 2002 Exchange Rate.

Forests' projections forecast a reduction in timber supply after approximately 15 years from the onset of the MPB, with a total harvest reduction at approximately 14% below the pre-outbreak allowable harvests by the 2015–2017 period. This represents a harvest reduction of 7.1 mill. m^3 when compared to the supply levels prior to the beetle response up-lifts**.**

The financial feasibility of investing in biomass energy facilities is fundamentally challenged by both the lack of long-term feedstock supplies and a source of low-cost feedstock**.** This raises a series of questions. Are there opportunities to provide feedstock in this region past the anticipated time period when harvest reductions take hold? Assuming some of the beetle-killed timber is still harvestable, what is the cost of a long-term feedstock supply through dedicated harvest? What is the potential to provide post-MPB feedstock through aforestation of appropriate marginal lands in the region with fast-growth plantation fibre?

4. Options for energy from forest biomass

The next section examines the potential for converting mill residues into wood pellets. The is followed by a discussion of policy measures taken to promote biomass energy and a pair of case studies examining options to convert beetle salvage timber to biomass energy.

An alternative use of processing residuals, rather than direct energy production, is to create a value-added product such as wood pellets, or products based on other innovative conversion technologies such as enzymatic ethanol or bio-oil. There are a number of pellet production facilities currently operating in BC, making use of processing residuals, and the capacity is rapidly expanding with increased timber processing. A recent Swedish study (Hirsmark 2002) estimated the costs to produce pellets at a commercial scale (80,000 tonnes/ year) at about $44 per tonne (see Table 2). However, this estimate did not include any provision for the cost of the feedstock.

Feedstock supply resulting from direct harvest of MPB killed trees will be more costly than fibre from processing residuals. The early estimate of available feedstock in BC resulting from the MPB outbreak is at least 200 mill. m^3. Although harvesting for lumber production can provide sufficient financial returns to develop harvest areas, transport the fibre, reforest and pay economic rents, it is not the case with biomass feedstock. A simple example examining the costs to procure feedstock through direct harvest in the northern interior of BC is given in Table 3.

Table 3. Costs to harvest, haul and chip timber in Northern BC.

	Traditional Logging, Hauling then Chipping	Whole-Tree Chipping On Site
	$/BDt	
Logging Costs (Tree to Truck)[a]	40.71	33.73
Development Costs[b]	9.49	7.86
Overhead[c]	16.67	13.82
Basic Silviculture[c]	8.57	7.10
Total Log Costs Pre-Hauling	75.44	62.51
Hauling[a]	17.16	17.16
Chipping[d]	8.00	8.00
Total Delivered, Chipped Prices	100.60	87.67
Tree to Truck + Haul + Chip	65.87	58.89

Sources: [a] BC Ministry of Forests 2001
[b] Peter 2004
[c] BC Ministry of Forests 2004(b)
[d] McNeil (2003) converted to $Cdn.

It must be noted that the $101/tonne value estimated in Table 3 assumes all of the costs (including reforestation) to deliver and chip logs are accounted for in the biomass feedstock costs. The only cost not included is payments to the resource owner (i.e., stumpage to the provincial government). This omission reflects the lack of economic rents in the energy production example. A tonne of wood chips (dry) delivered to existing facilities can generate approximately 1,330 kWh of electricity (net), which means the imputed value of electricity in a BDt wood is $66/tonne, using a price of $0.05 kWh^{-1}. Prior to accounting for any of the capital or operating costs of a generating facility, the $101 estimated for the direct costs of providing the feedstock exceeds the value of the energy being produced which is $66/tonne of feedstock.

There is potential to reduce the feedstock costs to some degree if on-site chipping of whole trees is feasible. This will increase the yield for a given volume of logs by 20.7% (accounting for non-bole biomass, Nagle 1990). The delivered cost of the chips drops to $88/BDt in this system, or to $59/BDt if development and reforestation costs are not included.

The following sections examine these costs by comparing them with feedstock costs in other regions and are used to examine markets, instruments and/or policy that could make direct salvage harvest of feedstock an attractive option for beetle-killed timber.

5. Possible Measures to Increase Biomass Energy Uptake

In the example presented above, it is clear that accounting for energy prices alone (at current levels) will not support woody biomass energy production from the beetle salvage, even with the lowest cost feedstock option. However, the challenge of a biomass energy option deserves further examination because there are additional benefits to producing energy from wood. For example, one major benefit is predicated on the fact there are costs to leaving large volumes of woody biomass on landscapes vulnerable to large-scale disturbances. These costs include any additional risk of wildland fire, habitat alteration and reduced growth rates in subsequent stands. The rate of stand growth may be very important to regions with forest-dependent communities, although most of these costs will accrue in the future.

A frequently cited benefit to biomass energy production is the displacement of emissions from burning fossil fuels. This is especially valid in cases such as wood waste where carbon is released (generally through beehive burners) whether or not energy is produced. Many domestic, regional and international programs recognize the benefits of renewable energy production in general, and biomass energy production in particular, designing various economic/policy instruments to promote its uptake.

The European Union (EU) adopted a directive in 2001 to promote renewable energy production in internal electricity markets (IEA Renewable Database 2004). The target is to generate 22.1% of electricity and 12% of all energy consumed from renewable sources by the year 2010. In the EU directive renewables include wind, solar, geothermal, wave, tidal, hydro, biomass, landfill gas, sewage treatment gas and biogas. Although this is very much a regulated target, individual countries within the EU were given country specific targets and discretion on how to meet the targets, many choosing to use market incentives. There are many programs to support green energy development throughout the EU, most notably feed-in tariffs which guarantee a price premium for renewable energy production. It should also be noted that many of these countries had well entrenched systems in place prior to this directive, most notably the Nordic countries.

Carbon taxes on non-renewable energy sources have been used in the Nordic countries and the Netherlands since the early 1990s. Countries with specific taxes on CO_2 include Denmark, Finland, Italy, Norway, the Netherlands and Sweden (IEA 2005). Finland was the first country to institute carbon taxes in 1990 and Sweden followed suit in 1991. In the case of Sweden, CO_2 emissions have risen since 1990, although at a slower rate than would have been the case without the taxes (Bohlin 1998). The effectiveness of the carbon tax in Sweden has been weakened by a reduction in the rates paid by industrial users. Carbon taxes were instituted in Sweden in 1991 with an initial rate of $US 133/tonne C. This was changed two years later to a differential rate with industry charged $US43/tonne and consumers $US160/tonne. In addition to a carbon tax, Sweden also levies taxes on energy and sulphur, although for competitiveness reasons, industry is exempt from the energy tax. Biomass energy is exempt from all of these taxes in Sweden, leading to a relative cost advantage versus the case in an instrument-free market situation. There are many other programs in Sweden that are aimed at increasing biomass energy uptake as well including (IEA 2005):

- Green certificates scheme in which tradable certificates are generated by select green energy sources, with certificates produced for MWh's of production. Consumers are required to purchase a certain number of certificates or face a fine.
- Tax breaks to individual homeowners who install pellet or wood burning furnaces.
- Feed-in tariffs, which guarantee additional support above the market price of electricity for small independent power producers using wind or biomass.

In Canada, institutions are under development, such as carbon credits and associated markets, which should help close the gap between current market costs and benefits to carbon-neutral energy production in the future. In the March 2005 federal budget Canada introduced a program (The Renewable Power Production Initiative) to promote investment in renewable energy. This program provides 1 cent per kWH for eligible non-wind, renewable energy projects.

Two simple case studies are developed below to examine the required value of carbon credits for a direct harvest for a) dedicated direct-fired biomass electrical production in BC, and b) co-firing with coal in neighbouring Alberta. The models assume the carbon benefits from each of the systems is equal to the carbon emissions not released due to the reduction in fossil fuel use minus the carbon emissions arising from the collection and transport of the biomass feedstock. The metric used for this analysis is the \$/tonne value of CO_2, generated by the proposed facility that would make a decision-maker indifferent between the reference system and the proposed biomass facility. In order to complete this analysis the costs of producing energy from the biomass and the reference systems to be displaced must be fully accounted for.

Case Study 1 – Carbon Credit Values Required for Direct-Fired Electrical Production from Salvage-Harvested Pine.

This case study is based on direct-fired energy production using feedstock harvested solely for producing biomass energy. The costs for feedstock from the previous section (Table 3) are used in addition to energy production parameters developed from recent studies by the National Renewable Energy Laboratory (Bain et al. 2003, Spath and Mann 2000). The costs (pre-feedstock) are modeled here based on the parameters (capital costs and operating costs) given in that study, although converted to \$Cdn. The carbon credits that are generated from biomass energy production are based on displacing generation from a Combined-Cycle Natural Gas (CCNG) system (assumed to be the baseline, *or reference system*) on the basis of life cycle global warming potentials. The assumed costs for this reference system are those used by BC Hydro in their 2004 Integrated Electricity Plan (BC Hydro 2004), which form a cost range of 5.6 to 8.1 cents per kWh for average annual costs. The levelised costs of CCNG in the BCHydro analysis formed this range on the basis of size and the assumed future prices for natural gas. The cost estimates were replicated using the BCHydro assumptions at 250 and 500MW capacities and the estimated costs are closer to 5 cents kWh-1 using a natural gas price of \$4.80 GJ-1, a discount rate of 7.5% (real) and the BCHydro assumed operating and capital costs. The analysis is based on a biomass energy facility of 100 MW. It is further assumed that the location of this facility is such that the transport distances are the same as is the case for the representative (average) sawmill in the Prince George region, the underlying assumption in the transport costs used in Table 3. The key parameters for the two systems are outlined in Table 4.

The annualized costs for the biomass plant are approximately \$48 MWh^{-1} prior to the costs of delivered feedstock being included, and rise to \$124 MWh^{-1} using the feedstock costs derived in Table 3. This is substantially higher than for the reference natural gas system costs. The cost range used by BC Hydro for biomass power production is \$56 to \$190 MWh^{-1} (BC Hydro 2004(a)). Our estimate of \$124 MWh^{-1} falls close to the centre of this range. The value of carbon credits required to bring the biomass energy system costs to the \$56 to \$81 MWh^{-1} range for the CCNG reference is \$90.76 to \$143.72 per tonne CO_2. Sensitivity analysis estimating carbon credit values by varying feedstock costs and natural gas prices are summarised in Table 5.

Although the analysis examines the use of carbon credits as the instrument to narrow the cost gap between biomass and natural gas power generation, there are a host of instruments that can be used for this purpose including subsidies to collecting and/or transporting the feedstock or guaranteed price premiums for the electricity produced. It is clear the energy biomass from direct salvage requires financial assistance for any level of feedstock costs above zero in the absence of substantial increases in natural gas prices.

Case Study 2 – Carbon Credit Values Required for Feasible Transport and Co-firing Feedstock from Salvage-Harvested Pine.

The co-firing of biomass with coal in existing facilities is generally the low-cost option for electrical generation. This is an interesting opportunity for MPB fibre considering the *relatively* short distance from the Prince George region to the area west of Edmonton where the bulk of Alberta’s coal generating capacity is located (approximately 780 km by road).

Table 4. Case study parameters – direct biomass energy from salvage harvest versus greenfield combined cycle natural gas (CCNG) energy.

	Biomass 100MW Plant	CCNG Reference > 59 MW
	Per MWh	
Emissions Associated Providing Feedstock (tonnes)	0.027[a]	0.125
Total GHG Emissions (tonnes)	0.027	0.499
Feedstock Costs ($)	75.8	n.a.
Total Generation Costs ($)	123.8	56 to 81

Notes:
[a] Based on emissions in Sambo 2002, for the Prince George region whole tree harvest and haul.
Any carbon sequestration associated with additional growth due to removing the standing dead pine is not included here. Biomass facility capacity use is 7000 hours. Wood is converted to energy at 1.33 MWh BDT^{-1}

Table 5. Sensitivity analysis on feedstock costs and carbon credit values ($ $tonne^{-1}$ CO_2) to make biomass energy from direct harvest competitive to CCNG reference.

Natural Gas Prices $ $mmbtu^{-1}$	Feedstock Costs in $ BDT^{-1} 0	25	50	75	100
			$ tonne CO_2		
5	-6.7	33.2	73.1	112.9	152.8
7	-33.1	6.8	46.7	86.6	126.5
9	-59.4	-19.5	20.0	60.3	100.2
11	-85.7	-45.8	-5.9	34.0	73.9
13	-139.3	-72.1	-32.2	7.7	47.6

Note: Shaded region indicates biomass energy is low cost option.

Alberta has in excess of 5,000 MW of capacity in coal-fired electrical plants. At 10% biomass use in co-firing, this would represent greater than 500 MW of wood-fired capacity, nearly equivalent to the total used in BC at this time. The second case study is harvesting salvage pine, chipping on-site and transporting directly to the coal plants in Alberta where the chips are co-fired with coal to produce electricity. The key parameters necessary for the analysis, and the sources of this data, are provided in Table 6.

The incremental costs of displacing coal (per MWh) are the delivered costs associated with three quarters of a tonne of chips, plus the annual capital costs of upgrading the plant to accept biomass, less the delivered costs of 0.468 tonnes of coal. The incremental costs of displacing coal with biomass feedstock using the parameters outlined in Table 6 would be $72.41 MWh^{-1}. Again, as in the previous section if we examine the costs of CO_2 credits necessary to make this an economically efficient alternative, it would be $71 $tonne^{-1}$ CO_2. Sensitivity analysis is again performed on these results varying the delivered cost of chips and the delivered coal price (see Table 7).

The combinations of coal prices and feedstock costs that generate negative values in the table indicate combinations where biomass co-firing lowers the overall generation costs of the electrical facilities. If feedstock can be delivered at $50 per BDt or less, and coal prices achieve $50 per tonne or more, displacing coal with biomass in these facilities would work with carbon credits at > $17 per tonne CO_2. Although such increases in delivered coal prices

Table 6. Case study parameters – co-firing salvage harvested with whole-tree chipping in existing Alberta thermal generating facilities.

	Biomass	Displaced Coal
	Per MWh	
Total GHG Emissions (tonnes)	0.046[a]	1.02[b]
Feedstock Required BDt	0.753	0.468[c]
Delivered Feedstock Costs ($)	85.51[d]	15.44[e]
Annualized Upgrading Costs ($)	2.08[f]	0

[a] Same as the estimate in Table 5 with the additional emissions associated with fuel use to move chips 780 km to Alberta.
[b] Life cycle emissions of thermal (coal) electrical production from Spath et al. 1999.
[c] The 0.468 coefficient is the average coal per MWh for US thermal generation (EIA 2003).
[d] This is with the whole-tree system, chipped on-site and loaded into chip trucks for delivery in Alberta, thus the $17.16 BDt^{-1} to move feedstock to a central location from the previous case study is not incurred in this case. The overall transport costs are $43.03 BDt^{-1} to move the chips to Alberta (based on costs in Webb 2003).
[e] The delivered coal price is 33/tonne which is the value used by BCHydro 2004(b).
[f] This is the annualized costs of the capital upgrades to existing thermal facilities to co-fire with biomass. These are from Bain et al. 2003, and the total is $218.60 kW^{-1} of installed capacity.

Table 7. Sensitivity analysis on coal costs and carbon credit values ($ $tonne^{-1}$ CO_2) to make salvage harvest, whole-tree chipping co-firing competitive to thermal (coal) reference.

Coal Costs $ $tonne^{-1}$	Feedstock Costs in $ BDT^{-1} 25	50	75	100
	$ tonne CO_2			
25	10	29	48	68
50	-2	17	36	56
75	-14	5	24	44
100	-26	-7	12	31

Note: Shaded region indicates biomass/thermal blend is low cost option.

seem excessive given historic prices, coal prices which set highs in 2004 may be indicative of the rapid increase in Chinese demands for metallurgical coal dragging along the relatively low-valued thermal coal.

In order to co-fire biomass on a large scale in Alberta's thermal power generation sector would require planning on feedstock streams "post-MPB". The region in which much of this thermal capacity is located in some of the best potential aforestation sites in the country. If contractual arrangements with local private landowners could be initiated to examine the potential to grow fibre for energy, and the costs were not prohibitive, the possibility for co-firing biomass and coal would be complemented.

6. Discussion

One of the more obvious barriers to biomass energy projects has been the competition from low cost natural gas combined cycle systems. Recent spikes in natural gas prices mean that biomass generation is cost competitive if feedstock is available for free. The problem is that standing biomass is spread across regions, especially in the context of the MPB, which results in high feedstock procurement and transport costs that drive energy production costs much higher than those based on natural gas. In addition, the pay back period to recover the costs of these facilities is a longer term (20 to 30 years) and the availability of MPB feedstock is almost certainly less than this. It appears unlikely that a new facility to produce energy from MPB fibre would be feasible without being able to extend or substitute with another fuel source after the (approximately) 15-year window.

If a large-scale project using MPB fibre is initiated, a strategy to phase-in the use of an alternative feedstock source would be required to substitute as the MPB fibre disappeared. One such example could be dedicated energy crops such as fast growing plantation fibre. For the case study of using MPB fibre for co-firing in Alberta thermal power plants, this would seem to be a logical extension, as sufficient land base and growing conditions exist for such plantations in the region of Alberta where most of the coal capacity is located. Strategies such as this, that involve using existing facilities, with lower capital requirements, and shorter pay back periods offer the greatest potential for a biomass energy option to capturing value from the post-MPB salvage.

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Corporate Social Responsibility and Illegal Logging Activities: The Italian Experience

Davide Pettenella, Gianluca Santi and Laura Secco

Dept. TeSAF, University of Padova, Italy

Summary

Corruption and illegal activities afflict timber harvesting and wood trade in many countries, especially in developing countries with rich forest resources. Wood traders have a key role in fighting against illegalities. Many instruments are available for the enterprises involved in wood trade to promote an ethical behaviour. The paper describes the best practices and initiatives to reduce incentives to illegal acts and to induce law compliance by companies involved in wood trade in a leading world importer of forest products: Italy.

The paper is divided into three main sections. After a brief description of the main general aspects connected with illegality and corruption in the forestry sector, an overview of different instruments and initiatives to control illegalities and to promote the use of wood products from legal sources is presented. Instruments to promote legal behaviour in the forestry sector are grouped in three categories: institutional, voluntary, and informational. The results of the implementation of these instruments by the private sector are reported in the following part of the paper, making reference to three approaches adopted by companies in dealing with the illegalities' problems: pseudo philanthropy, strategic philanthropy, social investment. The future challenges of regulation and market development policies are briefly analysed and discussed in the conclusions.

Keywords: Corporate Social Responsibility, illegal logging, wood products trade, forestry sector

1. Introduction

Corruption and illegal activities afflict the forestry sector in many countries, especially in developing countries with rich forest resources and high poverty levels. The illegal acts are various along the wood chain but they tend to be concentrated on timber harvesting and wood trade. Illegalities can be of many different types: violation of norms of forest harvesting licences,

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unauthorised trade, contraband timber, omission of documents on dimension, quality and value of timber, false accounting, oversize or undersize tree felling, unauthorized felling in protected areas or of rare and threatened species, use of corruption to gain harvesting rights, and others (Brack 2003; Buttoud 2001; ECE-FAO Timber Committee 2000; FAO 2001; FERN/RIIA 2002; ITTO 2002; Morozov 2000; Scotland and Ludwig 2002; World Bank1999a).

Beyond harvesting, illegal practices may also extend to transport infringements, illegal processing and export, evasion of taxes or charges and misstatements to customs. The dimension of the problem is not officially known, but the Organisation for Economic Co-operation and Development estimates that approximately one tenth of international timber trade is provided by illegal timber, with a value at the minimum of $150 billion/year (OECD 2001). In several countries, illegal cutting exists alongside with legal cutting; in others, conditions of illegality are more common than legality (World Bank 1999b). This opinion is confirmed also by other sources of information: "*in some areas the rate of illegalities overtakes half of harvested timber and this happened also in the last rainforest existents: in Congo, in Asia, in the Amazon forest*" (FERN/RIIA 2002). In many countries the situation in the last years appears highly critical: in 1997 in Cambodia, illegal extraction was ten times that of legal extraction (World Bank 1999b). In 1998 in Indonesia 40% of wood was illegally cut, with a value of above $365 million (ITFMP 1999); furthermore, it is estimated that this percentage in 2001 was increased up to 70% (Scotland and Ludwig 2002).

Illegalities are not a problem connected only with Less Developed Countries. In European countries with economies in transition approximately 20–30 million cubic meters of wood are cut in illegal forms every year (ECE-FAO, Timber Committee 2000). At least 20% of the wood harvested in Russia (i.e. 22 million cubic meters) is cut in totally illegal manner or against some of the existing legislation (Morozov 2000).

Apart from the obvious negative environmental and social impacts, there is a direct economic damage to the countries' governments affected by high level of illegal practices in the forestry sector, which are losing tax revenue from licences and duties equivalent to 10–15 billion of euro/year (World Bank 2002). These economic losses contribute to the reduction of reinvestments in forestry sector as well as to the decrease of monitoring capacity and enforcement; in addition, they contribute to restrict the concrete possibilities to carry out programmes for sustainable management of forest resources. In a medium-long term period, these conditions generate a depletion of the natural stock and a deterioration of the economic wealth of the country. Moreover, illegalities contribute to keep timber prices down, thus reducing the competitiveness of those enterprises that are complying with the laws and promoting socially and environmentally responsible activities in the sector.

Corruption and illegality have also some relevant indirect effects, like poaching by workers employed by forest concessionaires, the secondary use of forest tracks by local villagers to access forests resources, the use of "*timber that has been traded at some point in the chain of custody by armed groups, be they rebel factions, regular soldiers or the civilian administration, either to perpetuate conflict or take advantage of conflict situations for personal gain*". This is the definition of "conflict timber" provided by Global Witness, expression coined in the report of the United Nations Panel of Experts on the Illegal Exploitation of Natural Resources and Other Forms of Wealth of the Democratic Republic of Congo. There is evidence of the use of "conflict timber" in regional conflicts in Cambodia, in Liberia and in the Democratic Republic of Congo (FERN/RIIA 2002).

As reported by Transparency International, the general level of corruption in the forestry sector (5.1)[1] is not high if compared with other sectors, in particular public works (1.3),

1 Corruption is assessed through the bribery in business sectors' index. The scores are mean figures from 0 to 10, where 0 represents very high perceived levels of corruption, and 10 represents zero perceived corruption. The question asked is "How likely is it that senior public officials would demand or accept bribes, e.g. for public tenders, regulations, licensing, in the following business sectors?". For more information see: www.transparency.org

armaments (1.9) or oil (2.7). However, the consequences of corruptive behaviours in the forestry sector have probably worst and more widespread consequences on the environmental and social context, negatively influencing any future development program based on the sustainable use of local resources.

Because of the several direct and indirect environmental, economic and social consequences of illegal activities within the forestry sector, since the end of the 1990s different international and national initiatives have been taken in order to detect and reduce the phenomenon.

Before the official assumption of responsibilities by many international and national public organisations, the presence of NGOs and a close-knit network of local action groups have led to the establishment of an efficient collecting and sharing information's action, blowing the whistle on illegalities, making the public and policy-makers aware of these problems.

As described in the last part of the paper, all these problems and initiatives are involving also the Italian private operators as well as the national country's authorities being Italy the sixth world importer of wood products, the second European importer of tropical timber and the first importer from the Balkan area. For these reasons Italy represents a quite interesting case-study for analysing which good practices to reduce illegal acts and to induce law compliance are implemented and how, as well as their effects in the wood products market.

2. Instruments to promote the use of legal wood

The initiatives and instruments to promote the use of legal timber and best practices for enterprises are continuously in progress. With the objective of analysing the Italian experience, the instruments which can contribute to contrast the diffusion of illegal logging could be grouped into three main categories:

I. institutional instruments, based on existing international laws and regulations' enforcement and special agreements among governments and institutions;
II. voluntary instruments and initiatives implemented by private organisations as well as by public administrations;
III. informational and networking activities.

In addition, two initiatives based on an integration and co-ordination of all these instruments have to be mentioned: the European Union (EU) action plan on Forest Law Enforcement Governance and Trade (FLEGT) and the various programs of international cooperation for rural development. The premise of the FLEGT Action Plan is a recognition that the EU, as a significant consumer of timber, shares responsibility with timber-producing countries to tackle illegal logging and trade associated with it. The EU recognises that as long as it imports illegally logged timber, it undermines the efforts of producing countries to tackle the problem. Voluntary partnership agreements between the EU and individual timber-producing countries have no intention of imposing solutions on countries but rather of working with them to supplement and build on their own efforts. The FLEGT Action Plan aims to combat illegal logging, to exclude illegal timber from the EU market and to promote the use of legal timber. In 2004, Italian government has started the implementation at national level of the FLEGT action plan through the creation of a working group composed by the representatives of four State institutions: the Ministry of Environment and Protection of Territory, the Ministry of Agricultural and Forest Policies, the Ministry of Foreign Affairs and the Ministry for Productive Activities. External experts are invited to the sessions of the working group. The actions that the Italian government should promote to implement FLEGT Action Plan are: to identify the legality of production (legality verification), to track it to the market (customs co-operation and enforcement), to enforce the prohibition of market access for illegally sourced timber products (finance and procurement). Other fields of activities should be the monitoring of the factors which tend to promote illegal logging such as unmonitored loans and financing, for example by banks and export credit agencies, money laundering, and purchases by public procurement bodies. At present the discussion is open but no agreement or instrument have already been approved by the Italian government and no co-operation programmes between developed countries and emerging economies have been stipulated yet.

The first category, institutional instruments, refers to some international and national regulations and agreements like the Convention on International Trade in Endangered Species (CITES); regulations approved by OECD and ITTO; international, regional and bilateral agreements between commercial partners (like the UK-Indonesia agreement – ITFMP, 1999); national legislation against stolen goods; money laundry and all the other relevant and possible applicable legislation, conventions and plans[2] (United Nations Convention Against Organised Crime, OECD Guidelines for Trans-National Corporations, …) (Speechly 2003). In this category also the regulatory instruments oriented to prevent or fight criminal activities and illegal profit, like regulations for banks and insurance companies involved in the financial brokerage and transportation, are included.

Among the international and national conventions and regulations, commitments and action plans promoted by public organisations, the most effective instrument that has been implemented in Italy to promote the use of legal wood is the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Actually CITES is the unique instrument for controlling the trade of illegally sourced timber but it is limited to a small number of internationally protected species. The Italian authority competent for granting permits is the State Forest Corp with 18 operative units in the main international seaports and airports, while 25 certification offices (CITES Office) established in the main regional capitals and in the main cities support the investigation system. The State Forest Corp is making more than 25,000 controls, checking more than 300,000 cubic metres of imported wood every year. Also the Convention on Biological Diversity (CBD) is having a certain role against illegality in the forestry sector.

Various national agencies are dealing with the implementation of these legislation. The increasing number of initiatives related to international regulations is creating problems of inter-agency coordination.

The second category refers to voluntary initiatives implemented by private organisations (both profit and non-profit) or by national and local public authorities. The fields of action of these initiatives and the targets are various and the purpose of these initiatives responds to different requests: to develop legal markets, to change the behaviour of enterprises, to promote traceability, to improve the awareness of the gravity of the situation among the consumers. The most significant voluntary actions can be grouped in three categories with reference to the criteria of transparency and accountability:

a. commitments, best practices (like compensative investments and sponsorships), and codes of conduct without any formalised external control and/or communication;
b. commitments, best practices, partnership agreements and codes of conduct with some formalised instruments of communication (like the use of standards of communication as those developed by the Global Reporting Initiative) and/or external control (like formalised external auditing of companies and institutions);

2 The regulative actions developed for the wood products can take advantage of the experience gained in other sectors (Kimberley Process, Lacey Act, Convention on the Conservation of Antarctic Marine Living Resources, …)..

Box 1. Green public procurement policies. In European Union countries public procurements amounts to 14% of Gross Domestic Product. This level reaches 17% in Italy and 24-25% in some other countries, such as Denmark and Sweden (Andriola et al. 2003). Public investments are distributed among a wide range of forest products and services from paper to wood playgrounds and furniture. If that public money began to be directed towards products and services from well managed forests and legal forest activities, the impact on the sustainable use of forest resources would be considerable. In a long term vision responsible public procurements could modify also the private consumers' behaviour in buying goods and services. Governments, choosing to buy legal products and services and goods with a low environmental impact, have a significant power to exert influence through the supply chain to combat illegal logging and to promote responsible forest management. With reference to the Italian experience, there are several positive examples of environmental criteria already introduced into purchasing procedures by national, regional and local authorities, while a number of town councils and municipalities have officially committed themselves to purchase environmentally friendly products (recycled paper, wooden-made products coming from well managed forests and similar) in the future.

c. third part certification based on the adoption of standards for Corporate Social Responsibility which include environmental management system standards (ISO14000, EMAS,…), wood-based products ecolabelling systems, social accountability standards (Social Accountability 8000) and those more specifically related to the Sustainable Forest Management and Chain of Custody (Forest Stewardship Council – FSC, Programme for the Endorsement of Forest Certification – PEFC – schemes).

Enterprises, not only respecting national and international laws but assuming a pro-active policy on ethical matters, have better possibilities to grow and to do business in the long term, taking advantage of the support of consumers and other components of the civil society. Customers and NGOs with the support of public institutions can also steer the markets playing an important role in changing the enterprises' behaviour.

Green public procurement policies (see Box 1) are very effective voluntary best practices that can be included among the initiatives implemented specifically by national and local public authorities and institutions.

The report "To buy or not to buy: Timber procurement policies in the EU" stress the attention on "the possibilities for EU member states to implement green timber procurement policies are threefold: to include 'legal and sustainable' as contract conditions; to include 'legal and sustainable' in technical specifications; to include 'legal and sustainable' in award criteria" (FERN 2004). This step-by-step approach offers different opportunities to increase the level of sustainability in public spending thus encouraging a gradual development of the demand of legal wood products, but there is also the risks of ambiguous definitions and substitution of wood with non-wood products, with the final results of not promoting responsible forest management practices.

The third category refers to the informational and networking instruments to enhance the stakeholders awareness, to stimulate the accountability of private enterprises and public authorities and their socially responsible behaviour, and to rise the public support in fighting corruption and illegality. Basically the informational instruments and the networking actions can be grouped in four main categories: research and monitoring activities; scientific and technical reports publication (printed documents and web sites); networking activities, meetings and conferences; target campaigns.

Several reports on illegal logging and related issues, referring to the international situation or to a specific-country situation, prepared by research institutes and international institutions are available on the web; video have been recently produced and distributed by Greenpeace in order to make the Italian families conscious of the origin of wood products and paper they are daily using and often wasting; the 26th edition of Forum Public Administrations 2005, a national event dedicated to the public authorities, is for the first time focused on the environment and on the topic of green public procurements. Furthermore, in 2004 in Italy the Greenpeace campaign “Friends of Forests Cities” and the publication by WWF of the survey to monitor the implementation of the FLEGT Action Plan by the EU member countries[3] have been extremely effective for promoting public awareness on the problems of illegal logging and corruption in the wood chain.

3. Corporate Social Responsibility: the Italian experience

Italy is an important commercial partner of countries with serious problems of deforestation, illegal harvesting or which are going through periods of political instability (Peck 2001; FAO 2001). For example, it is the first export market for wood products from Cameroon, where during 2001 more than 50% of timber was illegally cut (ITTO 2002). Italy is also an important commercial partner for Brazil, Indonesia, Serbia, Albania and Bosnia which are internationally known as countries with a high level of illegal activities in wood harvesting and trading.

The high reliance on foreign markets for the rough and semi-finished products is connected with the leadership position of the country in the furniture sector: Italy is the second largest world exporter of furniture after China (till 2002 it used to be the first), thanks to its well organised and competitive wood processing industry. Being a country with a very open position in the world trade of wood products, Italian customers and enterprises have direct and indirect responsibilities in the way forests are managed and wood products are processed and traded in the partner countries. Large quantities of wood are imported from small- and medium-sized companies[4] whose level of social accountability is generally quite low (Pettenella and Santi 2004).

Table 1 reports the countries more affected by deforestation problems (first column) and the leading exporting tropical countries (second column). Many of the main exporting countries are, as supported by documentary evidence from international institutions and NGOs, involved in problems of illegality, corruption, political instability, forest degradation, un-sustainable management of forests. A significant number of these countries (reported into grey cells in table 1) are among the main commercial partners of Italy in the trade of tropical wood products.

Table 2 reports the quantity and the value exported of tropical roundwood to Italy by countries. Cameroon, Congo and Gabon alone cover more than 72% of the Italian market of tropical timber. An bilateral agreement with these countries on the issue of responsible trade

3 For more information see: www.greenpeace.it/camp/foreste/citta/ and www.wwf.dk/242000c
4 96.8% of the 87,000 industrial companies working in the sector has less than 20 employees.

Table 1. Tropical countries affected by deforestation processes and main exporters.

Deforestation	Top World Exporters	Top Exporters to Italy
1. Brazil	1. Malaysia	1. Brazil
2. Togo	2. Indonesia	2. Cameroon
3. Cote D'Ivoire	3. Brazil	3. Indonesia
4. Nigeria	4. Hong Kong	4. Cote D'Ivoire
5. Benin	5. Mexico	5. Congo
6. Liberia	6. Thailand	6. Nigeria
7. Ghana	7. Gabon	7. Gabon
8. Guatemala	8. Papua New Guinea	8. Paraguay
9. Sri Lanka	9. Singapore	9. Ghana
10. Zimbabwe	10. Myanmar	10. Malaysia
11. Myanmar	11. Cameroon	11. Liberia
12. Philippines	12. Cote D'Ivoire	12. Thailand

Source: FAO Database (1990-2000) and EFI/WFSE Forest Products Trade Flow Database based on United Nations COMTRADE data 2005.

Table 2. Tropical roundwood import by countries to Italy.

	Cubic meters	%	US dollars (x1000)	%
Cameroon	160273	27.0	42724	44.9
Congo	101645	17.1	13249	13.9
Gabon	55592	9.4	13236	13.9
Nigeria	50068	8.4	1936	2.0
Paraguay	49722	8.4	993	1.0
Indonesia	46421	7.8	1433	1.5
Liberia	35434	6.0	7460	7.8
Myanmar	20143	3.4	2979	3.1
Brazil	15266	2.6	441	0.5
Central African Republic	13273	2.2	2923	3.1
Ghana	7941	1.3	254	0.3
Madagascar	7916	1.3	397	0.4
Total	563694	94.9	88025	92.4
Others	30293	5.1	7240	7.6

Source: EFI/WFSE Forest Products Trade Flow Database based on United Nations COMTRADE data 2005.

could have remarkable effects on the consumption of timber from legal sources in Italy. Similar consideration could be expressed in relation to a selected number of East Europe that are exporting wood products to Italy.

Corporate Social Responsibility (CSR) of Italian companies working in the forestry-wood sector is still quite low as a consequence of structural internal factors: Italian wood traders and wood-working enterprises have on average a small-medium size; their competitive advantages are mainly based on design, high quality and flexibility and not on instruments of societal marketing. External factors are favouring this situation: a low public awareness of the problem of illegality and corruption along the wood chain and reduced domestic demand for responsible productions, but also a limited interest and weak instruments of law enforcement by public authorities.

To better analyse this situation a survey on the ethical behaviour of the Italian wood working companies has been carried out aimed at finding out how many companies can be classified under the following four categories:

- companies without any specific instrument of CSR;
- companies adopting an approach of pseudo philanthropy;
- companies with an approach of strategic philanthropy;
- companies considering their economic activity as a social investment.

Pseudo philanthropy is a CSR approach based on occasional, non systematic, often limited, activities which involves mainly internal direct stakeholders[5]. In general these actions are not pro-active but they tend to compensate (or to hide) some negative consequences of the business activity. When involving natural resources, the pseudo philanthropy as an instrument of CSR is sometimes defined as a "green washing" activity[6].

Companies adopting a strategic philanthropy approach are characterized by a systematic ethical interest on a target intervention and they work with continuity on a single or on a limited number of objectives. The action may involve both the direct internal and the external stakeholders.

A good example of a strategic philanthropy approach is Valcucine, one of the world top producer of exclusive kitchen furniture in the world. The ethical approach of the enterprise is based on two objectives: respect for the people (quality and total guarantees, control of toxic emission of all the kitchen components, control of wood radioactivity,…) and respect for the environment (environmentally friendly raw materials, recyclability of kitchen components, …)[7]. As far as the use of wood resources is concerned, Valcucine has launched the Bioforest project, a compensatory investment for the afforestation and protection of biodiversity in some villages in Amazon and in Ecuador[8].

With a social investment approach companies have an holistic view of all impacts of their activities which are systematically monitored and evaluated against a set of ethical objectives. Attention is given not only to direct but also to indirect and external stakeholders.

Coop Italy, which is an interesting example of this approach, is the leading Italian consumers' co-operative with more than 5 million of members and the first chain store in the food market with 1,265 shops and 47,300 employers. In 1998, it was the first enterprise in Europe to obtain the SA8000 certification. After implementing its social and environmental commitments in the organic food market and in the market for the fair and equitable trade products, Coop, once informed about the problems of illegal logging and overexploitation of wood resources used for pulp and paper production, decided in April 2002 to start selling FSC certified tissue products with the Coop brand and without any premium price. Nowadays, it has four paper suppliers, 10 different types of FSC certified paper products sold in the store, and it is developing the market of certified products in other sectors, such as garden furniture.

Analysing the Italian sector we can estimate that, out of 87,000 companies working or connected with the forestry sector, only less that 200 are adopting a pseudo philanthropy approach, less than 50 a strategic philanthropy approach and less than 10 are considering their economic activity as a social investment.

5 In Lesourd and Schilizzi (2001) the definition of external and internal, direct and indirect, stakeholders is reported.
6 The managers of an Italian company working in West Africa have presented their commitment to the sustainable use of tropical forest stating: "we are so concerned about the state of the forest resources in our concessions that in many cases we are directly providing the salaries to the local forest officials", with clear effects on their law enforcement capability!
7 The company has obtained the EN ISO 14001 certificate. The oil-treatment used by Valcucine has been awarded by the German Ministry of Ecology and by the German Institute for Environmentally-friendly Building. Presence of artificial radioactivity is random sample analysed by CRAD Nuclear Spectrometry Laboratory and CATAS laboratories carry out analyses on panels to check the respect of strict standards (E1 cat.). See: www.valcucine.it
8 See: www.bioforest.it/progetti.htm

4. Conclusions

There is a clear lesson learned from the analysis of the Italy case study: the socially and environmental responsible behaviour of a limited number of companies and their use of CSR instruments are rather limited instrument to reduce corruption and illegalities along the wood chain if not supported by a large and active involvement of civil society and by the public institutions' commitment. Only the spreading of the public awareness of the problem could positively influence the accountability of a significant number of companies. The pressure exerted by the civil society can also inspire and encourage public voluntary initiatives, such as the green public procurement policies. Only with a more active external pressure, companies can be motivated to develop codes of conduct, to apply external audit, to start to control the chain of custody of their products and to ask for raw materials of legal origin.

Some recent market developments are not favouring the law enforcement and the reduction of illegal logging and corruption in the forestry sector. It is worthwhile to mention two of the most negative trends that are characterizing the Italian market: the de-localization process of wood working industries and the development of an horizontal (North-North vs. South-South) trade of virgin raw material and semi-finished wood products.

The de-localization process towards developing countries and countries in transition is not only changing the pattern of Italian trade, but also the perception of the responsibility and the problems connected with law enforcement. For example, export activities towards the Russian market of an Italian furniture company de-localised in Romania are not influencing Italian stakeholders even when serious problems of law compliance in wood procurement are involved. Similarly, a reduced attention on the problems of law compliance may occur with the process of substitution of imports of tropical roundwood with import of a composite finished products, especially when these products are made in a country not associated with serious problems of deforestation (e.g. Singapore).

After Italy, the second larger export market for Cameroon is China, a country that in the 1980s was not a commercial partner in the timber market for Cameroon. This is a good example of the change in the patterns of world trade. While in the last decade Italy has remarkably increased the import of high-quality hardwoods from USA, its dependence from tropical countries has been reduced. On the contrary there is a growing import flow of tropical wood to some countries – like China and India – where the awareness of the problems of law compliance are quite low. The risk of creating two separate markets (a legal market vs. a market dominated by wood from illegal sources), associated to different levels of economic development of the commercial partners, exists.

For these reasons, the manifold aspects of the problem of illegality in wood production and trade require the development of a large set of instruments to be implemented at different scale and by different actors. No single solution or instrument can be selected as the best one to tackle the problem, as the analysis of the case study in Italy clearly show.

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Situation and Prospects of Forestry and Timber Processing Industry in Central and Eastern European Countries

Ludek Sisak

Faculty of Forestry and Environment, Czech University of Agriculture,
Prague, Czech Republic

Abstract

Central and Eastern European Countries form rather a large group of countries going through different stages of transition to market economy. Restitution and privatisation processes are still underway there. Statistical data and information on individual countries are of a different quality within the international context. The CEEC have a great potential in raw timber production and supplies, as well as in production and supplies of a wide range of timber products. In the near future, production and demand for timber and timber products will gradually rise. Nevertheless, exports will not be dramatically higher because of rising domestic building industries, national economies, and therefore enhancing domestic consumption of timber products in the individual Central and Eastern European Countries.

Keywords: forestry, timber processing industry, Central and Eastern European Countries, situation, prospects

1. Introduction

Central and Eastern European Countries (CEEC) create a relatively large group of countries going through a rather difficult stage of their history. These countries do not form a homogenous group. They differ in economic, social, cultural, historical, and also natural conditions. Differences among these countries originate from history as social, economic and cultural differences were in the block of former socialist countries. The difference has still been increasing to a certain extent in the process of transition to market economy.

At the beginning of the transition process, state ownership dominated. After the restitution of real land rights, the owners, both private and municipal, could freely choose the form of

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management of their own forestland. Some of them started to manage their land individually, others decided to create local associations, part of these formed shareholding companies or limited companies, some of them leased their forestlands, or even sold them to other private bodies. In some countries, state forests were transformed into state joint-stock companies. Operations in state forests were partially privatised.

Statistical data and information about individual countries are also of different quality within the international context. Many data and indicators have diverse contents and are hardly compatible with other countries. Data and information of better quality come from the new EU countries or candidate countries (in the process of accession to EU). Especially the north-south belt of the CEEC (new EU countries and the neighbouring ones) are mainly treated in this paper as these countries can effectively and actively share in timber market with the EU countries at present and in the near future, in contrast to Russia. The group of CEEC in the paper consists of (from north to south): Estonia, Latvia, Lithuania, Belarus Ukraine, Poland, Czech Republic, Slovak Republic, Hungary, Slovenia, Romania and Bulgaria.

In the early stages of transition processes in the CEEC (first half of 1990), there was a great fear that the exploitation of forests in the CEEC could produce large amounts of very cheap raw material in a short period and that the export would decrease timber prices throughout Europe, undermining the economic basis for sustainable forestry. Nevertheless, because of substantial changes in forest ownership, organisational and administrative difficulties, lack of financial means, bankruptcy of many companies, poor-quality machinery and equipment, low quality of labour force, inaccessibility of forests for logging operations, phyto-sanitary and other limits, unreliability in timber supplies, the timber cuts and exports from most CEEC have been without rapid and significant changes.

2. Position of forestry in the CEEC and their economies

The position of forestry in the CEEC and in their national economies differs from one country to another. Nevertheless, the share of forestry in GDP is generally relatively low in most CEEC (about or less than 1%). The level of wages and salaries in forestry is below the national average labour earnings, and the level of investments in forestry is even lower, reaching less than half the contribution of the forestry sectors to national economies. On the other hand, forests are important objects of public interest as they provide many other benefits apart from timber. In particular, these benefits include water control, soil protection, climate regulation, recreation, landscape formation and the conservation of the unique character and biodiversity of wildlife, and, last but not least, forests provide inhabitants with non-wood products (Sisak 2004).

Area of forests and other wooded lands amounting on average to 32% of the CEEC indicates the importance of forestry in rural areas. There is also a great difference in quality of forest cover in the group of the CEEC. The natural dominance of so-called high forest prevails in all forested areas of Europe but in some CEEC coppice occupies rather large areas. It has spread mainly as a consequence of uncontrolled harvesting without attention to regeneration of the previous forests. Coppice is considered to be a partially degraded forest resulting from a long-term attitude to the forest as a source of fuel, household wood and area of pasture. There have been efforts to convert coppice into high forest with only partial success, despite the fact that the proportion of coppice is decreasing in the long-term in the CEEC. Coppice amounts to 37% in Bulgaria and 30% in Hungary while in the Czech Republic the share is negligible (about 1%).

The share of forest area has been gradually and substantially increasing for a long time. Both natural succession on abandoned agricultural lands to forest, and artificial afforestation contributed to forest expansion in the CEEC in previous 50 years. Afforestation played an important role in a number of countries such as Poland, Hungary, Czech and Slovak Republics, and others. In Poland, 1,227,000 hectares of planted forests account for 50% of the total increase. In Hungary, the 650,000 hectares of forests planted corresponds to nearly all the recorded increase in the forest cover. A similar situation was in the ex-Czechoslovakia with more than 450,000 ha of forest area increment in spite of the fact that large areas of forest land were deforested for the building of infrastructure, artificial lakes, enlargement of settlements and industrial areas (Sisak and Broukal 2000).

The process of increasing forest area is still going on. Lots of agricultural lands have been abandoned in recent years. For example, the estimations of needs in afforestation of marginal agricultural lands in the Czech Republic speak of 5% – 10% of the farmland, i.e. 200,000 – 400,000 hectares. This measure would need huge financial support. But the lack of finance in the state budget makes these intentions uncertain. Some arable land should be transformed into pastures, and intensive agriculture should become more extensive in some areas.

A number of the CEEC are considering medium and long-term afforestation of extensive areas of marginal agricultural land. Government-approved afforestation programmes for low-productivity or abandoned lands have been continued or revived in Poland, Hungary and Slovakia. The increase of forest cover is a priority of the Romanian forestry development programme and state financial assistance for afforestation is provided in the Czech Republic and, to a limited extent, also in Latvia and Poland. Within the framework of the Phare programme, demonstration sites for afforestation of private lands have been established over the whole of Latvia.

Recent experiences in some countries (Czech Republic, Slovakia and Latvia) indicate that afforestation is rather expensive in the light of the current economic situation. Total expenditures vary between 2,000 and 3,000 € per hectare, including further protection of planted areas against weeds and game in Czech Republic and Slovakia. Costs also increase due to complex administrative procedures and legal regulations in the agriculture and environment sectors. Natural colonisation of abandoned lands will thus play an important role in the future extension of forests in many countries, especially in the Baltic and central CEEC region.

Forests designated for the primary supply of non-market forest goods and services – such as protective services (soil, water, environmental, ecological and settlements protection), conservation services (nature reserves, parks, sites of biological significance, monuments and cultural heritage sites) and special purposes services (recreation, education, research, watershed, etc.) – represent about 30% of the total forest area. The proportion exceeds 30% e.g. in Bulgaria, the Czech Republic, Latvia, Poland, Romania and Slovakia, with percentage ranges from 10% to 30% in Estonia, Hungary, Lithuania and Slovenia. But these administrative shares depend on different national conceptions of non-market services and of zonings of the respective areas. It is therefore difficult to compare the figures.

Since the early 1990s, the CEEC Forestry Sectors experienced many substantial changes basically influencing forestry production and economics. Completely new state forest administrations were formed, private sectors developed in forestry, new structures of forest owners came into being, new structures of state forest establishments administering state forest lands occurred, new systems of forestry financing were gradually formed.

Forestry sectors have different structures in individual countries (Sisak, 2000). There are differences in types of forest ownership. State forest estates have different management structures. The majority of private owners possess very small patches of forestland. This presents many problems for the surveying of the boundaries and woodlands, and places great demands on the professional and state administration and the government finance. Further problems arise in connection with the quality of forest management, as the private owners with small pieces of forestland generally have little understanding of forestry. New forest owners with returned

Table 1. Timber production and trade (1,000 m^3) in 1995 and 2003.

Country	Production		Exports		Imports	
	1995	2003	1995	2003	1995	2003
Belarus	10,015	7,543	444	1,518	0	77
Bulgaria	2,844	4,833	92	224	2	71
Croatia	2,604	3,847	387	560	89	95
Czechia	12,365	14,541	2,335	2,514	334	994
Estonia	3,710	10,200	2,658	3,365	47	941
Hungary	4,331	5,785	695	1,753	240	530
Latvia	6,900	12,916	2,752	4,461	15	465
Lithuania	5,960	6,275	1,770	1,407	16	78
Poland	20,350	28,835	386	1,009	412	669
Romania	12,178	13,961	0	211	80	21
Slovakia	5,323	6,355	919	1,189	87	160
Slovenia	1,866	2,591	160	385	295	486
Ukraine	6,318	13,186	28	2,137	471	116
Total	94,764	130,868	12,626	20,733	2,088	4,703
Russia	116,210	168,500	18,460	37,730	951	200

Table 2. Industrial roundwood production in 1995 and 2003.

Country	Production (1,000 m^3)		% of timber production	
	1995	2003	1995	2003
Belarus	9,206	6,446	91.9	85.5
Bulgaria	1,970	2,646	69.3	54.7
Croatia	1,744	2,868	67.0	74.6
Czechia	11,716	13,534	94.7	93.1
Estonia	3,137	8,300	84.6	81.4
Hungary	2,383	3,004	55.0	51.9
Latvia	5,690	11,925	82.5	92.3
Lithuania	4,870	4,955	81.7	79.0
Poland	18,939	26,485	93.1	91.9
Romania	10,015	11,562	82.2	82.8
Slovakia	4,887	6,051	91.8	95.2
Slovenia	1,639	2,232	87.8	86.1
Ukraine	4,420	5,068	70.0	38.4
Total	80,616	105,076	85.1	80.3
Russia	82,750	121,800	71.2	72.3

(restored) small pieces of forestlands generally have a weak claim to the ownership of the land, a lack of financial means, often live very far from their land and work in other sectors of economy. The forest policies, state administrations and authorities are therefore trying to support small-size forest owners by finance, education and advisory networks.

In spite of the decreasing economic efficiency in forestry in recent years, the overall current economic situation is still relatively more stable and better than in agriculture in most CEEC. Generally, the forestry sector does not have economic problems and losses like agriculture. In the majority of countries, forestry can be considered profitable. Exports of timber prevail

Table 3. Logs (sawlogs and veneer logs) production (1,000 m^3) in 1995 and 2003.

Country	Production		% of timber production	
	1995	2003	1995	2003
Belarus	3,920	2,304	39.1	30.5
Bulgaria	877	1,581	30.8	32.7
Croatia	1,252	2,055	48.1	53.4
Czechia	5,812	8,073	47.0	55.5
Estonia	1,413	3,870	38.1	37.9
Hungary	1,303	1,571	30.1	27.2
Latvia	2,900	7,842	42.0	60.7
Lithuania	2,320	3,370	38.9	53.7
Poland	9,337	11,666	45.9	40.5
Romania	4,274	7,800	35.1	55.9
Slovakia	2,109	2,533	39.6	39.9
Slovenia	918	1,291	49.2	49.8
Ukraine	3,111	3,324	49.2	25.2
Total	39,546	57,280	41.7	43.8
Russia	52,550	58,300	45.2	34.6

over imports. In this context, forestry can be an important stabilising factor in rural areas in most CEEC.

In the process of transition, many socio-economic and organisational problems arose in the CEEC. Many enterprises in forestry and timber processing industry recorded losses and disappeared from the markets, especially during the 1990s. Many still have debts and lack of financial means. Nevertheless, the situation has been quite different from one country to another. Recent years have seen an economic improvement in the forestry and timber processing industry, corresponding to the gradual general socio-economic improvement in most CEEC (Tables 1–3).

Finally, it can be said that more socio-economic advanced CEEC have been relatively more successful in performing the transition to market economy with lower socio-economic losses than the less developed CEEC.

On the other hand, forest productivity and forestry economic effectiveness become gradually more limited and increasingly affected by public limitations, by public requirements for enhancement of forest environmental non-market services. It is becoming more and more evident that forest market production (especially timber production) and other forest market services will not be able to finance increasing demand from society (the public) in individual countries for non-market forest goods and services. The intensified supply of non-market forest goods and services usually enhances production costs and reduces incomes from timber supplies. Therefore, timber as an environment friendly and sustainable material becomes less competitive or even uncompetitive, with other, less environmentally friendly and unsustainable materials on the market.

If forestry is considered as a part of the market economy based on different types of ownership and not budget economy based on state ownership alone, then all factors increasing market (timber) production costs and income losses caused by catering for society with non-market forest services must be identified. Effective systems of promoting such services (especially economic instruments – subsidies and purchase of non-market services) tailored to individual socio-economic and natural conditions of the respective countries will have to be set up in a short time. Otherwise, we run the risk of many producers disappearing (forest owners and entrepreneurs), or even total sectors based on timber production, from the market and their respective national economies, with all the negative impacts on the socio-economic state of rural areas. The respective manufacturing sectors processing timber could also be affected by this situation in the primary production sector.

3. Position of timber processing industry

The CEEC have sufficient quantities of domestic, quality, ecological and renewable raw material for the timber industry. But the timber product per capita consumption is still substantially lower than in the majority of old EU countries. In contrast to very good raw material potential, big problems can be seen in financial aspects. Credit policy by the banking sector is generally unsatisfactory compared to EU. Credits in the timber processing sector are very often classified as high-risk credits, which has a negative impact on investments for technology modernisation. Chronic lack of capital lowers the level of competitiveness in the CEEC. Work productivity is also low. Nevertheless, the restructuring and modernisation processes should enhance work productivity and economic efficiency in the coming years.

Shares of timber industry production (sawnwood and wood based panels) in the total industry production exceed the share of forestry sectors more than twice in most CEEC. The timber industry in most countries has good competitive advantage in domestic production. Sufficiently experienced and qualified labour forces exist in the majority of countries. Nevertheless, products and exports are low-effective (little added value). Roundwood and sawnwood products are exported in high quantities, compared to products with higher added value (wood based panels, construction materials, furniture).

Prosperity mainly depends on strategic international partners, and on domestic markets development especially related to the building industry (house building). Reconstruction of panel houses (blocks of flats built massively in the 1960s and 1970s) is one of best prospects in near future. The entrance of multinational companies (major economic entities) and their expansion (globalisation) into the CEEC has been the most important phenomenon during the last ten years. The timber processing industry is gradually rising up (Tables 4–7).

At present, the big international companies occupy the most important position in the markets. National producers have been gradually losing competitiveness. Mainly national enterprises of big and medium size have been disappearing. Small enterprises of local importance, with specialist products and services, are resisting.

Future expectations of the timber industry are generally:

- Inflow of foreign capital investments;
- Mergers and acquisitions of companies, multinational purchase of products, multinational commercial chains;
- Restructuring of timber sector for:
  - Liquidation of uneconomic enterprises,
  - Modernisation of economically prospective enterprises (new technologies),
  - New types of products with higher added value,
  - Bigger enterprises;
- Production with higher added value
- Restructuring of exports – raising share of products with high added value (wood based panels, timber based construction materials);

These processes will be slow and essentially long-term, with differences in individual countries. Globalisation processes will also continue in the forestry-timber industry sector. Production will probably gradually rise but exports will not be dramatically higher because of the growing building industry, national economies, and therefore higher domestic consumption of timber products in the CEEC markers. Volumes of certified timber products will substantially increase.

Table 4. Sawnwood production and foreign trade (1,000 m^3) 1995 and 2003.

Country	Production		Exports		Imports	
	1995	2003	1995	2003	1995	2003
Belarus	1,545	2,304	143	1,197	2	116
Bulgaria	253	332	57	273	6	7
Croatia	578	585	402	512	96	561
Czechia	3,490	3,800	1,548	1,448	250	381
Estonia	350	1,950	296	1,209	36	363
Hungary	230	299	149	277	809	1,121
Latvia	1,300	3,951	1,487	3,234	7	392
Lithuania	940	1,400	767	1,007	23	341
Poland	3,842	3,320	1,148	945	127	424
Romania	1,777	4,170	746	2,609	3	15
Slovakia	646	1,651	471	855	16	50
Slovenia	511	460	382	373	107	204
Ukraine	2,917	2,075	31	1,366	2	24
Total	18,379	26,297	7,627	15,305	1,484	3,999
Russia	26,500	20,155	6,076	10,500	23	11

Table 5. Wood-based panels production and foreign trade (1,000 m^3) 1995 and 2003.

Country	Production		Exports		Imports	
	1995	2003	1995	2003	1995	2003
Belarus	374	815	54	359	11	190
Bulgaria	233	533	6	280	6	137
Croatia	75	96	25	54	42	230
Czechia	785	1,109	338	727	140	611
Estonia	277	358	249	380	93	152
Hungary	477	608	145	384	82	391
Latvia	236	358	162	291	9	80
Lithuania	156	371	105	191	38	254
Poland	2,434	5,779	451	1,968	313	1,066
Romania	437	765	133	519	46	440
Slovakia	341	438	57	333	30	257
Slovenia	390	364	140	182	85	248
Ukraine	596	1,156	13	283	8	662
Total	6,811	12,750	1,878	5,951	903	4,718
Russia	3,949	6,284	973	1,655	31	910

Table 6. Main kinds of wood-based panels in total of the CEEC in (1,000m^3) 1995 and 2003.

Commodity	Production		Exports		Imports	
	1995	2003	1995	2003	1995	2003
Plywood	704	1,178	380	843	169	486
Fibre board	1,403	3,132	654	1,810	142	1,368
Particle board	4,469	7,978	783	3,101	530	2,735

Table 7. Main kinds of wood-based panels in Russia in (1,000m^3) 1995 and 2003.

Commodity	Production		Exports		Imports	
	1995	2003	1995	2003	1995	2003
Plywood	939	1,960	670	1,201	5	41
Fibre board	748	1,075	134	251	0	260
Particle board	2,206	3,176	169	185	26	605

4. Conclusions

The CEEC are a rather large group of countries at different stages of the transition process to market economy. The countries differ in economic, social, cultural and natural conditions. These differences have still been increasing gradually in the process of transition to market economy because the more economically advanced countries have managed the process more successfully than the less developed ones.

The position of forestry in the countries and in their national economies differs but generally, the forestry share in GDP is not high in most of the CEEC. Nevertheless, the CEEC have an important place in production, processing and foreign trade with roundwood, sawnwood and wood based panels, and other wood products. After the recession in the first half of the 1990s, the forestry and timber processing economy has been going up gradually. The overall current economic situation of forestry is still relatively more stable and better than in agriculture in most of the CEEC. In general, the forestry sector has no economic problems and losses as in agriculture. In some countries, forestry can be considered profitable.

Further prosperity depends mainly on strategic international partners and on domestic markets, especially in the building industry (house building). At present, big international companies occupy the most important position in the market. National producers have been gradually losing the competition –big and medium sized national enterprises have been disappearing. Small enterprises of local importance, with specialist products and services, will mostly resist.

Economic productivity and economic efficiency of timber production and timber processing is more and more affected by increasing public requirements for forest environmental non-market services. Therefore, timber as an environmentally friendly and sustainable material becomes less competitive or even uncompetitive compared to less environmentally friendly materials on the market. Volumes of certified timber products will substantially increase but this process will not solve all the fundamental problems.

All factors worsening the economics of timber production and elaboration must therefore be identified and compensations or purchase of non-market forest services will have to be developed. Otherwise, there will be an increased risk that many subjects disappear from the market and from national economies with all negative socio-economic impacts.

In the near future, production and demand for timber and timber products will gradually rise but exports will not be dramatically higher because of the growing building industry, national economies, and therefore enhanced domestic consumption of timber products in the CEEC markets.

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The Controversial Issue Concerning Chestnut Forests: An Evaluation Using Preferences of Pan-European Criteria of Sustainable Forest Management

Francesco Carbone, Francesco Ciccarella and Antonino Scarelli

Department of Ecology and Sustainable Economic Development, Viterbo, Italy

Abstract

Chestnut forests are important ecosystems in Italy. They cover more than 650,000 hectares and are managed as coppice (58%), high forest (10%) and high forest for fruit (32%). These ecosystems characterise various marginal areas of the Apennine regions.

Chestnut ecosystems are a typical case of a multifunctional forest. Chestnut coppice is specialised for wood, chestnut high forest mix for wood and nuts, and chestnut high forest, nuts only. Environment, amenities and recreation are also relevant services that the chestnut ecosystem provides. All ecosystems could be included as forest according to the National Forest Act.

The aim of the study is to compare preferences from different points of view. Each kind of chestnut ecosystem has been evaluated using criteria obtained from the Pan-European Forest Process of Lisbon (1998). A panel of experts were called upon to express their preferences. The result is a ranking of the different chestnut ecosystems.

Keywords: Mediterranean forest management, environment, coppices, non-wood forest products

1. Introduction

Sweet chestnut (*Castanea sativa* Miller) is a common forest species in Western Europe. It occupies large areas of Italy and France but is also present in Northern Spain and Portugal as well as Greece and Turkey.

In Italy, the chestnut is very common in hilly areas (200–800 m a.s.l.) (Pavari 1982), but also in higher areas. If we consider western Italy, France, (200–1000 m a.s.l.) (Arnaud et al. 1997) and Extremadura, Spain (the western boundary of chestnut ecosystems in Europe), chestnut levels in western Europe can reach as high as 500–1200 m a.s.l. (Rubio et al. 1997).

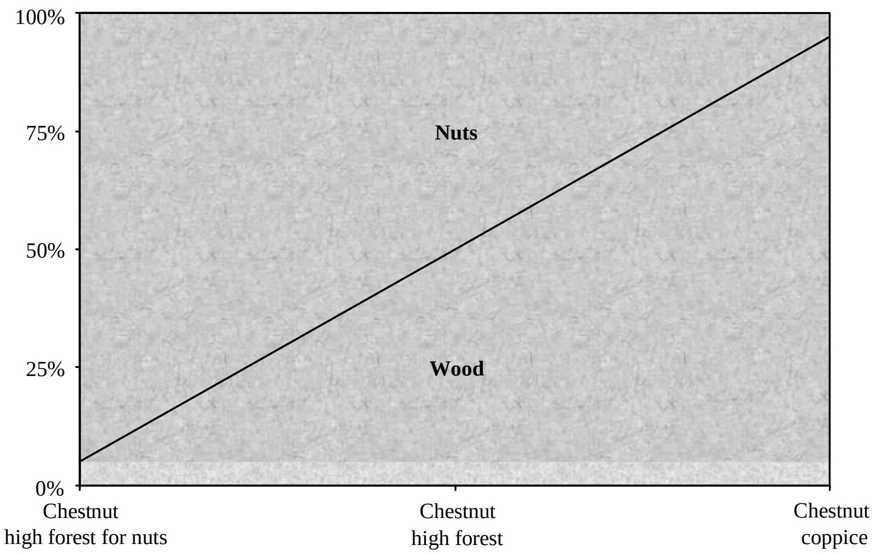

Figure 1. Indicative production of wood and nuts for each chestnut ecosystem, if 100 is the total production.

The chestnut is a typical multipurpose tree. It is used for wood or nuts. It is also managed for encouraging the natural regeneration of mixed broadleaved species (Everard et al. 1995).

Many different silvicultural treatments have been proposed and developed in order to improve the profitability of the chestnut, both from a financial and environmental point of view. According to the level of production (wood and nuts) given 100% the total production of ecosystem (Figure 1), it is possible to distinguish three different ecosystems created by the sweet chestnut:

- chestnut coppice;
- chestnut high forest;
- chestnut high forest for nuts.

Each ecosystem has a different performance from an economic, social and environmental point of view. In general, as far as wood is concerned, preference goes to the chestnut coppice or chestnut high forest, while chestnut high forest for nuts is the best for fruit productions.

Various studies have compared the chestnut coppice with chestnut high forest, considering the chestnut high forest double produce of timber and nuts (Ciancio et al. 1983), and have expressed a preference for high forest instead of coppice in the long-term from an economic point of view. High forest is preferred to coppice for landscape preservation and protection (Gillins 1990). The high forest is also preferable for fire risk reduction, hydrological balance and soil protection (Cucchi 1990).

The chestnut high forest for nuts is a different ecosystem from that of the coppice and high forest. It demands specific treatment, and in a certain way, the chestnut high forest management for fruit is closer to orchard management rather than silvicultural management. Nevertheless, chestnut high forest for nuts is included as forest in the National Forest Act, if the Regional Forest Act has already been included.

Chestnut ecosystems have been examined in the Italian scientific and environmentalist arena. The open issues are: “are chestnuts native to Italy?” and subsequently, “do chestnut ecosystems have to be evaluated as human or natural ecosystems?", and finally "what type of chestnut ecosystem would be preferable from an environmental, landscape, protective, productive point of view?".

The aim of this research is to take part in this discussion, specifically concerning the third question "what type of chestnut ecosystem would be preferable from an environmental, landscape, protective, productive point of view?" It is a typical issue on which optimal combinations of products and services could be obtained by multifunctional ecosystems.

This paper is a first contribution regarding this subject. We briefly present the statistical information about chestnut ecosystems in Italy, and then describe the different ecosystems. Ranking of the three alternatives has been obtained using preferences expressed by a panel of experts.

2. Chestnut ecosystems

The history of the chestnut is very articulated. It was a common forest species in Italy during the Tertiary period. It disappeared during the Wurm glaciations. The Balkans and the Anatolia area, together with the Apennine regions from Liguria to Lazio, were areas hemmed in by chestnuts. (Krebs et al. 2004). Greek and Roman civilizations contributed greatly towards the dissemination of chestnut cultivation on a European scale (Conedera et al. 2004). Human activities increased in the areas where chestnut trees grew, especially during the Middle Ages, for the production of the sweet chestnut. They were appreciated as a food and characterised the diet and economy of rural areas.

Over the last two centuries, chestnut ecosystems have increasingly declined (Arnaud et al. 1997). The chestnut ecosystem areas have also decreased in Italy. Using the available data (Alvisi 1979), in 1876 just less than 500,000 hectares of chestnut were for fruit, and at the end of the 20th century only 209,000 hectares are reported by the official statistic (ISTAT 2000).

A picture of 1980 is reported in the FLA (1983). At that time, less than 682,000 hectares were chestnut ecosystems, of which 317,000 for nuts and 355,000 as chestnut coppice.

A recent study specified that 843,038 hectares are covered by chestnut ecosystems (Blasi et al. 2002).

3. General information concerning chestnut ecosystems

There are great differences among management, environment, employment, production and income for each chestnut ecosystem.

Chestnut coppice

Shoots grow up from stumps, which have a very long lifespan. Frequently, stumps are over 100 years old, and grow more or less 5 generations of shoots.

In Italy, chestnut coppice is wood production oriented. It is the most productive broadleaved forest from the timber point of view. A wide set of wood products are obtained by chestnut coppice. Smaller-sized wood is used in the farming sector, while large pieces of timber are used for furniture, refurbishing old buildings, construction of country houses. Only small quantities of chestnut are used for fuel.

Management is simple. From a theoretical point of view, before the age of 10, many young shoots should be cut, leaving an average of not more than 6-5 shoots per stump; later at 15 years the number will be reduced, on average, to three per stump. Final cutting is around 20 years. Locally, this management can change, usually reducing to one intermediate cut.

Chestnut coppice is a ecosystem with high production performances. The traditional rotation length is not always efficient from the financial point of view. Postponing rotation length by three or four years could achieve better financial results (Spagnoli et al. 2004).

Ring shake of wood production, and forest fire, are the relevant risks of this management change. Ring shake is the most important disadvantage of older chestnut production. Many Italian firms prefer French chestnut wood because it is of larger size and first of all, ring shake risk is less.

Chestnut coppice ecosystem is characterised by low biodiversity value, provided the natural regeneration process, but the ecosystem as a whole has high biodiversity value. From the hydro-geological point of view, chestnut coppice ecosystems could be classified as efficient, also from in terms of carbon sequestration. Coppice chestnuts have a negative landscape impact during the three-five years following clear cutting of the shoots. Chestnut coppice it is not appreciated for recreation activities.

Chestnut high forest

This is an important ecosystem, but it is not frequent in Italy. There are very few chestnut high forests from natural regeneration. Baldini (2005) reported that there are pure chestnut high forests only in Sicily, in the other areas, such as Tuscany, the forest is a mix of old coppice and high forest from natural regeneration.

Chestnut high forest has a long rotation length, 50 to 70 years. There are no specific data on wood production, hypotheses are between 220–260 m^3/ha. Most of the production should be used by timber industries.

At present, in Italy, chestnut high forest could be considered in an experimental way, in order to improve the amount of timber production, and thus reduce timber imports from France. Scientists are confident about the results of chestnut high forest (Cutini 2001; Amorini et al. 1997), instead, operators are worried about the ring shake risk.

Environmental impact: from the biodiversity point of view chestnut high forest is more appreciated, even if the maximum effect is obtained after two or three rotations later. It is very efficient from the hydro-geological point of view, and in carbon sequestration. This type of forest is more appreciated than chestnut coppice for recreation activities. Management produces a periodic negative landscape impact, during the five-ten years after clear felling.

Chestnut high forest for nuts

This is a specific chestnut high forest oriented to fruit production, i.e. nuts. With this aim, the plants can often be grafted in order to obtain a particular variety of nuts. Number of trees per hectare is very low, less than 200, and plants are often very old, more than 200–250 years.

Wood production is for fuel-wood, while annual nut production is about 2–4 t/hectare.

The landowner manages the area to facilitate the gathering of nuts. In some areas special harvesting machinery can be used.

Chestnut high forest for nuts is appreciated for recreational activities. In November, people may gather nuts that have not been harvested by this date, and it is tradition that they can also enter privately-owned forests.

In marginal areas chestnut high forest for nuts is extremely important for employment. In areas where it is impossible to use machinery, or in the small chestnut farms, many people, especially women, are employed to gather nuts.

Financially, the results are strictly linked to the quality of nuts. Chestnut high forest is preferable where nuts are of high quality, and harvesting can be mechanised (Ciccarella et al. 2005).

Table 1. Macro-objective.

Macro-objective
Environmental function Landscape function Protective function Productive function

Table 2. Pan-European forest criteria and general management aims.

Pan-European forest criteria	Code	General management aim of chestnut ecosystems
Maintenance and appropriate enhancement of forest resources and their contribution to global carbon cycles	OG_1	Maintenance and appropriate enhancement of forest resources and their contribution to global carbon cycles
Maintenance of forest ecosystem health and vitality	OG_2	Maintenance of forest ecosystem health and vitality
Maintenance and enhancement of productive functions of forest	OG_9	Maintenance and enhancement of productive functions of forest (wood and non-wood production)
Maintenance, conservation and appropriate enhancement of biological diversity in forest ecosystems	OG_3	Conservation and appropriate enhancement of animal and vegetation diversity
	OG_4	Exploitation of landscape
Maintenance, conservation and appropriate enhancement of protective functions in forest management (principally soil and water)	OG_5	Maintenance and conservation of water
	OG_6	Maintenance, conservation and appropriate enhancement of erosion functions and general protection of land
Maintenance of other socio-economic functions and conditions	OG_8	Contribution to local income and employment
	OG_7	Exploitation of local cultural heritage and traditions

4. Material and method

4.1 Data collection

The research was conducted through questionnaires sent out to a panel of experts. The questionnaire was divided in three sections which:

1) briefly described the chestnut ecosystems;
2) considered the importance of the macro-objectives that the public Authority pursued in the management of chestnut ecosystems (Table 1);
3) considered the importance the landowners pursued in chestnut ecosystem management. Management aims were obtained from the Pan-European criteria of sustainable forest management (Table 2).

Table 3. Re-classification of management aims into the macro-objective.

Macro-objective	Code	General management aim of chestnut ecosystems
Environmental	OG_1	Maintenance and appropriate enhancement of forest resources and their contribution to global carbon cycles
	OG_2	Maintenance of forest ecosystem health and vitality
	OG_3	Conservation and appropriate enhancement of animal and vegetation diversity
Landscape	OG_4	Exploitation of landscape
Protection	OG_5	Maintenance and conservation of water
	OG_6	Maintenance, conservation and appropriate enhancement of erosion functions and general protection of land
Production	OG_7	Exploitation of local cultural heritage and traditions
	OG_8	Contribution to local income and employment
	OG_9	Maintenance and enhancement of productive functions of forest (wood and non-wood production)

Table 4. Importance of the chestnut tree function.

Macro-objective	Questionnaire number											Importance Average
	1	2	3	4	5	6	7	8	9	10	11	
Environmental function	10	30	20	30	25	30	20	20	30	30	18	23.91
Landscape function	10	30	30	20	25	20	20	30	10	15	2	19.27
Protective function	20	10	20	30	25	30	30	20	30	25	40	25.45
Productive function	60	30	30	20	25	20	30	30	30	30	40	31.36

Each management aim has been re-classified according to the macro-objectives of Table 1, as shown in Table 3.

The questionnaire was sent via e-mail to 51 experts. Most work in the University, but others work in the Environmental Offices of Public Administration. All have been involved, directly or indirectly, in the chestnut ecosystem field.

All experts work in the Lazio Region, especially in the province of Viterbo, an area where chestnut trees cover large areas of land managed as coppice and high forest for nuts.

Only 21.56% of the experts involved returned the questionnaires. The data is reported in the table below. Table 4 shows the importance of the various functions. The question submitted to the experts was: “if 100 is the global weight of the macro-objective reported in the table, in your opinion, what is the importance of each one?” Importance must be expressed using a number between 1 and 100, with the constraint that the total of the column must be 100.

Table 5 shows the importance of the chestnut ecosystems for each function expressed by the panel of experts. Concerning the environmental function, the experts had to answer with reference to the different areas (protected areas, Nature 2000 areas and outside environmentally sensitive areas). The question submitted to the experts was: “if 100 is the global importance for all chestnut ecosystems reported in the table, in your opinion, what is

Table 5. Priority of each chestnut ecosystem for each function

Macro-objective	Zone	Chestnut ecosystems	Questionnaire number											
			1	2	3	4	5	6	7	8	9	10	11	Average
Environmental	Protected areas	Chestnut high forest	30	40	30	100	35	50	40	40	40	60	30	45.00
		Chestnut high forest for nuts	40	50	35	0	50	20	40	40	40	25	50	35.45
		Chestnut coppice	30	10	35	0	15	30	20	20	20	15	20	19.55
	Nature 2000 areas	Chestnut high forest	40	40	30	100	35	50	40	40	40	50	30	45.00
		Chestnut high forest for nuts	30	40	40	0	50	20	40	40	40	30	60	35.45
		Chestnut coppice	30	20	30	0	15	30	20	20	20	20	10	19.55
	Outside protected area and Nature 2000 areas	Chestnut high forest	20	40	30	20	35	50	33	40	15	30	20	30.27
		Chestnut high forest for nuts	30	30	30	40	50	20	33	40	45	35	70	38.45
		Chestnut coppice	50	30	40	40	15	30	34	20	40	35	10	31.27
Landscape		Chestnut high forest	20	45	25	30	40	50	40	30	35	60	10	35.00
		Chestnut high forest for nuts	70	45	50	50	10	30	40	50	50	20	80	45.00
		Chestnut coppice	10	10	25	20	50	20	20	20	15	20	10	20.00
Protection		Chestnut high forest	40	30	35	60	34	50	30	25	40	70	15	39.00
		Chestnut high forest for nuts	40	40	25	20	33	30	20	25	20	20	70	31.18
		Chestnut coppice	20	40	40	20	33	20	50	50	40	10	15	30.73
Production		Chestnut high forest	20	30	30	10	45	30	20	30	15	20	20	24.55
		Chestnut high forest for nuts	45	50	40	50	15	20	40	40	40	55	60	41.36
		Chestnut coppice	35	20	30	40	40	50	40	30	45	25	20	34.09

the importance of each ecosystem?" The level of importance had to be expressed using a number from 1 to 100, with the constraint that the total of the column must be 100 for each function. In the questionnaire each macro-objective was a separate table.

Table 6 reports the importance of each management aim landowners pursued in the management of chestnut ecosystems, according to the panel of experts. The question submitted to the experts was: "if 100 is the importance of the management aim reported in the table, in your opinion, what is the importance of each one?" The importance had to be expressed using a number from 1 to 100, with the constraint that the total of the column must be 100.

In Table 7, each management aim was evaluated within the chestnut ecosystems. The question submitted to the experts was: "if 100 is the importance of management aim reported in the table, in your opinion, what is the importance of each chestnut ecosystem?" The importance was expressed using a number from 1 to 100, with the constraint that the total of the column must be 100 for each management aim. In the questionnaire each macro-objective and its management aim was a separate table.

4.2 Method

Ranking of the three management alternatives was obtained by processing the collected data according to the Analytical Hierarchical Problem (AHP) (Saaty 1983). Instead of using the specific software, where preferences should be expressed comparing alternatives in pairs, experts directly expressed the values. This approach was selected because of the low confidence of experts regarding the use of this tool, and of the difficulties in assisting each expert during the answering of the questionnaire.

The ranking index was obtained as a linear combination of weight and importance, articulated for macro-objective and management aims. Three index valuations were elaborated:

a) macro-objective index: $I\_MO = \sum_{j \to 1}^{3} P_i \bullet D_{i,j}$

b) environmental macro-objective index for environmental value of the area:

$I\_EV = p_i \bullet d_{i,k}$

c) management aim index: $I\_MA = \sum_{i \to 1}^{3} p_i \bullet OG_{i,t} \bullet d_{i,t,j}$

Each result has been normalized.

5. Results

The chestnut high forest is the most preferable ecosystem without considering the specific environmental value of the area (average value) (Table 8). Chestnut high forest for nuts is closer to the high forest than the chestnut coppice. The latter ecosystem is far from both.

Preference for the chestnut high forest is more marked when the experts specifically take into consideration the environmental value, such as the protected and Nature 2000 areas. Instead, results change, outside the environmentally sensitive areas, where chestnut high forest for nuts is preferred and chestnut coppice is preferred to the high forest.

Chestnut high forest for nuts is preferred for productive and landscape macro-objectives (Table 9), whereas the chestnut high forest is preferred for environmental and protective

Table 6. Weight of management aim.

Management aims		Questionnaire number											Average weight
		1	2	3	4	5	6	7	8	9	10	11	
OG_1	Maintenance and appropriate enhancement of forest resources and their contribution to global carbon cycles	8	5	13	8.58	3	25	3	5	5		8	8.36
OG_2	Maintenance of forest ecosystem health and vitality	7	15	12	8.57	6	12,5	3	10	15		10	9.91
OG_3	Conservation and appropriate enhancement of animal and vegetation diversity	10	5	8	8.57	3	6,25	4	10	5		10	6.98
OG_4	Exploitation of landscape	10	30	7	8.57	6	6,25	5	10	5		1	8.88
OG_5	Maintenance and conservation of water	15	10	13	8.57	6	6,25	5	5	10		17	9.58
OG_6	Maintenance, conservation and appropriate enhancement of erosion functions and general protection of land	15	10	13	8.57	3	12,5	10	10	20		17	11.91
OG_7	Exploitation of local cultural heritage and traditions	5	10	8	8.57	3	6,25	10	15	10		7	8.28
OG_8	Contribution to local income and employment	15	10	13	20	3	6.25	30	15	20		20	15.23
OG_9	Maintenance and enhancement of productive functions of forest (wood and non-wood production)	15	5	13	20	67	18.75	30	20	10		10	20.88
Total		100	100	100	100	100	100	100	100	100	0	100	

Table 7. Management aim importance for each chestnut ecosystem.

Macro-objective	Management aims		Chestnut ecosystems	Questionnaire number 1	2	3	4	5	6	7	8	9	10	11	Importance Average
Environmental	OG_1	Maintenance and appropriate enhancement of forest resources and their contribution to global carbon cycles	Chestnut high forest	30	30	30	60	33	40	33	30		70	30	38.60
			Chestnut high forest for nuts	50	30	20	10	34	40	33	30		15	40	30.20
			Chestnut coppice	20	40	50	30	33	20	34	40		15	30	31.20
	OG_2	Maintenance of forest ecosystem health and vitality	Chestnut high forest	20	40	25	70	33	50	40	33,34		75	25	41.13
			Chestnut high forest for nuts	20	20	25	10	34	20	20	33,33		15	50	24.73
			Chestnut coppice	60	40	50	20	33	30	40	33,33		10	25	34.13
	OG_3	Conservation and appropriate enhancement of animal and vegetation diversity	Chestnut high forest	25	40	30	80	33	60	40	30		75	20	43.30
			Chestnut high forest for nuts	60	30	20	10	34	10	20	30		15	60	28.90
			Chestnut coppice	15	30	50	10	33	30	40	40		10	20	27.80
Landscape	OG_4	Exploit of landscape	Chestnut high forest	30	30	30	30	33	50	40	30		50	15	33.80
			Chestnut high forest for nuts	50	50	40	40	34	30	40	50		30	70	43.40
			Chestnut coppice	20	20	30	30	33	20	20	20		20	15	22.80
Protection	OG_5	Maintenance and conservation o water	Chestnut high forest	50	30	35	70	33	50	40	30		70	20	42.80
			Chestnut high forest for nuts	30	20	30	10	34	30	20	30		15	60	27.90
			Chestnut coppice	20	50	35	20	33	20	40	40		15	20	29.30
	OG_6	Maintenance, conservation and appropriate enhancement of erosion functions and general protection of land	Chestnut high forest	50	30	30	70	33	50	40	25		75	20	42.30
			Chestnut high forest for nuts	30	20	40	10	34	30	20	25		15	60	28.40
			Chestnut coppice	20	50	30	20	33	20	40	50		10	20	29.30
Production	OG_7	Exploitation of local cultural heritage and traditions	Chestnut high forest	25	30	20	10	20	30	40	25		30	33	26.30
			Chestnut high forest for nuts	50	50	20	60	60	40	30	50		40	34	43.40
			Chestnut coppice	25	20	60	30	20	30	30	25		30	33	30.30
	OG_8	Contribution to local income and employment	Chestnut high forest	25	25	20	20	40	20	30	20		30	33	26.30
			Chestnut high forest for nuts	50	60	40	40	20	40	40	50		35	34	40.90
			Chestnut coppice	25	15	40	40	40	40	30	30		35	33	32.80
	OG_9	Maintenance and enhancement of productive functions of forest (wood and no wood production	Chestnut high forest	30	30	30	30	45	20	33	30		50	20	31.80
			Chestnut high forest for nuts	40	50	30	40	15	30	33	40		30	30	33.80
			Chestnut coppice	30	20	40	30	40	50	34	30		20	50	34.40

Table 8. Ranking of the chestnut ecosystems for different environmental land values.

Environmental macro-objective	Protected areas	Nature 2000 areas	Outside protected and Nature 2000 areas	Average value
Chestnut high forest	45.00%	45.00%.	30.27%	40.09%
Chestnut high forest for nuts	35.45%	35.45%	38.45%	36.45%
Chestnut coppice	19.55%	19.55%	31.27%	23.45%

Table 9. Ranking for macro-objective.

Average					
Chestnut ecosystems	Macro-objectives				Global
	Environmental	Landscape	Protection	Production	index
Chestnut high forest	40.09%	35.00%	38.09%	24.55%	33.73%
Chestnut high forest for nuts	36.45%	45.00%	31.18%	41.36%	38.30%
Chestnut coppice	23.45%	20.00%	30.73%	34.09%	27.98%

Protected areas					
Chestnut ecosystems	Macro-objectives				Global
	Environmental	Landscape	Protection	Production	index
Chestnut high forest	45.00%	35.00%	38.09%	24.55%	34.90%
Chestnut high forest for nuts	35.45%	45.00%	31.18%	41.36%	38.06%
Chestnut coppice	19.55%	20.00%	30.73%	34.09%	27.04%

Nature 2000 areas					
Chestnut ecosystems	Macro-objectives				Global
	Environmental	Landscape	Protection	Production	index
Chestnut high forest	45.00%	35.00%	38.09%	24.55%	34.90%
Chestnut high forest for nuts	35.45%	45.00%	31.18%	41.36%	38.06%
Chestnut coppice	19.55%	20.00%	30.73%	34.09%	27.04%

Outside protected and Nature 2000 areas					
Chestnut ecosystems	Macro-objectives				Global
	Environmental	Landscape	Protection	Production	index
Chestnut high forest	30.27%	35.00%	38.09%	24.55%	31.38%
Chestnut high forest for nuts	38.45%	45.00%	31.18%	41.36%	38.78%
Chestnut coppice	31.27%	20.00%	30.73%	34.09%	29.85%

functions. Coppice is more penalised as an environmental and landscape macro-objective, while it is considered more for protection and production. For the latter, the chestnut high forest is preferred, and follows chestnut for nut production. Considering the macro-objective as a whole, chestnut high forest for nuts is top of the global index ranking.

In the sensitive environmental areas, chestnut high forest and chestnut high forest for nuts

Table 10. Management aims ranking.

Average value	Macro-objective Environmental	Landscape	Protection	Production	Global index
Chestnut high forest	40.89%	33.80%	39.05%	28.89%	33.86%
Chestnut high forest for nuts	27.70%	43.40%	29.88%	38.03%	34.48%
Chestnut coppice	31.41%	22.80%	31.07%	33.09%	31.66%

are closer in the average ranking, even if the former is preferable from an environmental point of view, whereas chestnut nut production is better from a landscape point of view. Generally, coppice is more penalised but is considered more for production and protection.

Outside the protected and Nature 2000 areas, even if the global index shows preference for chestnut high forest for nuts, from the top and bottom alternatives in the ranking, the difference is less than in the previous ranking. Coppice receives better results from an environmental point of view.

In the management aims, the ranking of chestnut high forest for nuts is the best, but the other two alternatives are very close (Table 10).

6. Conclusion

From a methodological point of view, the study was affected on the one hand by the low confidence of the experts in this tool and, on the other, by the difficulties in helping them during the filling in of the questionnaire. The experts directly expressed the weight and preference for each chestnut ecosystem. Ranking of the alternatives has been obtained using a linear combination of the data. In terms of methods, the study is very simple but very transparent.

No chestnut ecosystem was rejected by the experts panel. All ecosystems can exist, but the areas for each one might change with the local macro-objectives. When chestnut ecosystems must be the answer to environmental and protection macro-objectives, chestnut high forest is the best solution; instead, from a landscape and production point of view, chestnut high forest for nuts is the best. Chestnut coppice is always at the bottom of the ranking but better results are obtained outside environmentally sensitive areas.

When all macro-functions are at the same level, chestnut high forest for nuts is the best solution.

Preference for chestnut high forest could be explained by the major environmental value of this ecosystem, and the minor human disturbance in the management programme, according to its long rotation time of more than 50 years. Instead, chestnut high forest for nuts maybe preferred in marginal areas where they significantly contribute in terms of tradition, employment and recreation.

Finally, chestnut coppice may be penalised by the short rotation time of the management programme – usually around 20 years. It is regarded as a high human disturbance of the ecosystems. A longer rotation period could improve their human impact, with better financial performances (Spagnoli et al. 2004).

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Part 5 – Non-market Forest Products and Services – Methodological Issues, Policy and Management Implications

Valuing Environmental Damage: an Integrated Economic Framework[1]

Edi Defrancesco[1], Paolo Rosato[2], Luca Rossetto[1], Alice Candido[3] and Alessandra La Notte[1]

[1]Dept. TeSAF, University of Padova, Italy
[2]Dept. Civil Engineering, University of Trieste, Italy
[3]Dept. DIMEG, University of Padova, Italy

Abstract

Environmental resources valuation is a critical issue, mainly when non-market value elements are relevant. The economics literature suggests the total economic value (TEV) approach as being in line with valuing environmental resources, but robust estimates are required of TEV change, when an environmental damage assessment is needed in order to ask for damage compensation in a court. Currently, for environmental damage claims the valuation methods usually proposed are subject to considerable scrutiny and therefore have to be used carefully. This paper aims to: a) analyse the pro and cons of the different valuation methods under the imputed-revealed-stated-preference economic approaches; b) present a matrix-based framework for environmental damage valuation; and c) establish a link between the proposed procedure and the Italian law on environmental damage claim.

Keywords: natural resources, valuation, environmental damage

1. Theoretical background

Monetary valuation of natural resource losses is a milestone for conservation policies; within this context environmental damage valuation is one of the most important issues of environmental goods assessment.

1 The paper presents some results of a research project on 'Environmental damage evaluation' funded by a grant from the Italian Environmental Protection Agency (APAT).

Environmental damage valuation firstly requires a definition of the ‘environment’ and relationships between environment and economic system, then the definition of the environment economic ‘value’.

For economic valuation purposes, a helpful definition of the environment was given by the European Council and is to be found in the ‘European Union Green Book’ (EU Commission 1993): ‘the environment includes abiotic and biotic natural resources such as air, water, land, fauna and flora, the interaction between these factors and goods that are part of the cultural heritage and characterize the landscape’[2]. The ‘EU White Book’ (EU Commission 2000) stresses this definition, extending it to biodiversity in natural sensitive areas.

The value of the environment can be analysed from different but complementary standpoints (Howe 1990): i) the scientific standpoint, which identifies the role of physical and biological systems; ii) the economic standpoint, which measures the economic value accruing to *homo oeconomicus;* and iii) the social one, which assesses the changes in social welfare. The economic approach, which tries to put a ‘price tag’ on environmental resources, has often been criticised by non-economists. However, this approach is necessary when considering not only the resource market value, but also the monetary measure of welfare losses suffered by individuals through environmental damage.

Regarding the value of the environment, the economics literature agrees on the concept of total economic value (TEV) including both (direct and indirect) use and non-use, or passive, values. These values refer to public goods and services, both human-related and ecological, provided by the natural resources, (Krutilla 1967; Alberini et al. 2004). The TEV that individuals place on an environmental resource, and in particular passive values, depends on: i) damage irreversibility; ii) uncertainty on resource availability for future generations; iii) resource uniqueness. Obviously, the weight of use and passive value losses may be very different, so environmental damage valuation should take into account only public value changes significantly appreciated by society.

Having defined the ‘environment’ and its ‘value’, a theoretical framework for the environmental damage valuation process is then outlined. Formally, the monetary value of the utility losses caused by environmental damage can be derived as follows. Let’s assume the following utility function, U:

$$U = f\left(\mathbf{p}^{x};\mathbf{q}^{k};M\right)$$

were: $\mathbf{p}^{x}$ = vector of market prices of private goods **x**; $\mathbf{q}^{k}$ = vector of environmental goods **k**; M = income.

Let’s assume that individuals enjoy the current level q^{z}_{1} of environmental good *z*, the initial income M_1 and utility level U_1. The utility loss from the reduced provision of an environmental good from q^{z}_{1} to q^{z}_{2} can be measured as a compensating surplus (CS), i.e. the minimum monetary compensation that individuals would accept for bearing the environmental damage and maintaining the initial utility level U_1. By assuming that M_2 is the income level that achieves the initial utility U_1, the compensating surplus can be expressed as:

$$CS = M_2 - M_1 = g\left(\mathbf{p}_1^{x};\mathbf{q}_1^{k\neq z};q_2^{z};U_1\right) - g\left(\mathbf{p}_1^{x};\mathbf{q}_1^{k\neq z};q_1^{z};U_1\right)$$

A logical relation between economic theory and valuation practices supporting any operational decision would then be recognized.

Although the compensating surplus and, thus, the willingness to accept (WTA) a compensation is an appropriate measure of environmental damage, the literature agrees on referring to the willingness to pay-based estimates (WTP) (Bergstrom 1990).

2 In Italian law the principle of environment uniqueness can be found in sentence no. 641/87 of the Constitutional Court: ‘the environment is a unitary intangible asset consisting of various elements, each of which can be separately preserved, while being considered as a whole’.

Environmental damage valuation focuses on relationships between the injured resource and affected individuals, as behaviour and satisfaction level, over time and space. We can distinguish between the case when individuals react to the damage by changing their behaviour aiming to reduce their utility losses, and the case when they do not. In the former case, the welfare losses can be assessed by observing changes in the expenditure function (Nicholson 1995). In the latter, individuals do not change their observable behaviour and their welfare loss has to be assessed by directly valuing their WTP to restore the baseline conditions.

2. Damage valuation methods

Environmental damage valuation can be accomplished by assessing public goods and services provided by injured resources, getting not only use values from human-related or indirect uses (Touaty and Gié 2004; Point 1993), but also passive values. It should firstly be pointed out that, in claiming compensation for environmental damage, robust valuation methods are required to assess both restoration costs and welfare losses.

Methods for valuing environmental damage are reported in Table 1, classifying them according to classic valuation approaches: imputed, revealed and stated preferences (Garrod and Willis 1999; Turner et al. 1994; Gregersen et al. 1997; Touaty and Gié 2004).

Revealed and imputed preferences approaches rely on a market where, through prices or costs, individuals implicitly express their preferences for environmental resources: generally, lower-bound estimates of total welfare losses suffered by individuals can be assessed through changes in their expenditure or production costs. Being market-linked, these methods give more accurate estimates for use value changes, while underestimating the TEV when values are passive.

Imputed preference methods (IPM) estimate an environmental resource damage directly, observing: i) defensive actions (avoiding expenditure, including remedial, clean-up, mitigation, monitoring and assessment costs); ii) spending on restoring the injured environmental resources (restoration cost); iii) actions for substituting harmed resources or services provided by them (substitution cost). The underlying assumption behind IPM is that the welfare losses coming from the environmental damage are at least equal to what affected individuals pay to avoid damage, restore the resource or substitute the injured environmental goods and services provided by it (World Bank 1998). The main advantage of IPM is low valuation cost and short estimation time. Although IPM have been used extensively in valuing environmental damage, they may provide inaccurate estimates as there is no univocal relationship between sustained costs and welfare losses. As a consequence, IPM may underestimate welfare losses because they: i) cannot fully appreciate the welfare changes of all affected individuals; ii) exclude any passive value; and iii) give lower-bound damage estimates, being based on costs. On the other hand, when restoration can take place but its cost is 'excessive' with respect to TEV change, IPM overestimate the damage.

Revealed preference methods (RPM) infer the value of an environmental resource starting from individuals' decisions in real markets. RPM assume that individuals' affected preferences are estimated through market goods and services somehow linked to injured environmental resources. They estimate public goods and services losses provided by the injured resources, linking them to demand for private complementary or substitute goods and services (market price, travel cost or hedonic price). The pros and cons of RPM are similar to those of IPM. Still, RPM can give more accurate estimates but they are usually more data demanding and time consuming (Garrod and Willis 1999).

Table 1. Approaches in valuing environmental resource damages.

Approach	Method	Type of Study
Imputed preferences	Defensive cost Restoration cost Substitution cost	Primary, ad hoc field survey
Revealed preferences	Market price Travel cost Hedonic pricing	Secondary, benefit transfer
Stated preferences	Contingent valuation Conjoin analysis	

The stated preference methods (SPM) are based on the equivalence between welfare losses and the monetary compensation restoring the original utility level. With respect to the previous methods, SPM can be applied to a wide range of environmental damage encompassing all TEV losses. This approach is particularly suitable when irreversible damage occurs and passive value losses are relevant. More specifically, SPM such as contingent valuation or conjoint analysis refer to simulated markets, whereas individuals' WTP are elicited via questionnaire-interviews. The main advantage of SPM is their ability to get TEV changes of the affected resource, but they are relatively more expensive, time consuming and often provide weak and questionable estimates (EU Commission 1996; Amigues et al. 2003; Bonnieux and Rainelli 2002).

Methods for valuing environmental damage can be applied through: i) primary or ad hoc field surveys or ii) secondary studies or benefit transfer. In the first type of study, each resource is valuated through specific surveys. Conversely, benefit transfer is an approach where information on costs or benefits is taken from other comparable sites and fitted to the specific context, lowering assessing costs, saving time and boosting questionability (Loomis 1992; Van Bueren and Bennett 2004).

3. Damage valuation and time

In order to properly valuate an environmental damage, the scale of injury should previously be defined through: i) its geographical distribution; ii) different categories of individuals suffering welfare losses; iii) length of time needed to re-establish, if possible, the baseline conditions of the damaged natural resource ('before the injury') (Howe 1990; Pennisi and Scandizzo 2003). Assessing environmental damage, these three dimensions have to be accurately explored: i) not forgetting relevant elements of damage (e.g. off-site secondary effects, welfare loss of particular individuals' categories); ii) avoiding double-counting errors (Howe 1990; US Federal Register 1996a and 1996b; Ofiara 2002).

Focusing on damage profile over time (Howe 1990; EU Commission 2001; Ofiara 2002; Boyd 2001; Defrancesco et al. 2002), Figure 1 and Figure 2 (depicting a hypothetical profile of different damage elements) distinguish two periods in order to identify the elements concurring in defining the damage monetary compensation. Starting from the moment when the injury occurs (time 0), the two phases are as follows: i) a temporary phase (time 0-n),

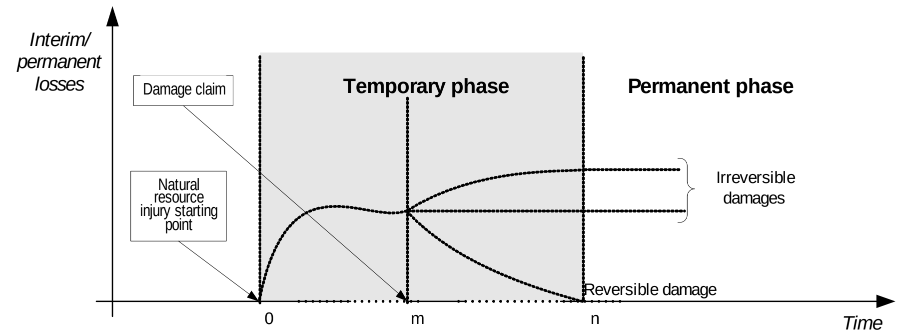


Figure 1. Welfare losses profiles over time (example).

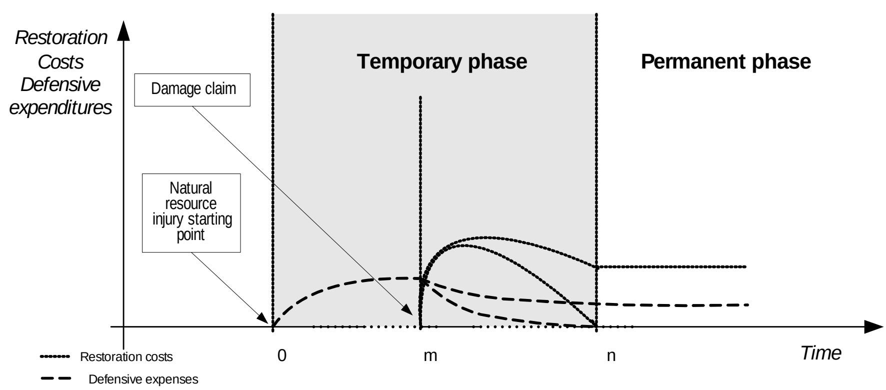


Figure 2. Restoration/substitution costs and averting expenses profiles over time (examples).

during which the damaged resource capacity to provide public goods and services is lower than at the baseline conditions (x-axis) and variable over time. This phase can be split into two sub-periods (0-m) and (m-n). The first of these covers the emerging damage phase, before the claim from the person liable. The second starts at the damage claim moment and ends when injury effects are stabilized and/or full restoration has been undertaken; ii) a permanent phase (n-∞) during which the environmental harm effects are set at zero when the baseline conditions are fully recovered, or the injury impacts on the natural resource are steady beneath the baseline and the yearly damage elements may be considered as stable from n to infinity.

During the temporary phase: i) individuals may suffer interim welfare losses, generally linked to resource public use values and ii) the public can sustain costs to limit the damage and restore the damaged resource or, if restoration is technically or economically infeasible, to substitute it or at least the services provided by it. During the permanent phase individuals yearly welfare changes are permanent and constant over time because of a stable loss or impairment of the public goods and services provided by the damaged resource. In this case both use and passive value losses may be observed. Table 2 summarizes the elements to be taken into account in valuing a monetary compensation for environmental damage,

Table 2. Elements to be considered when valuing environmental damage according to damage reversibility/irreversibility and resource restorability.

		Resource: Restorable	Resource: Not restorable
Damage	Reversible	(1) Defensive expenditures Substitution Costs Restoration costs Temporary welfare losses	(2) Defensive expenditures Substitution Costs Temporary welfare losses
	Irreversible	(3) Defensive expenditures Substitution Costs Restoration costs Temporary welfare losses	(4) Defensive expenditures Substitution Costs Temporary and permanent welfare losses

Table 3. Declining long-term discount rate suggested by the UK Treasury (2003).

Period of years	0–30	31–75	76–125	126–200	201–300	> 300
Discount rate	3.5%	3.0%	2.5%	2.0%	1.5%	1.0%

distinguishing the case where the damage is reversible, i.e. the injured resource can be naturally recovered (Boxes 1 and 2, Table 2), from that where the resource does not spontaneously recover, i.e. irreversible damage occurs (Boxes 3 and 4). In both cases the possibility of activating and/or accelerating natural resource recovery, at a ‘reasonable’ cost by human intervention must also be considered (EU Parliament 2004; EU Commission 2001). In the case of resource restorability (Boxes 1 and 3, Table 2), restoration effects and costs have to be included in the damage valuation. It should be stressed that Table 2 describes a case where the damaged resource provides only one public service. More realistically, intermediate situations may occur when the harm to the natural resource affects the provision of different public goods and services with various profiles over time.

In order to properly estimate the monetary compensation for environmental damage D_m all the relevant elements estimated in the different sub-periods have to be considered[3], taking their present value referred to the time of the damage claim (m):

$$D_m = \sum_{i=0}^{m}(B_i + C_i)(1+r)^{m-i} + \sum_{j=m+1}^{n}(B_j + C_j)\frac{1}{(1+r)^{j-m}} + \frac{(B_k + C_k)}{r}\frac{1}{(1+r)^{n-m}}$$

Where: B_l $(l=i,j,k)$ are yearly individuals’ interim and permanent welfare losses; C_l are costs sustained by the public; r is the social discount rate.

Environmental damage valuation requires the choice of a proper discount rate. The social dimension of value losses asks for a social discount rate. The economics literature agrees on a social discount rate lower than real market interest rates, due to: i) as a whole, society’s time

3 In aggregating the elements concurring at damage quantification, double counting errors have to be avoided. Double counting risk may be high when: i) costs and welfare losses; ii) damage different spatial scales (geographical and among different individuals) are jointly taken into account.

horizon is longer than the length of time considered by individuals when expressing their preferences over time; and ii) lower risk and uncertainty from the society's point of view (with respect to an individual), when risk on future results is taken into account in selecting *r*. The choice of an 'appropriate' social discount rate, ranging from zero (no-discounting) to higher positive values, is still controversial (Fisher and Krutilla 1974; Pearce et al. 2003; Page 1997; Kula 1997; Markandia and Pearce 1994), and significantly affects the value of D_m. This paper lacks the space to adequately summarize the current theoretical and operational debate on social discount rate (Pearce et al. 2003; Gollier 2002; Newel and Pizer 2003; Weizman 1998; Pennisi and Martelli 2000). However, it has to be pointed out that while in the past the same social discount rate was used over the whole timescale covered by the damage valuation, the more recent literature agrees on the choice of a declining *r* as the time horizon increases, at least following an approximated step schedule of rates (Table 3) (Oxera 2002; NOAA 1999).

4. Operational framework for damage valuation

The operating procedure for environmental damage assesment is in five phases (Figure 3). After the initial step when damaging action is detected and, if possible, interrupted, remedial actions such as clean up and mitigation measures are undertaken (step 2). The preliminary damage assessment phase (step 3) starts by identifying the affected ecosystems and the directly damaged resources in order to evaluate harmed human-related and ecological services. After that, a quantification of injury effects is carried out by collecting and processing chemical, physical and biological data in order to identify the spatial extent and magnitude of the damage. As Figure 3 highlights, phase 3 takes into account both direct and secondary effects, i.e. other resources linked to affected primary ecological services. Once the injured resources and lost or impaired public services are identified, the elements concurring in defining the damage can be evaluated. The damage profile across time is identified in step 4 and proper valuation methods are chosen. In the last phase (step 5), monetary compensation to the public for environmental damage results by aggregating the present value of each element, avoiding double counting errors.

A more detailed description is given below of steps 3 (matrix approach) and 4 (choice of valuation methods) according to our operational proposal.

A general framework is proposed to identify injured resources and all public services affected by the damage. It is organised as a set of matrices linking the loss of impaired public services to indicators (expressed in physical, chemical and biological terms) that can outline the damage extent and features. The affected ecosystems are identified first. The ecosystem matrices provide a guideline to identify habitats and specific sub-areas where different injury effects are observed. Recognition of the resources for each specific ecosystem is then done, distinguishing between: i) abiotic resources, e.g. coastal water, river water, soil and air; and ii) biotic resources, including flora and wildlife.

The services provided by resources can be classified according to the value individuals assign to them. On the one hand, services such as demand and production functions are usually considered as use values because of the direct link existing between the damage and affected human activities. On the other, services such as preservation of genetic resources are usually associated with passive values. Finally, ecological services, such as interactions within and between abiotic and biotic resources, are usually associated with indirect use values (Pearce and Moran 1994; Brock and Xepapadeas 2002; Gios and Notaro 2001), even if they often express passive values (Perman et al. 2003). The strict mutual relationship among ecological services may spread damaging effects to environmental resources different from those originally injured. In this case the ecological service valuation should be carefully carried out, avoiding double counting errors.

Here, environmental damage valuation is focused on public services provided by natural resources. Nevertheless, Table 4 reports in italics some private functions which have to be taken into account when they are mixed goods, when they have a relevant public component and when they help a better identification of public services losses. Following the matrix approach, the extent of the injury to each resource is identified and measured by proper environmental services[4] . An example of a river water matrix is reported in Table 4.

Once the damaged resources and injured services have been fully identified and measured, the valuation methods are chosen, as described in the following.

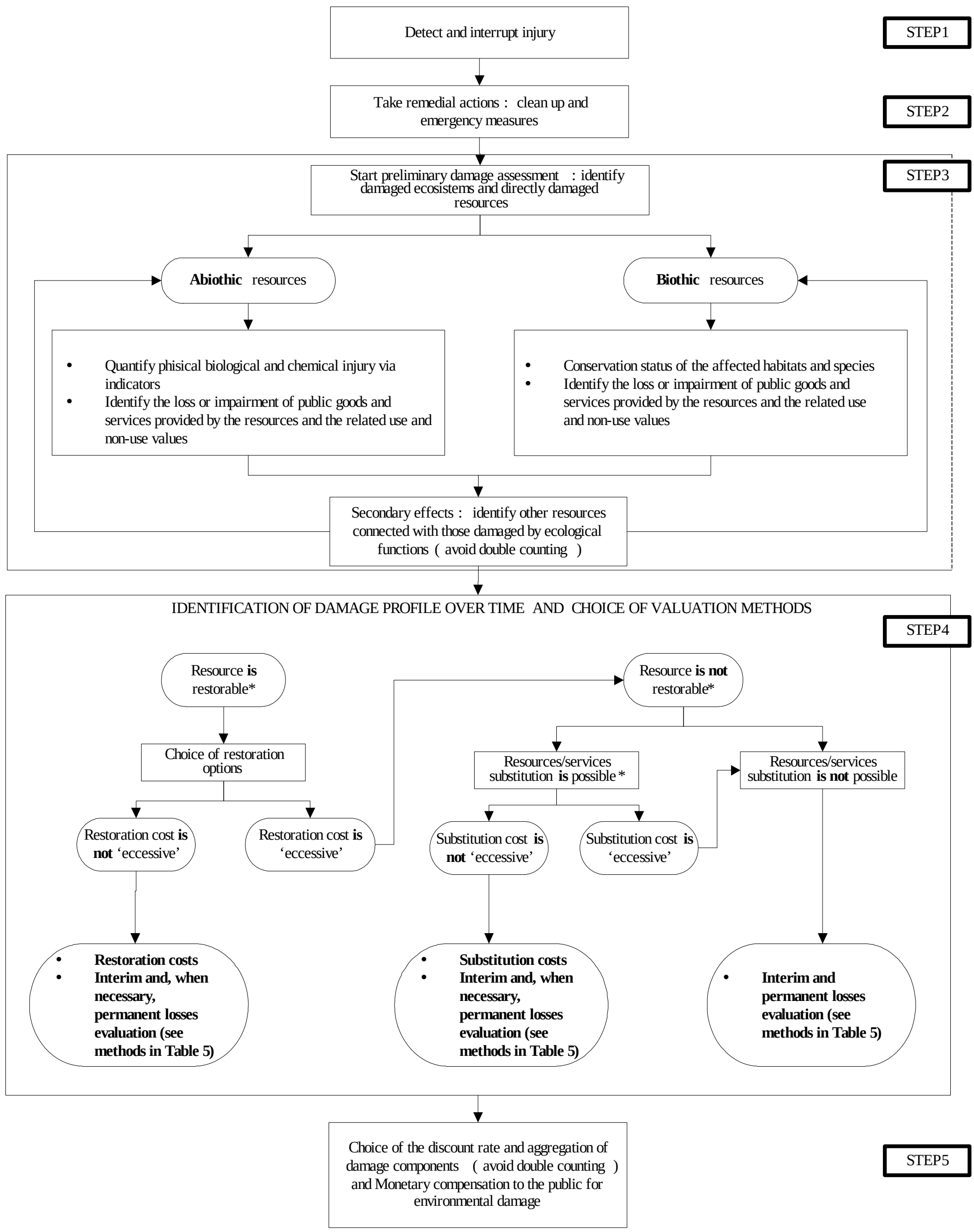
The choice of valuation methods is strictly related to step 4 of the damage assessment procedure shown in Figure 3. First of all, the technical and economical feasibility of the restoration actions has to be considered. When restoration is technically feasible cost-effectiveness and/or cost-benefit analysis may help to choose among different options or to exclude any restoration when costs are 'excessive' if compared with benefits. When restoration is neither technically nor economically feasible, two main alternatives are possible: i) to substitute the injured resources or damaged public services according to the NOAA proposal (1998); ii) to assess only interim and permanent welfare losses when substitution is not possible or unaffordable. It should be pointed out that interim and sometimes, permanent losses, also occur when restoration or substitution actions are undertaken. Table 5 reports general guidelines for choosing proper valuation methods according to the affected functions or services.

Finally, as indicated in step 5, the value of all damage elements are carefully aggregated to avoid double counting errors and adopting a proper social discount rate in order to measure the monetary compensation for environmental damage.

5. Concluding remarks

The paper proposes an integrated economic approach to the multidimensional assessment of compensation for environmental damage. The approach is based on individuals' utility theory and resource TEV. Valuation methods referred to imputed, revealed and stated preferences approaches have been suggested, according to the considered damage elements. This valuation framework accounts not only for the cost sustained to mitigate environmental injury effects and to restore or substitute damaged natural resources, but also for the interim and/or permanent welfare losses suffered by affected individuals, because of a reduced provision of public goods and services. A proper valuation of damage compensation, i.e. including all the 'relevant' damage elements but avoiding double counting errors, can be made following these main steps: i) choosing an approach that breaks down the injury effects into inter-related biotic-abiotic matrices; specifically, these matrices can be useful in establishing a link between the assessment stage, focused on damage identification and quantification as magnitude and scale (e.g. indicators) and the monetary valuation phase; ii) defining each damage element as profiles over time and selecting the proper and robust valuation method for each damage component.

4 There might be some services not easily detectable by resources matrices. Because of their high complexity, these services could be perceived from an ecosystem perspective by using the ecosystem matrix.



* at least partially

Figure 3. Valuation of monetary compensation for environmental damage: operational procedure.

The proposed valuation framework could be adopted for environmental damage compensation valuation under Italian law (Art. 18 Law 349/1986). It offers a via operandi: i) under the so-called compensation valuation according to the 'equivalence' principle (Figure 4), which takes into account both cost and welfare losses; or alternatively, ii) under the approach based on the 'equity' principle, which accounts only for restoration costs and the

Table 4. River Waters Matrix.

VALUE	USE														USE/PASSIVE								PASSIVE				
FUNCTION/ SERVICES	Production									Demand					Ecosystem services												
	Primary sector				*Manufactory Sector*		*Services sector*				Recreation and landscape																
INDICATORS	*Irrigation*	*Livestock*	*Aquaculture*	*Fishing*	*Goods production*	*Energy production*	*Transport*	*Tourism*	Others…	Civil uses	Swimming	Boating	Recreational fishing	Other recreational uses	Others…	Floodwater storage and conveyance	Groundwater recharge and discharge	Shoreline stabilization	Pollution assimilation	Biodiversity storehouse	Nutrient cycling	Habitat for species	Others…	Preservation for future generations	Preservation of genetic resources	Preservation for others	Cultural-Historical	Others..
Drinkable water indicators																												
Swimming indicators																												
Water habitat indicators																												
Water quality indicators																												
Water quantity indicators																												

Table 5. Economic valuation methods for public services losses.

ECONOMIC VALUATION METHODS	FUNCTIONS/SERVICES													
	Production			Demand		Ecosystem services								
	Primary sector	Manufactory sector	Services sector	Public goods	Recreation and landscape	Species habitat	Pollution assimilation	Biodiversity storehouse	Others…	Preservation for future generations	Preservation of genetic resources	Preservation for others	Cultural-Historical	Others..
Defensive expenditure cost	X	x	x	x	x	x	x	x						
Restoration cost[1]						x	x	x						
Substitution cost	x	x	x	x	x	x	x	x						
Market prices	x	x	x	x/X	x									
Hedonic price	x	x	x	x/X	X									
Travel cost					X									
Contingent valuation				x	x	X	X	X		X	X	X	X	
Conjoint Choice analysis[2]				x	x	X	X	X		X	X	X	X	

X = suitable method (first best solution); x = applicable method (second best solution); x/X = the use of the method depends on the specific damaged natural resource and/or on the services provided by it.

1 Method suggested to evaluate ecosystem services losses when restoration is mandatory.
2 Conjoint choice method can even be used to choose the restoration and replacement actions to undertake.

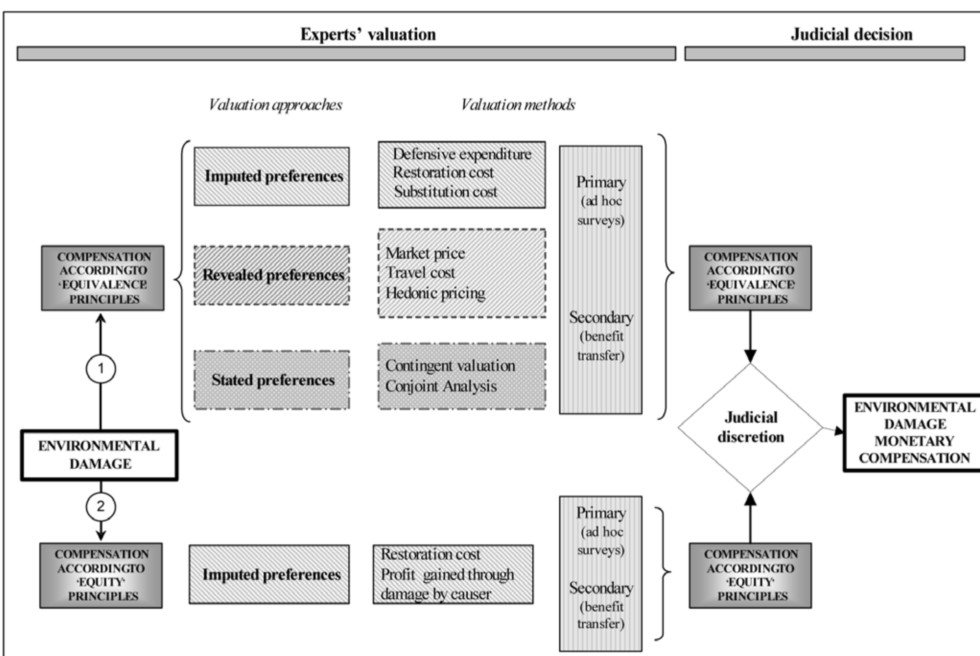


Figure 4. Environmental damage compensation under Art. 18, law 349/1986.

profit gained through the offending action by the person liable. The latter approach has been largely preferred in past claims because it is easy to implement and saves time and money. However, the proposed ‘equivalence’ principle-based approach seems to be in line with the economic theoretical background on environmental damage valuation, so it should be preferred when the cost of the valuation exercise is ‘affordable’ considering all elements concurring in defining the monetary compensation for environmental damage.

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Stated Preferences for Conservation Programmes: Evidence from a Forest in Corsica

Francesco Bonnieux[1], Alain Carpentier[1] and Jean-Christophe Paoli[2]

[1]INRA ESR, Rennes, France
[2]INRA LRDE, Corte, France

Abstract

In order to assess the public's preferences regarding Mediterranean forest protection and management, visitors to the Bonifatu forest in Corsica and people living in the area have been surveyed using two similar questionnaires which combine choice experiment and contingent valuation questions. The interviewees were informed about the need for a protection programme to improve the control of different threats, and were then asked to think about an overall management programme targeting multiple objectives including a diminution of fire hazards, biodiversity conservation, and improvement of the recreational experience.

Empirical results demonstrate that visitors and residents have similar preferences, despite significant socio-economic differences. As expected, the highest priority is given to fire protection. In contrast the preference for the creation of a nature reserve, extending over one-third of the total area and closed to the public, was not expected. Specific actions favouring public access and improved recreational facilities are considered to be of minor importance.

Keywords: forest conservation; choice experiment; contingent valuation

1. Context and issues

Forests provide a range of goods including market commodities such as timber and firewood, as well as recreational and environmental services that are not remunerated. In the Mediterranean area, grazing, marginal agricultural crops (resin, aromatic plants, mushrooms, berries) and hunting can have a prominent share in total output. Otherwise, offering recreational and environmental services is often regarded as a diversification, whereas these benefits can be the main production of some Mediterranean forests. This complex combination of outputs involves very specific management problems that are exacerbated by fire hazards.

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Bonifatu is a typical Mediterranean forest located in Corsica in the steepest water basin of the Figarella River, and extends over 3000 hectares from 300 to 2000 metres in altitude. The dominant species are the maritime pine, Laricio pine and holm oak growing on siliceous soils containing very limited water quantities. However, a series of adverse factors impair tree growth and restrict the development of timber and firewood production. The undergrowth density favours game while herds of mouflon can be watched in the upper areas of the forest where this endangered species is protected. Otherwise it is no longer grazed and flocks of sheep rarely cross it.

The forest is threatened by fire, indeed more than twenty occurred during the last century extending over more than one hundred hectares. The most dramatic one in 1982 destroyed one-third of the total area and killed four hikers. Fire protection comprises a comprehensive set of activities including a clear-cut of the vegetation along the various tracks and around different facilities, the construction and maintenance of reservoirs and firebreaks. The average yearly cost of fire protection programmes in Corsica is 6.3 € per hectare of woodland, which is far less than the direct cost of a fire. Indeed, a conservative estimate of the cost of forest fire-fighting was about 900 € per burnt hectare in 2002, i.e.; 14 € per hectare of woodland.

An old forest road eased wood harvesting, but a large number of Bonifatu forest plots were inaccessible. As a consequence, the burnt wood could not be taken away, even to allow forest regeneration. A new paved road was thus planned in 1983 and completed by late 1988. Road maintenance and depreciation amount to a yearly total of 20.5 € per hectare of woodland. Three crops were gathered in 1987, 1991 and 1998. The first harvest was mostly based on burnt wood, while the others concerned mature trees. The plots of standing timber are sold by the forestry commission, the buyers are lumber firms. The market price results from a Dutch auction with a lower bound. In 1998, two sawmills processed wood, a Corsican one, which produces timber, and an Italian one that produces crates and pallets. According to the local ranger, no other marketable crop is planned over the next fifty years, because of the forest regeneration needs. The forestry commission is in charge of building and maintaining a series of facilities including unpaved tracks, a parking lot, but also recreational facilities such as nature trails, footpaths, picnic areas with a total yearly cost of 22.7 € per hectare of woodland. In conclusion, public expenditure is about 63.5 € per hectare of forest each year.

The forest is close to the shoreline and suffers the pressure of day-trippers who enjoy the cooler temperature and swimming in the Figarella River. There is free access to the forest along the paved road that ends at a parking lot located at 500 metres a.s.l., which is the starting point for several footpaths. The parking charge is 3 € per vehicle in summer. Tourist facilities including a forestry house, restaurant, picnic areas and information points are available nearby. The resulting trend in tourism, there are currently 50,000 thousand visitors in summer, involves a significant increase in fire hazards, while difficult vehicle access and steep slopes reduce the efficiency of firemen’s efforts. Increasing numbers of hikers use the Corsican footpath network and cross the forest during the peak season. The rest of the year most visitors are residents who benefit from recreational activities including walking, hiking, hunting (boar) and mushroom picking.

2. Survey design and questionnaire

In order to assess the general public’s preferences with respect to Bonifatu forest management, residents and visitors were surveyed using two similar questionnaires during summer 2003 (Bonnieux et al. 2004). Questionnaires combine choice experiment and contingent valuation questions.

Choice experiment is an attribute-based method that offers an alternative approach to contingent valuation. It has been extensively applied in marketing and to some extent in transportation economics, and became popular in environmental economics during the last decade (Adamowicz et al. 1999; Louvière et al. 2000). In a choice experiment respondents are presented with a series of programmes, differing in terms of attributes, and asked to choose their most preferred. Because it is an important element to interpret respondents' choices in economic welfare terms, the status quo option is usually proposed in each choice set as it is used as a benchmark.

Choice experiment is particularly suited to dealing with multidimensional changes since its major advantage is that it is possible to evaluate the attributes of interest separately. Although it avoids an explicit elicitation of respondents' willingness-to-pay it involves a crucial cognitive task, which may restrict its implementation in a number of practical cases. Otherwise, it is not free of a number of problems that affect the contingent valuation exercise. Indeed, the hypothetical bias, as well as biases resulting from respondent's behaviour such as free riding or biases due to the payment vehicle are embedded in the survey approach itself and affect all stated preference techniques (Bateman et al. 2002).

The main difference between the two questionnaires concerns the payment vehicle: residents were asked to contribute to a specific fund devoted to forest protection, while visitors were asked their willingness to pay an increased parking fee. Moreover all visitors use the forest whereas some residents are non-users.

The resident questionnaire was administered in 99 face-to-face interviews at home. The sample was randomly selected from the resident population. The visitor questionnaire was administered in 103 face-to-face interviews on-site at the end of the visit. Usual information on socio-economic characteristics, environmental attitudes and outdoors activities of the respondents was collected.

Let us focus on the choice experiment component of the questionnaires. The baseline situation was thoroughly depicted using a series of photographs, figures and maps emphasising the beautiful landscape, wildlife and flora as well as the major threats resulting from tourist pressure and fire hazards. People were then asked to think about an overall management programme targeting multiple objectives including a diminution of fire hazards, biodiversity conservation and an improvement of recreational experience.

Four attributes were described as follows:

Fire protection

- Clear-cut of the vegetation over a strip (at least twenty metres wide) along both sides of existing roads and car tracks, as well as the parking lot, restaurant and other buildings in order to improve public safety and facilitate firemen operations in case of emergency,
- Setting new water facilities (with 100 m^3 reservoirs) and a wide fire-break between the plain and the forest to limit the spread of a possible fire from lowland up to woodland,
- Maintenance of existing firebreaks, possibly by shepherds.

Biodiversity

- Creating a nature reserve extending over one-third of the forest and closed to the public.

Access facilities

- Transferring the parking lot to the edge of the forest and establishing a shuttle system from the entrance.

Recreation opportunities

- Providing more recreational opportunities (nature trails, horse riding, canyonning, rock climbing etc.) and facilities (picnic areas etc.)

The fire protection attribute comprises a comprehensive set of activities whose achievement should lead to a significant decrease in the probability of a fire occurring. The creation of a nature reserve should limit adverse effects resulting from visits to the remoter parts of the forest. Transfer of the parking lot outside the forest would restrict access to vehicles; visitors would therefore either walk or take the shuttle to enjoy the forest experience. While the second and third attributes participate to a decrease in frequenting and fire hazard, the fourth involving an increase in the provision of recreational facilities is likely to adversely impact the environment.

The precise definition of the various attributes results from interviews of a sample of stakeholders, and is based on a pre-test work. It was decided to restrict to two levels for each attribute and consider four levels for the payment vehicle. Respondents were presented with a series of programmes and asked to choose their most preferred, a baseline programme corresponding to the status quo is included in each choice set. Table 1 gives an example of a card shown to visitors; Programme C is associated with the status quo option. Respondents were asked to trade-off changes in attribute levels against the cost of making these changes. However they could opt for the status quo, i.e. no new action at any extra cost to them.

The total number of possible programmes is $4\times(2^4)$ which result in $(64\times63)/2$ choice sets. Each choice set is associated with a specific choice card. Experimental design provides a structure that allows the estimation of the parameters of interest. Due to the limited size of each sample, stratification was not considered and assumptions of zero coefficients were required. Programmes were constructed in order to maintain orthogonality in the attributes, this allows all the main effects to be estimated but all interactions are assumed to be zero. A fractional orthogonal design of 16 programmes was considered and 8 choice cards were finally defined using random procedure. So each respondent had to make eight different choices, which is reasonable as shown by past experience and by the administration of the survey itself.

After making this sequence of choices, people were asked to assess the questions they were asked to answer (quality of the information given, clarity and precision of the wording etc.). This part of the questionnaire was designed to check that people had clearly understood and accepted the exercise. It was also useful to debrief interviewees before turning to the contingent section of the questionnaire, which was a standard one (Bonnieux 1988). People, being familiar with the context and the various actions to be undertaken, were asked their willingness-to-pay to implement a defined programme to protect and maintain the forest as well as welcome the public. The payment card format was used while the same payment vehicles as before were considered. In a second step, they were then asked to distribute this money amount according to the four attributes that were defined in the choice experiment. Finally, as usual a series of follow-up questions were asked to identify the non-response and zero-answer motives.

3. Statistical results

The resident population is older (mean age 49 years) than visitors (mean age 40 years), 29% of residents are over 60 years of age and only 6% of interviewed visitors. The share of pensioners in both samples strengthens this difference, since this category accounts for 28% and 5%

Table 1. Example of choice cards for the visitors.

Actions	Programme A	Programme B	Programme C
Fire protection improvement	YES	YES	NO
Creation of a nature reserve	NO	YES	NO
Transfer of the parking lot	YES	YES	NO
New recreational facilities	YES	YES	NO
Parking fee	6 €	7 €	3 €
Preferred programme			

respectively. The other significant difference concerns the distribution of interviewees according to their occupation, with a large number (67%) of highly-qualified people (managerial and professional occupations or similar) among visitors. Whereas working residents are categorised as small businessmen, self-employed or employees, which amounts to 28% of the sample. An analysis of the distribution of income and formal education level corroborates this – the share of people with at least a college degree is 72% of visitors and 27% of residents.

A significant part of residents (36%) are non-users of the Bonifatu forest. There are a relative limited number (12%) of regular users (at least once a month) in the resident population. Most people (37%) stated that they visited the forest at least six times in 2002, the year before the survey. Recreational activities of residents are ranked as follows: walking and hiking (68% of the sample), swimming (59%), walking along the seashore (48%), mushroom picking (33%), biking (25%), fishing (21%).

Most visitors (97%) take overnight recreation trips and are accommodated in Balagne. One-third come from the Paris area, 23% from Mediterranean regions of continental France, and 13% from foreign countries. People living in Corsica account for 5% of the visitor sample. It is the first visit to Bonifatu for 77% of interviewees. It is associated with a short stay: half-day for one-third and a single day for one-half. During their visit, all visitors had taken a walk linked to nature watching (82%). Picnicking and swimming in the Figarella River are very popular since they concerned two-thirds of the sample, while 22% ate in the local restaurant. Participation in other outdoor activities, including mountain climbing, was very limited.

Visitors strongly agreed with the payment vehicle and were willing to pay a higher fee, while residents were more reluctant to contribute to specific funds. This may to some extent explain why residents were more inclined to opt for the status quo than visitors. Indeed, the status quo was the most preferred programme in 37% of the choices made by residents and 20% of the visitors.

Despite significant differences in respondents' characteristics between the two samples, residents and visitors similarly ranked the attributes of the programmes (Table 2). The priority given to an improvement of fire protection measures was expected, whereas the preference for the creation of a nature reserve was not. Indeed this would imply a banning of the public over one-third of the total area and would therefore significantly reduce the provision of recreational services. Other actions were seen as being relatively less important. A transfer of

Table 2. Attribute occurrences in the most preferred programmes (%).

Attributes	Residents	Visitors
Fire protection	61	81
Biodiversity	46	59
Access facilities	34	51
Recreation opportunities	35	40

the parking lot was ranked in third position by the visitors and in fourth by the residents, while the reverse held for the creation of additional recreational facilities. Here it is interesting to note that the access issue is put on the agenda by a number of stakeholders and that some would favour the provision of recreational services in order to increase tourist frequentation. Thus there are differences between the general public and stakeholders related to the forest management.

There is thus empirical evidence that the respondents considered the status quo as a very specific programme that is not directly comparable with the other competing options. This generates an asymmetry between the baseline situation and the proposed hypothetical options. This issue has been thoroughly considered in contingent valuation (Green and Tunstall 1999; Sugden 1999) where some respondents are shown to provide what is now known as yea-saying responses to questionnaires following a tendency to agree with an interviewer's request regardless of their true views (Couch and Keniston 1960).

4. Estimation of willingness-to-pay

4.1 Residents

The econometric model is derived from a random utility model and consists of a standard conditional logit in which the status quo is considered as a specific programme (Bateman et al. 2002).

Econometric results show that the value of forest development does not significantly depend on the socio-economic characteristics of the residents. This may result from the fact that the underlying population is relatively homogeneous so individual profiles are closed. Although residents state a strong consensus with respect to forest protection and development, some differences between interviewees' preferences exist and are linked to their individual characteristics.

The impact of the fire protection attribute is common to all residents. Only individuals who refused to indicate their income reveal a lower preference for this attribute. These interviewees may reject the valuation exercise because they do not have enough to contribute to forest protection and development.

The variance of the distribution of the values given to the creation of a nature reserve is higher. Both aged residents and forest users dislike this development proposal. This is consistent for frequent users as it will involve constraints to hikers and hunters. It should be noted that people living in Calenzana, the commune where the forest is located, are more favourable to this proposal than people living in Calvi which is about twenty kilometres from

Table 3. Residents' estimation of programme attributes (€).

Attributes	Mean	Median	Percentile 10%	Percentile 90%	Standard deviation
Fire protection	39.5	43.1	18.0	57.3	15.1
Biodiversity	30.8	34.2	1.2	57.8	22.7
Access facilities	-17.8	-16.0	-44.7	3.6	16.8
Recreational opportunities	-11.2	-12.8	-25.3	7.5	13.1

Bonifatu on the seashore. There is an indication that some people from Calenzana consider that the creation of a nature reserve should reveal a public acknowledgement of the value of natural assets belonging to their small community. Otherwise, higher income people are more inclined to favour this proposal.

People, especially forest users, are strongly against the transfer of the parking lot. This is consistent for users since it would generate several constraints due to the implementation of a shuttle system at least during the peak season. Moreover residents reject the development of recreational opportunities that would threaten the pristine features of the forest and lead to a shift in user characteristics.

The most educated interviewees as well as frequent users are less likely to opt for the status quo. The effect of education corroborates the role of cognitive factors in selecting a programme involving a shift from the baseline situation. Frequent users are more willing to state that they 'want to do something' for the forest because it is associated with well-defined uses and values.

The above empirical evidence is corroborated by the econometric estimation of attribute values (Table 3). Fire protection (with a 39.5 € average) and the creation of a nature reserve (with a 30.8 € average) are the most highly valued attributes by the residents. On the contrary, the change in access facilities and development of recreational opportunities are negatively valued, with respectively – 17.8 € and – 11.2 €.

The relatively high values in absolute terms of willingness-to-pay (mean and median) are an indication of a clear statement with respect to the proposed development. However, as shown by percentiles and standard deviations, the range of values is quite wide. This is particularly clear for the biodiversity attribute, for which interviewees' preferences are significantly heterogeneous.

4.2 Visitors

Despite contrasting socio-economic profiles visitors and residents reveal similar preferences related to programme attributes. Visitors are willing to a topup parking fee of 5 € to apply a better fire protection programme, and of 3.2 € to create a nature reserve. The stated preference for fire protection may result from the combination of an increased demand for safety and a strong concern for environmental protection. The latter motive is consistent with the preference for a nature reserve associated with a refusal of the development of recreation opportunities. Visitors are willing to pay between three and four times more for parking in order to jointly improve fire protection and create a nature reserve.

The only difference between residents and visitors is minor as it is related to the ranking of the parking lot transfer and recreation opportunity development. While residents primarily refuse the transfer and then recreation development, visitors do the opposite.

5. Concluding comments

There is evidence that the data collected in these surveys are reliable because interviewers were generally welcomed by concerned people, and interviewees understood the context and issues as shown by the answers to specific questions. So cognitive difficulties were likely limited. The main problem is related to the choice of the status quo programme by a significant number of respondents. This behaviour is documented in the economic literature (Kahneman et al. 1990 and 1991), but is generally ignored in choice experiment research.

The most robust findings are related to the ranking of respondents' preferences. The highest priority is given to a significant improvement of fire protection. The creation of a nature reserve is the second preferred attribute, however this rank results from a majority and not from a consensus as for fire protection. Nevertheless, the stated preference for biodiversity illustrates the value people place on the Bonifatu environmental assets. The clear choice against the development of recreation opportunities (particularly visitors) and parking lot transfer (particularly residents) must be emphasised. Potential disamenities, especially for frequent users among residents, may justify the no-transfer choice. Threats to the environment and a risk of crowds explain why people refuse the development of activities in the forest. For both residents and visitors Bonifatu forest is a valuable natural asset, which must be protected against a number of pressures including too many visits.

The average resident is willing to pay about 39.5 € for fire protection and 30.8 € for a nature reserve, per year and per household. Aggregating these values over the whole of Balagne (6620 households) amounts to 465,386 € per year, or 155 € per hectare of forest and per year. Visitors are willing to pay a high amount to undertake these two programmes, thanks to their high income. Aggregating over the number of vehicles (17,241) that parked during the 1993-summer season amounts to 141,379 €, or 47 € per hectare of forest and per year. Aggregate figures are only simple indicators that must be carefully considered given a number of limitations attached to the validity of surveys, as well as the econometric modelling and estimation exercise. Nevertheless, total willingness-to-pay is far more than the public budget for the forest.

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The Economic Valuation of Non-productive Forest Functions as an Instrument towards Integrated Forest Management[1]

Sandra Notaro[1], Alessandro Paletto[2] and Roberta Raffaelli[1]

[1]Department of Economics, University of Trento, Italy
[2]CRA Forest and Range Management Research Institute of Villazzano, Trento, Italy

Abstract

Actual applications of *Integrated forest management (IFM)* are not very frequent. Lack of information is one of various obstacles to successful IFM. Estimating the economic value of single forest functions enables the forest planner and manager to obtain an accurate picture of the monetary importance of non-productive as well as productive functions.

This paper presents the results of estimating the four main functions (productive, protective, recreational and carbon fixing) of a forest in the Italian Alps. It highlights the relative weight of non–productive functions and the importance of this information for IFM.

Keywords: non-market forest services; economic valuation; integrated forest management

1. Introduction

Merlo's statement (1987) that: "there is a social profitability if forest management is such to produce not only timber but also other social services of unpriced value" is interesting from many points of view. First and foremost Merlo seems to wish to highlight multifunctionality not simply as an intrinsic characteristic of the forest but rather as a product of forest management. Indeed we know that both timber production and non-timber services (NTS), (recreation, hydro-geological protection, biodiversity, wildlife support, etc.) are intimately bound up not only with use rate but also with harvesting patterns, even though in most cases it is difficult to identify the functional ties.

1 This paper is the result of the authors' shared reflections. However the single paragraphs have been written as following: Sandra Notaro wrote 4, 5.1, 5.2, 5.3, 5.4, 6, Alessandro Paletto wrote 2, 3, 5.5, 5.6 and Roberta Raffaelli wrote 1 and 7.

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From another point of view the emphasis placed on "social services of unpriced value" highlights the public or semi-public nature of many services guaranteed by forests. The rapid development of useful approaches to environmental resource evaluation over the past two decades has widened the possibilities of estimating many of the components of forest Total Economic Value (TEV).

This contribution aims to stress how an estimation of some use components of TEV (production, recreation, hydro-geological protection, carbon fixing) may be an important element for forest management.

2. Management theory and forest multi-functionality

The evolution of forest ecosystem management has depended on society's changing interest towards natural resources. Therefore management theories developed over the years have tried to maximise production of the goods and services in greatest demand by the general population.

In the early sixties, when the productive function of forests was of great economic importance, Rupf formulated the "*wake theory*" or "*kielwassertheorie*" (Rupf 1960). This theory was no more than a further elaboration of the theory of functions, which acknowledged forest multi-functionality but valued timber production over and above others. All other functions were considered of "secondary value" in the wake of timber production. The term "wake" comes from the idea that forest management focused on maximising timber production automatically brings about improvement in all the other functions, and therefore of forest multi-functionality (Koch and Kennedy 1991). The great limit to this theory is that it can only be applied in the management of forests with very specific characteristics, generally typical of northern central Europe, but is totally unsuitable for alpine and Mediterranean forests (Merlo and Rojas Briales 2000). In these regions, control of water courses and soil conservation play a primary role that cannot be subordinated to timber production.

Later, two other theories developed from the concept of forest multi-functionality: that of *large-scale segregation* and of *complete integration.* A third, known as the *small-scale segregation theory,* elaborated by Helliwell (1987), lies midway between the two. This consists of the application of *large-scale segregation* to small zones so that apparently the overall forest area would be managed in an integrated way.

The *large-scale segregation theory* (Pearson 1944) divides the area into spatial or time zones. These are designated for one main use to which all other possible uses must then be subordinate, and with which they must not interfere. This method carries the advantage of being easily applicable and reduces possible conflict of use. The most delicate stage obviously consists in identifying the prevailing use, according to the particular characteristics of the area. The theory can be applied by providing for different uses in adjacent sub-areas that together form a complex multiple-use area, or by alternating different uses over time on the same area (Saastamoinen 1982). The first version differs from the *small-scale segregation theory* only in the size of the single forest areas.

The *complete integration theory* (Dana 1943; McArdle 1953) opens the entire area under management to all uses, at the same time. The advantage of this method, if correctly applied, is greater efficiency, with the disadvantage that it is more difficult to apply (Helliwell 1987).

3. The conceptual basis of integrated forest management

Our current concept of *integrated forest management* was developed from the complete integration theory in the mid sixties, with the aim of improving efficiency in forest management. In particular, advice was given during the 1967 Canadian Forestry meeting on how to conduct integrated forest management under multiple-use principles (Jeffrey et al. 1970). Subsequently, the concept was widened during the Annual Congress of Forestry Engineers for the Province of Quebec, with the purpose of promoting forest uses other than timber production (Paille 1971).

The term *integrated resource management* was defined by Smith D.A. in 1970 (Jeffrey et al. 1970) as the application of management strategies aiming to maximise *output* by optimising the use of natural resources, for the benefit of a reference group and its successors. However, only in the early eighties did it became widespread at an international level.

This concept became specifically known in forestry as *integrated forest management* (Erdle 1996) and *integrated forest resource management* (Atkinson 1995). As Filius B.M. (1996) stated, this concept presupposes a form of management that aims to optimise forest functions through their integration. According to the theory of complete integration, which provides the conceptual basis for *integrated forest management*, environmental, social and economical objectives must be maximised at the same time (Kangas and Store 2002). The implications of this kind of management, strictly bound to the decisions of forestry technicians and conducted in most cases from a highly rational viewpoint, have widened over the years to incorporate concepts of sustainability and participatory decision-making. This in turn has given rise to *co-operative integrated forest management*, which presupposes complete integration of forest functions where planning decisions are the fruit of negotiation and conciliation between all the social players involved.

For integrated forest management not to appear simply as resource management with constraints (Carrow 1994), it must meet a series of basic requirements involving the social, economic and environmental fields:

1. Economic requirements (Carrow 1994; Davidson-Hunt et al. 1999):
   - acknowledgement of the potential economic value of all goods and services offered by forests;
   - acknowledgement that although certain forest services have no market price they are still of value for their social function;
   - integration of all these values into forest planning and management;
   - forest planning and management flexibility towards variations in the value of single functions, in response to changing economic, social and environmental priorities.
2. Social requirements (Johnston and Calp 1986):
   - the voluntary involvement of all *stakeholders* in the decision making process, so as to identify objectives and priorities;
   - maximisation of benefits for the local population and in second place to society.
3. Environmental requirements (Johnston and Calp 1986; Benson 1990):
   - application of planning decisions to special management units, fruit of both detailed and large scale analysis (eco-systemic approach);
   - optimised environmental quality in the area under management;
   - use of extensive silvicultural techniques.

This last point is certainly the most controversial: while extensive management is prevalent in Europe, in many non-European contexts intensive forestry management is more efficient

(Bird 1990). The extensive approach is based on naturalistic forestry techniques aiming to reconcile timber production with other forest functions. It concentrates exclusively on indigenous species and natural regeneration, while the intensive approach does not exclude clear felling and artificial regeneration with highly productive crop species (Bird 1990).

In particular, the theoretical vision of extensive integrated management developed by the Canadian school can be translated, in management terms for Alpine forests, into the application of naturalistic forestry principles aiming to foster multifunctionality and encourage natural forest diversity. Indeed it is implicit in the concept of naturalistic forestry that timber extraction for production purposes must be "compatible with the primary objectives of forest care" (Paci 2004: 3), exploiting the production potential of single plants without giving more importance to one function than others.

4. Economic valuation as a steering tool in forest management

The question of expediency, in economic terms, of adopting extensive rather than intensive forest management can be approached by considering the relative monetary value of resources (Benson 1990).

In other words, the total economic value of the forest should be calculated, enabling us to respond to two fundamental requirements of integrated forest management mentioned before i.e. not only attributing a monetary value to all the goods and services provided by the forest, but also evaluating all those services without market price. The results emerging from empirical studies should, as stated by Carrow (1994), be taken into consideration when deciding on forest planning.

At an empirical level, the best way of confirming that environmental benefits turn into economic ones is to compare two estimates, carried out in similar contexts, in order to see how the values vary for single forest functions, and consequently how the total value of the forest in question changes, under different management systems. In particular, intensive management directed primarily to timber production entails high intensity exploitation, and does not exclude the clear felling of small areas and delayed artificial regeneration. This inevitably leads to a reduction in other functions potentially in conflict with timber production, among which tourism-recreation, protection and, to some extent, carbon-fixing.

The negative effects of intensive management on recreation can be seen when visual enjoyment of the forest is compromised by clearings and the absence of sizeable trees, but otherwise users are seen to prefer managed to unmanaged forest (Gianola 1993), where dense undergrowth inhibits easy access to the area. The same can be said for the protective function, particularly where forests directly protect infrastructure or human activities from natural hazards (Motta and Haudemand 1999), where only operations necessary to optimum forest functioning are permitted.

The effect of increased timber removal on carbon fixing is not easy to schematise because of the limited time span of the entire carbon storage process in plants and wood products (Cairns and Meganck 1994). The only reflection we can make is that carbon is stored in standing plants throughout their lifetime plus decomposition, before returning to the atmosphere, while the time carbon is stored in wood products depends on the type of product and its life cycle. Since this is shorter than storage time in a standing plant we must inevitably hypothesise that timber production leads to a decrease in carbon absorption.

Once we are aware that the increased value in timber production is matched by a sizeable decrease in the other functions, it is interesting to find out in terms of both real and potential value which management type is more efficient for the owner and for society as a whole. Only when these values largely converge can owners be motivated to manage their forests actively and sustainably so as to further benefit society. In this light we present the results of a study aimed to evaluate the most important functions of Alpine forests.

5. The economic valuation of the Lavazè forest

5.1 Study area

The area studied is the Lavazè forest in eastern Trentino, on the border between Val di Fiemme and Val d'Ega. At an altitude of just over 1800 m, the Lavazè plateau is part of the upper mountain plain, in an area characterised by conifers, mainly spruce and pines (*Pinus cembra*) but also larches (Gorfer 1977).

The Lavazè area is marked by the relatively gentle morphology of the plain with its glacial lake surrounded by meadows used for alpine grazing. Its woodland consists mainly of mature trees since seedlings germinate with difficulty due to poor drainage and previous improper use of forest resources (Pollini et al. 1998). This poor natural regeneration has led to a lack of young plants, making for an increasingly uneven composition in the development category of the trees. In an attempt to remedy the situation, the latest management plans have encouraged artificial regeneration, planting groups of larches, pines (*Pinus cembra*) and spruce.

The forest overall is healthy and unharmed, though slight damage may be found caused by hoofed animals, clearing operations and weather (Pollini et al. 1998).

The highly recreational use of Lavazè forest, has always had to be considered when planning intervention on the area, so as to interfere as little as possible with its enjoyment by tourists and residents. Naturalistic management has therefore sought to unite economic interests with safeguarding environmental balance.

The forest is partly owned by the municipality of Daiano and partly by the "Magnifica Comunità di Fiemme", for a total forested area of 99.1 hectares.

5.2 Estimate methodology

The economic value of the main functions of Lavazè forest was estimated using the methodology of added functionality.

The first stage was to identify the functions to be evaluated, on the basis of data available: timber production, landscape-recreation, carbon fixing, hydro-geological protection.

The second stage was to determine the best methodology for valuating each of these functions. These proved to be: market value for production and carbon fixing; contingent valuation for landscape-recreation; substitution value for protection.

5.3 Production function

Given the scarcity of non-timber products and wild animals in the area, the valuation of production was limited to timber. Two distinct components were considered: real monetary value, i.e. value of the portion of increment actually used (prescribed cut), and potential monetary value, i.e. value of the unused portion of the increment, constituting an investment in timber capital.

The real monetary value was estimated on the basis of harvest forecasted in the local Management Plan, and on the local real price of wood in 2003. The potential monetary value

Table 1. Timber production in the forest of Lavazè. Adapted from Management Plans for the municipality of Daiano and the "Magnifica Comunità di Fiemme".

Parcel	Owner	Surface area (ha)	Yield (mc/ha)	Current increment (mc/ha)	Harvest (10 years) %	Harvest (10 years) mc/ha
22	Daiano	22.6	302	4.76	13.0	39.3
23	Daiano	19.1	299	4.00	10.0	29.9
56	MCF	24.2	334	5.01	12.3	41.1
57	MCF	33.2	439	4.39	10.3	45.2
Total Average	-	99.1	343	4.54	11.4	38.8

was calculated on unharvested annual increment, valued at 50% of the average price of timber (Merlo and Ruol 1994).

An average 95% of timber harvestable in the Lavazè forest is spruce and 5% pine (*Pinus cembra*). 70% of this is industrial roundwood and 30% wood for packaging. So, the 3.88 m^3/ha of wood harvested on average in a year is: 2.72 m^3/ha industrial roundwood (of which an average 2.58 m^3/ha spruce and 0.14 m^3/ha pine), and 1.16 m^3/ha wood for packaging.

Considering the price of standing trees obtained in 2003 from timber sales in the 4 parcels (see Table 2), the resulting value of industrial roundwood timber is 133.6 euro/ha per year and of packaging timber 23.3 euro/ha per year. Therefore the overall real value is 156.9 euro/ha.

According to the Forestry Management Plans the current average increment is 4.54 m^3/ha with an average use of 3.88 m^3/ha. The estimated potential value of 13.3 euro/ha was calculated on the basis of the portion of annual increase not harvested and left in the forest (0.66 m^3/ha per year) multiplied by 50% of the market value for each component.

Consequently, the overall production value of the Lavazè forest for timber only is 170.2 euro/ha per year.

5.4 Landscape-recreational function

The value of the landscape-recreational function was estimated using the contingent valuation method (Carson 2004; Mitchell and Carson 1989; Gios and Notaro 2001).

On-site interviews were carried out during the summer of 2002. Questionnaires[2] were submitted to a random sample of 724 visitors, 54 of whom refused to reply, giving a return rate of 92.54%.

Interviewees were confronted with a proposed modification in the present management method, whereby the current selective cutting would give way to clear cutting. The main aspect of such a scenario would be the rapid growth of bushes and other spontaneous vegetation in the felling sites, to the detriment of the forest landscape and its natural beauty. It was explained that a change in forest management was however necessary because the high costs of maintaining the area were no longer covered by timber sales. Interviewees were then asked – with a payment card format – if they would be willing to pay an entry ticket to maintain the current method and, as a result, the existing landscape.

2 The content validity of the questionnaire was checked by appealing to a focus group and with a pre-testing.

Table 2. Economic value of production in the forest of Lavazè (source: authors' elaboration).

Component	Species	Quantity (m^3/ha)	Price (€/m^3)	Value per hectare (€/ha year)
Industrial	Spruce (*Picea abies)*	2.58	47.5	122.5
Roundwood	Pine (*Pinus cembra)*	0.14	79.5	11.1
Wood for packaging		1.16	20.0	23.3
Real value		3.88		156.9
Potential value		0.66	20.2	13.3
Total value		4.54		170.2

The first stage in the data processing concerned the identification of protest bids. Protest responses come from people who refuse to assign a monetary value to an environmental resource for ethical reasons or because they believe they have rights towards the goods in question, or because they are convinced that there should be some other party responsible for payment. These constituted 19% of total answers while real zero bids counted for 2.8% of the sample.

We then went on to identify the outliers, who represented 3% of the sample. Diagnostic regressions were used to identify influent observations. The outliers were subsequently eliminated by comparing the WTP for these observations, with the explanatory variables that economic theory and/or consolidated empirical evidence indicate as crucial factors in determining the entity of the offer. Influent observations were rejected when declared WTPs were clearly inconsistent with the variables in consideration (for more details see Notaro and Champ 2001).

We then went on to estimate the average willingness to pay, resulting at € 2.58. In order make the values comparable, this figure was updated to 2003 by applying ISTAT coefficients based on consumer price trends for the families of dependent workers. The resulting value was € 2.64.

The annual value of the landscape and recreational function of the forest varies from € 322 to € 497 per hectare, according to the estimate of the number of visitors (see Table 3).

The content validity of the study, checked with the list drawn up by Bishop and McCollum (1996), was satisfactory. Construct validity was checked through theoretical validity tests, estimating an evaluation curve. Results of the analysis are shown in Table 4.

The corrected relationship (exact sign of the variables with a significant t statistic) between willingness to pay and the socio-economic and attitudinal variables, and the preference variables regarding the resource, constitutes positive evidence of the theoretical validity of the results obtained.

5.5 Carbon fixing function

Carbon fixing was estimated by quantifying the carbon stock in the Lavazè forest in monetary terms, and then estimating annual growth (flow) on the basis of current increment.

In physical terms, thanks to the application of specific forecast models for plant mass and volume, a study conducted on the forests of Lavazè was able to show the quantities of carbon stored in the boles, branches and twigs, crown, dead plant mass and stumps (Fattorini et al.

Table 3. Economic value of the landscape- recreational function of the Lavazè forest.

	Tourists	Annual value (€)	Value per hectare (€/ha per year)
Lowest estimate	12073	31927,05	322,17
Highest estimate	18651	49322,57	497,70

Source: Authors' elaboration

Table 4. Construct validity test.

Variables	Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
(Constant)	0.658	0.844		0.780	0.436
Satisfaction with the area	0.272	0.105	0.110	2.597	0.010
Protection even though costly	0.232	0.103	0.100	2.257	0.024
Protection after economic development	-0.156	0.071	-0.095	-2.212	0.027
Importance of environmental conservation	0.265	0.125	0.093	2.122	0.034
Age	-0.030	0.006	-0.202	-4.604	0.000
N° family members	-0.113	0.072	-0.067	-1.575	0.116
Individual income	1.185E-05	0.000	0.090	1.935	0.054
Free time expenditure	0.000	0.000	0.107	2.325	0.020
Accommodation expenditure	0.001	0.000	0.175	3.921	0.000
Time employed to reach site	0.009	0.002	0.169	3.926	0.000
City or Village	-0.388	0.190	-0.086	-2.036	0.042
Reasons for choice of site	-0.034	0.025	-0.058	-1.392	0.165

Source: Authors' elaboration

2005). The forecast models, seeking to estimate plant mass and volume for each stand and the corresponding total value per surface unit, start with data from the diameter measurements for all trees, taken during the winters of 1996–1997, 1999–2000 and 2004–2005, and corresponding height measurements for a sample of trees (Fattorini et al. 2005). Results show that, on average, the plant biomass of the spruce *(Picea abies)* and pine *(Pinus cembra)* populations in the area contain a carbon *stock* of 217.4 t/ha (see Table 5).

For the average price per tonne of CO_2 equivalent absorbed, we used the value of 5.52 $/t$CO_2$ eq., calculated by Lecocq (2004) for the *Joint Implementation* and *Clean Development Mechanism* in the forestry field, conducted in the first five months of 2004. At present this is the best approximate real price available, given that we are dealing with a virtual market that has only started to take real shape in the last two years. If we consider an average Euro/dollar exchange rate of 1.23 for 2004, this price is € 6.79 per tonne, which when converted into a price per tonne of carbon absorbed corresponds to € 24.89. On the basis of this value we can affirm that the carbon *stock* contained in the Forest of Lavazè has a monetary value of 5.412 €/ha. If we consider an annual increase in fixed carbon of about 3.7 tC/ha, we obtain an annual monetary flow of 92.1€/ha per year.

Table 5. Carbon fixing in the Lavazè forest.

Reference period	Species	Trees per hectare	Basal area (m^2/ha)	Carbon *stock* (tC/ha)	Annual carbon *flow* (tC/ha per year)
1996–1997	spruce	388	53.89	186.68	-
	pine	4	0.44	1.00	-
	Total	392	54.34	187.68	-
1999–2000	spruce	388	55.45	201.06	-
	pine	4	0.47	1.06	-
	Total	392	55,92	202.12	4.81
2004–2005	spruce	388	58.78	216.31	-
	pine	4	0.47	1.10	-
	Total	392	59.25	217.41	3.06

Source: Fattorini et al. 2005

Table 6. Economic value of protection by Lavazè forest.

Type of intervention	Surface area (ha)	Cost (•/m)	Discount rate (%)	Value per hectare (•/ha per year)
			0.5	73.3
Fascines	99.1	23.7	1	139.4
			1.5	199.1

Source: authors' elaboration

5.6 Protection function

The hydro-geological protection function considered in this estimate concerns the general soil protection provided by a forest. According to the Forestry Management Plan, there is no real direct protection for any aspect of human activity such as roads, hiking paths, grazing ground, workman's houses, etc. Data reported in the Plan was confirmed by maps and aerial photos of the area.

The protection function was estimated by substitution value, based on the estimated costs of the building, amortization and upkeep of naturalistic engineering works designed to substitute this function. Since only the general soil protection provided by forest was considered, we opted for extensive operations with low environmental impact such as fascines (20–50 cm diameter bundles of sticks laid or impaled in the ground), laying five per linear metre at a distance of 12 metres between lines. This arrangement, achieving a good compromise in terms of efficiency (Notaro and Paletto 2004), entails 650m development per hectare for a total of 64,415 m. Considering a unit cost of 23.7 €/m (PAT 2004), for 10 years and applying a social discount rate of 1%, we obtain a total value per hectare of 15.405 €/ha and an annual value of 139.4 €/year.

Applying different discount rates, results fall within a *range* of 73 €/ha and 199 €/ha (see Table 6).

6. Analysis of results

The value of the four Lavazè forest functions studied, fruit of a naturalistic silviculture, is:

$V = V_t + V_l + V_c + V_p = 170.2 + 322.2 + 92.1 + 139.4 = 723.9$ €/ha per year

where:
V = total annual value of the four functions;
V_t = timber production value;
V_l = landscape-recreational value;
V_c = carbon fixing value;
V_p = protection value.

The overall value of the four forest functions analysed is 723.9 €/ha. This comes largely from the non-productive functions: 44.5% from landscape-recreation, 19.3% from indirect, general hydro-geological protection, 12.7% from carbon fixing. The remaining 23.5% of use value comes from timber production. Moreover, direct use values (production and landscape-recreation) counting for 68% of the overall value exceed indirect use values (carbon fixing and protection).

Such values may lead us to the conclusion that moving from an extensive to an intensive form of forest management, prioritising timber production, could lead to a decrease in overall economic value due to the diminished value of non-productive functions. In fact we can affirm that a change in management would greatly reduce the landscape-recreation value, since interviewees expressed their willingness to pay to avoid clear felling. However, in order to draw similar conclusions for the other functions we should have data available for an analogous area under intensive management, or more generally we ought to know how values change when the cultivation intensity is modified.

7. Conclusions

Estimating the potential economic value of the most important non-timber functions is a central element to IFM (Kulshreshtha 2001).

TEV estimation enables environmental concerns to be included in economic decision-making by integrating economic and ecological approaches. It could represent a criteria in ranking different forest management options and shed some light on the trade-offs between production and other non-timber functions, a knowledge of which is fundamental to the modelling of multiple criteria decision-making.

Moreover a clear picture of the relative monetary weights of the various functions in play may contribute to building consensus around the opportuneness of moving towards a more integrated approach to forest management and to justifying the considerable effort necessary to implement it.

Despite the numerous difficulties, an IFM approach may prove to be a very useful tool in helping mountain forestry achieve all three components of sustainability and reveal all its multifunctional potential.

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Methods of Evaluating Forests – A Renewable Resource in Croatia

Stjepan Posavec

Faculty of Forestry, University of Zagreb, Croatia

Abstract

The concept of non-wood forest services embraces a multitude of diverse benefits that people obtain from forests. These benefits result from spontaneous effects of forests on the living environment and from activities of people and nature in the field of production and services. These services belong to all members of the society and nobody can purchase them for their sole use. These services are not in the form of clearly defined products which could be evaluated on the market. Therefore, production in forestry, in this sense, cannot follow market laws. For the moment, there is no commonly accepted method of determining the total usable value of forests that would incorporate both market and non-market forest values. This research points to a growing demand for indirect, optional and future values of forests in the Republic of Croatia, as well as to increased awareness of multiple values and uses of this renewable natural resource. The company “Hrvatske šume” d.o.o. Zagreb manages forests and forestland in the Republic of Croatia. In the Republic of Croatia, non-wood forest services are regulated by the Forest Act. Based on the above, research is aimed at determining the evaluation of non-wood services in the area of Slavonija.

Keywords: forest, evaluation methods, multifunction services, forest resources

1. Introduction

A forest is a renewable natural resource whose values are manifested through ecological, sociological and productive functions. Through history, the relationship among these functions has undergone constant changes. Previously, forests represented only the source of timber and timber products, whereas today forests with their multiple functions constitute the basis of the ecosystem. The world currently faces four major ecological threats: the loss of the ozone layer (UV radiation), changing climate (the glasshouse effect), industrial waste, and

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chemicals from waste which gradually pollute groundwater. It is forests with their action that mitigate the negative effects of these factors.

Economic research on monetary (financial) assessment of products from natural environment is still uncertain although considerable progress has been made in this field. Positive economics describes facts and behaviour in economy, while normative economics includes ethical regulations and value judgements. The main disagreements in this respect among economists lie in the field of normative economics precisely because it deals with ethics and value judgements instead of facts (Figurić1996).

The forestry sector in Croatia is well positioned to contribute to the success of the tourist strategy of the Government. Forests and forest land occupy some 43% of the total land area and are recognised not only in the Republic of Croatia but also internationally for their natural qualities and diversity of plant and animal life. Despite the fact that forests and forest land occupy over 40% of the mainland area and their natural qualities and beauty, forests are not sufficiently included in the tourist offer. The geographic spread of forests and their potentials for tourism, especially the growing market for specialist products like eco-tourism and photo safari etc. makes them a suitable vehicle for rural development and employment. This potential cannot be realised without investment in infrastructure, training and collaboration with tourist organisations. Such development would support and be in line with the national tourism strategy.

2. Material and Methods

According to the results of an analysis carried out in the management unit “Gaj” – Našice, non-wood forest values account for the largest part of the value share; yet, they are the most difficult to measure in economic terms. Since there is yet no market for these products, or no supply and demand relationship, it is very hard to evaluate the resource in monetary terms; as a consequence, evaluation is reduced to subjective assessment. However, even this kind of evaluation is better than disregard for this value. In economic terms, non-wood forest functions should represent intangible assets in a balance sheet (under the assumption that a non-wood function is entered into a balance sheet).

A clear distinction should be made between a renewable and a non-renewable resource. Account should also be taken of the danger of one renewable resource becoming a non-renewable one. Putting together monetary and non-monetary values can only be done under certain circumstances. Trends in macro- and micro-economic variables are conditioned by independent variables that are completely different from measurable variables. The value of timber and its demand depend, among other things, on the substitute supply, whereas the landscape value or the erosion control are governed by a set of other variables that are only slightly related to the appearance and efficiency of substitutes. Thus, for example, appraisal of recreational forest values and the values of landscape protection depends much more on the general level of civilization, the size of gross domestic product per capita, habits, cyclic economic trends (growth, decline, recession, crisis, economic boom, and others), infrastructure and population density, than on the price of timber regulated by supply and demand, where other forces play an active part with varying degrees of intensity.

Methodologies of calculating the values of non-wood forest functions are well known and complex. Subjective evaluation involves completely different value calculations. Subjectivity is arbitrary to such an extent that it cannot even be compared to, for example, wine sampling or tea or coffee tasting, which are also sensory operations in which the subjectivity of a professional taster plays a major role (Sabadi 1997).

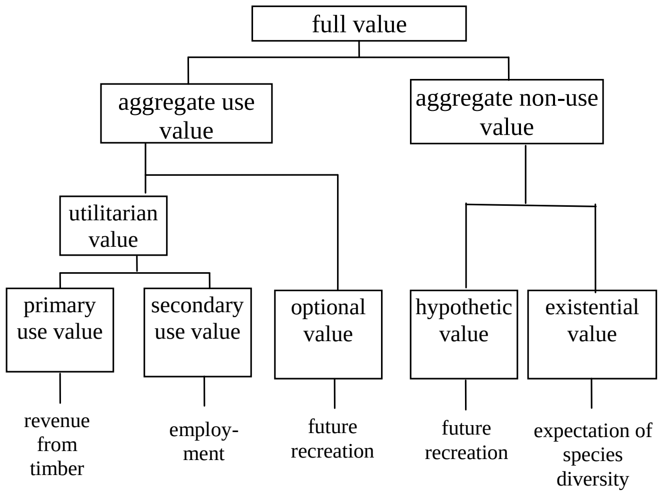

Figure 1. Total economic value of a forest.

Figure 1 shows the elements of the total value of a given stand.

Non-timber forest products, such as mushrooms, forest fruits, honey, medicinal plants, foliage and wild flowers can be a valuable source of revenue for local communities. Compared to other European countries, the non-timber forest products sector is underdeveloped and unregulated. Sustainable forest management also embraces the management of these products (Prpić 1992). Forests in general and forests in the Republic of Croatia in particular are highly beneficial resources and with their natural status have a very significant impact on the environment. Ecologically, forests have a very effective impact on water resources in the region through their hydrological role. Their water protection role is important in the purification and insurance of drinking water, while their anti-erosion and anti-emission impact is reflected through the purification of polluted air. They also influence the climate with their capacity to mitigate weather extremes or increase air humidity in periods of dry season.

2. Research results

An overall economic evaluation of a forest resource comprises the value of all the benefits derived from it. To evaluate the ecosystem of the management unit “Gaj” – Našice, of “Hrvatske Šume” d.o.o., Forest Administration Našice, a large number of use and non-use values were considered. The value of primary use, which includes the growing stock, was calculated by multiplying the existing growing stock with the current market prices. All diameter classes were included. However, a sustainable forest management method was not taken into account. Under the assumption that it were, the annual production (the annual cut) would be multiplied with market prices and the net value of forest production would be obtained by deducting management costs.

Revenue from game management is included in the primary use. A planned harvest for one year relates to full economic capacity in hunting productive areas of this management unit.

The values of game-management and hunting-technical amenities, as well as the value of biotechnical measures used in wildlife diet and additional nutrition have been added. The game-management and hunting-technical amenities are shown in their current condition. The added value of constructing the planned amenities in the future would increase the value of this item. The prices of planned kill do not include additional services, such as guides or hunters' accommodation. The average meat quantity of harvested animals is given, while individual trophy game values were not included. The value of food and supplementary nutrition was not expressed as a cost, as it appears, but as an investment into a hunting ground, which will enable the planned harvest and the ensuing revenue.

Non-wood forest functions in the calculation include wild plants, medicinal herbs, tourism, science and education as component parts of the primary use. Soil protection, flood control, nutrient cycling and ecological functions constitute a part of the secondary use. Values of the secondary use are more difficult to assess than those of the primary use because these values are usually not marketable. Evaluating the anti-erosion function of the soil may include the effects of erosion and mud deposition, as well as the cost of engineering operations aimed at preventing landslides and damage to bridges.

The hydrological value of a forest was calculated on the basis of water utility fee. The positive role of forests and their influence on water relations poses the need to change the current legislation in favour of forests and to exempt the company "Hrvatske Šume" from paying the water protection fee in accordance with the solutions in other West European countries. These means should instead be allocated to the recovery of damaged forest stands. The participation of water management agents in the financing of silviculture and forest protection activities should be considered.

No evaluation was made of the optional use of forest. The optional use of forest is the value which the primary consumers are prepared to pay for the conservation of the assets for future use. A survey should be conducted to find out what the interested citizens are willing to pay to prevent forests from changing their purpose, preserve the growing stock and ensure the future use of secondary forest products.

Non-use value consists of existential and quasi-optional value. Existential value refers to biological diversity, habitat and some threatened species. There is an awareness of a biological value of a habitat, but this value is difficult to assess in economic terms. There are no endangered plant and animal species in the area of this management unit at the moment, but their occurrence should be envisaged and evaluated. Existential values are partly included among the values of non-market forest functions.

The quasi-optional use, as part of non-use value that comprises as yet undiscovered future use of medicinal herbs or genetic material, could be assessed in the future. This should also include the value of products intended for forest regeneration and tree growth, such as forest seed. This value has been derived from the prices of sessile oak forest seed.

The value of forest roads, included among the values of this management unit, was obtained from the average price of forest road construction in the Našice Forest Administration.

The total economic value based on the calculation formula is:

$$V_I = v_s + c_u + v_{sbr} + v_{sp} + v_l + v_h + v_g + v_o$$

V_I = commercial value of a forest
v_s = value of a forest stand
v_{sc} = silvicultural costs
v_{sbr} = value of simple biological reproduction
v_{sp} = value of secondary forest products

v_l = value of forest land
v_h = hydrological value
v_{gm} = value of game management
v_a = value of amenities (less depreciation)

The results of commercial forest value were followed by calculations of the value of non-wood forest functions.

$V_{II} = V1 + v_{nwv}$
V_{II} = total commercial forest value
v_{nwv} = value of non-wood forest functions

Apart from these values, there is also the real market value which can be obtained from a forest and forest land.

The overall value of the management unit ‘Gaj’ Našice was calculated using the previously analyzed and applied combined method of the management unit value assessment. The obtained amount of 5,316,733 euro (398,755,000 kuna) includes non-wood forest values, whereas the amount of 5,562,785 euro (41,720,892 kuna) does not include these values.

According to the data of ‘Hrvatske Šume’, which manages the major proportion of forests and forest land in the Republic of Croatia, the total value of non-wood forest functions was 43.5 billion euro in 2002. The average value of these functions per hectare was 21,878 euro/ha, or 164,085.00 kuna (1 euro = 7.5 kuna). These values are within the limits of the previously calculated values of non-wood forest functions for the MU ‘Gaj’. According to the data from the year 2000, they were abut 200,000 kuna/ha.

The existential and intrinsic value of forests was recognized in Croatia relatively early. As a result, all economic subjects are legally bound to pay 0.07% of their income for non-wood forest functions (NWFF).

4. Conclusions

The value analysis of this management unit serves to demonstrate how difficult it is to fit an ecosystem into a model. It is still not possible to evaluate all forest outputs in exact terms. The unit of value need not be expressed in monetary units. Value may be reduced to so-called common index. Since ecosystems are dynamic bodies, it is very hard to predict their value beforehand with certainty.

To conduct proper evaluation, it is necessary to ensure cooperation among all levels of management in decision-making areas, as well as among managers of renewable natural resources, which include forests, land, water and animals.

By maintaining natural forests over 95% of the territory of state forests, by maintaining and promoting their amenities, by conserving and regenerating forests destroyed with degradation and by preserving biological diversity of landscapes, forest ecosystems and plant and animal species in Croatian forests, Croatian forestry has created the conditions that were recognized as outstanding and awarded the FSC certificate. This is yet another confirmation that forest management in Croatia is economically sustainable, socially responsible and ecologically acceptable.

This multidisciplinary approach gives a new outlook on an overall economic evaluation of renewable natural resources and calls for the adoption of a new management paradigm. To achieve this, a richer economic environment is needed in which capital surplus will be channelled into the preservation of its own life space.

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The Total Economic Value of Italian Forest Landscapes[1]

Tiziano Tempesta[1] and Francesco Marangon[2]

[1]Dept. TeSAF University of Padova, Italy
[2]DSE University of Udine, Italy

Abstract

A contingent valuation (CV) was used to estimate the Total Economic Value (TEV) of Italian forest landscapes. By means of a referendum simulation we attempted to measure the willingness of people to substitute tax cuts with action favouring forest fire prevention. We tested for embedding by carrying out a valuation of woodland for the Colli Euganei Regional Park, for the Veneto region and for Italy as a whole. Although attention should be paid to embedding, results would suggest that CV could help achieve sufficiently reliable estimates for TEV.

Keywords: forest, Total Economic Value, contingent valuation

1. Introduction

Forest landscapes are composed of a variety of ecological systems that provide people with many kinds of benefits. In the last ten years many surveys have been carried out in order to determine the monetary value of goods and services deriving from forest ecosystems (SCBD 2001).

An estimate of Total Economic Value (TEV) for woodland could be used in support of forest conservation policy and may also be able to indicate the social value of damage to woodland caused by illegal activity. Before action can be taken to increase forest surface area and prevent the destruction of woodland, the monetary value of all goods and services provided by woods needs to be quantified. Two methods can be used to estimate the TEV of forest landscapes (SCBD 2001). In the first, the various functions are estimated separately and the total gives an overall value by using both Contingent Valuation (CV) and other traditional appraisal approaches. This was the method used in earlier national research projects (Gios and Goio 2003).

1 This paper was included in the MIUR – PRIN 2003 project entitled "Landscape and environmental actions within the regional rural development policies".

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Although this method has the advantage of using private sector valuation tools, it also has the double drawback of not being able to prevent counting the same value twice and being affected by a considerably subjective choice in the valuation methods used and in the costs included.

An alternative method could be to use only CV. Such an approach, which has been adopted in many international research projects (SCBD 2001; Vincent et al. 1995), would allow us to include nearly all the TEV components in a single estimate. In Italy CV has only been used to estimate the recreational value of woodland, but has never been used to obtain its TEV[2].

The aim of our research was to determine a methodological approach that would allow us to obtain a sufficiently reliable estimate of the value that people give to woodland conservation. In particular, the contingent market design aimed to test the presence of the "embedding" phenomenon. In fact it is well known that the estimation of non use values could be biased by such source of error (Kahneman and Knetsch 1992a and 1992b).

2. The benefits of woodland

The economic value of forests mainly results from the fact that they are able to supply a flow of products and services. Moreover, the benefits of forest ecosystems go beyond timber production. Indeed, from an economic viewpoint, woodlands are a multifunctional goods, since they are capable of producing numerous positive externalities. In an attempt to estimate the economic value of natural ecosystems on a global scale, Costanza et al. (1997) provided a complete review of the benefits generated by natural ecosystems, including forests. They identified 17 different benefit categories and analysed each one of them for every kind of biosystem by means of appropriate parameters. The study revealed that forests can provide various kinds of benefits.

The main benefit derives from value related to direct use. Forests are a source of timber, fruits and even ingredients used in the manufacture of medicines. However, the number of indirect benefits is even greater and they are connected to services provided by the whole ecosystem.

Moreover, forests reduce soil erosion by absorbing water, thus softening the impact of rain on the land. Excessive soil erosion not only interferes with water processes, but also lowers the soil's fertility, hence blocking the normal nutritive and hydrogeological cycles. In addition, forests purify the air by removing lead and other dangerous toxins from the atmosphere; they give protection from insect infestation and help ensure that water quality is good. Since trees are capable of absorbing water, they play an important role in its storage, thus limiting soil water loss through evaporation. Moreover, they are partly responsible for channelling water into natural underground reservoirs. As a result, water flows more regularly and, consequently, there is less danger of flooding in periods of heavy rainfall and water supply is more constant. What is more, forests help regulate both the local and global climate by transpiring and producing oxygen. They also give protection against the devastating effects of atmospheric agents such as wind and hail by acting as windbreaks and creating undulations in the land. In addition, the potential effects of global warming due to the limited absorption of carbon are common knowledge. Lastly, forests provide a suitable environment for the generation and harmonious cohabitation of various species. Therefore, they have an important role in the conservation of biodiversity, which not only benefits science but also tourism, forest culture and folklore.

However, the economic value of woodland does not just depend on the production of the above-mentioned products and services. It also results from the importance that is given to its

2 A series of estimates regarding the recreational value of forest areas, which was compiled in Italy in the 1980s, can be found in Merlo, 1991 p.447. Numerous estimates were also made in the 1990s (Da Pozzo et al. 2003; Marangon et al. 2003; Scarpa et al., 2004, Tempesta, 1996; Tempesta and Thiene 2000).

conservation and the perception of it being a strategic resource for the survival of humanity. In other words, forests not only possess use values, but also conservation (or non-use) values.

According to the indications of the Secretariat of the Convention on Biological Diversity (SCBD 2001), woodland TEV can be divided into the following components:

Use values:
- direct
  - extractive
  - non-extractive
- indirect

Non-use values:
- inherent values
- stewardship
- vicarious

Non-use values are mainly dependent on altruistic behaviour, and differ from use values in so much as there is no physical interaction with the environmental resource. In other words, non-use values will exist if moral satisfaction is the only benefit gained from conserving the resource. Use values can either be direct (when there is willing interaction with the environmental resource) or indirect (when interaction does not result from a deliberate choice). For example, benefits related to the hydrogeological function of woodland are indirect because they are dependent on the place of residence. On the contrary, direct use value results from a deliberate individual choice both as regards allocating production factors (land, capital, work) to various business activities, and allocating relaxation time to various recreational activities, thus spending part of one's income.

TEV is the sum of all the items mentioned above. In theory, CV can capture both use and non-use values. With reference to forests, since very few people gain direct benefit from forestry or from the gathering and sale of products from the undergrowth, the value obtained by using the CV approach is the sum of direct non-extractive use values, indirect use values and non-use values.

3. Research method

In order to estimate TEV a pre-election poll of a referendum was simulated in which voters were asked if they wished to abrogate a law that helped prevent forest fires at a small cost to the taxpayer[3]. In this way it is easy to comprehend the contingent market: a YES vote would simultaneously lead to an increase in the number of forest fires and a reduction in tax paid to cover the cost of preventing fire. On the contrary, should voters vote NO, the law would be maintained and forests would be conserved, but income would be lower.

Given the hypothetical market structure, in order to estimate the demand function for forest landscape conservation we used the dichotomous choice method. We proposed five different tax reductions to five different groups: €51, €154, €258, €361 and €516.

Although the respondent is only asked to express their "willingness to accept" (WTA) and not their "willingness to pay" (WTP), the proposed hypothetical market is sufficiently clear. By voting YES the respondent would accept monetary compensation in the form of lower tax in exchange for less woodland availability. Given the method of payment involved (annual

3 Such an approach produced good results in a previous evaluation of hilly vineyard landscapes (Marangon and Tempesta 2001).

income tax) it is quite unlikely that WTA will regard the acquisition of moral satisfaction, rather than benefits resulting from woodland conservation. Moreover, in principle, embedding should be absent.

It should be said, however, that in the proposed political market willingness to accept is different from that described in literature. This is because in fact the taxpayer is already paying for the benefit, and therefore it would be a case of returning their own money and not increasing income to compensate for the loss of environmental benefits. In other words, since the current level of environmental quality is the result of taxpayer spending, it is evident that lower quality will lead to reduced public spending and less tax. Moreover, the opposite is also true. In this case, respondents will be asked to reallocate their total income (including tax paid) between private goods purchased on the market and public goods produced by the State (the conservation of forest landscapes in this particular case). Since the term "willingness to accept" (WTA) is widely used in literature, we will continue to refer to it in our exposition.

In order to verify if, and to what extent, respondents were able to differentiate their WTA in relation to the amount of forest protection, three split samples were created. The respondents were asked to determine WTA for the prevention of forest fires in:

· the Colli Euganei Regional Park (approx. 4,000 ha) (sample A) ,
· the Veneto region (271,000 ha) (sample B),
· Italy as a whole (6,570,000 ha) (sample C).

It was also intended to verify if giving more information about the effects of fire prevention policy would modify the interviewees' WTA. As a result three different questionnaires were used for each area describing the possible effects of abrogation in more or less detail.

The survey consisted of 534 interviews carried out according to NOAA Panel guidelines (Arrow et al. 1993). Face-to-face interviews took place in the city and province of Padua between February 2000 and April 2001. Just one interviewer was used so as to ensure homogenous data collection.

4. Results

In order to interpret WTA correctly, we first of all estimated a logistic model whose function was to verify whether the information given in the questionnaire and the amount of protected forests influence the WTA (Table 1)[4].

Surprisingly neither the amount of information given, nor the area evaluated seemed to have any effect on the likelihood that a respondent would accept the return of a specific sum of money[5]. The estimated mean WTA for the Veneto region as a whole was generally greater than that for the Colli Euganei Park, which is located in the same region.

However, the estimated mean WTA for the whole of Italy was lower than for both the Colli Euganei Park and the Veneto region. On the other hand, there was little difference in the average and median WTAs for the areas examined. For example, the median WTA was €235.9 a year per family for woodland in the Colli Euganei, €250.3 for woodland in Veneto and €219.3 for woodland in the whole of Italy. These values are not statistically different ($p = 0.05$). Therefore, we can suppose that the respondents were not able to differentiate their WTA in relation to changes in the surface area of protected forests and to the size of the

4 The approach used to investigate the effect of embedding and to see if, and to what extent, an improved description of the good would eliminate embedding is similar to the one suggested by Bennett et al. (1998) and by Blomquist and Whitehead (1998).

5 Brown et al. (1995) obtained a similar result, while Blomquist and Whitehead (1998) found that the degree of information given altered the estimates resulting from CV considerably.

Table 1. Relationship between WTA for the conservation of forest landscapes, conservation area considered (woodland in Veneto and Italy) and information contained in the questionnaire.

Dependent = Prob. NO

-2 Log Likelihood	449.05
Nagelkerke - R^2	0.49
CHI squared	223.69
% responses estimated correctly	76.75

Variable	coefficient	p - values
Constant	2.5095	0.0000
bid (thousands of Lire)	- 0.0056	0.0000
dummy estimated area Veneto	0.2365	0.4119
dummy estimated area Italy	-0.1501	0.6007
dummy questionnaire with average degree of information	-0.1516	0.5939
dummy questionnaire with high degree of information	0.2469	0.3946

potential benefits deriving from forest conservation, especially in the case of the small forest area in the Colli Euganei Regional Park.

In order to understand such evidently incoherent behaviour, we estimated a logistic function that would verify if, and to what extent, WTA was correlated to the aptitude and socio-economic characteristics of the respondents (Table 2).

All the variables are significant (p=0.05) and have the expected sign. WTA increases in relation to income, living or spending one's holiday in the Colli Euganei area, membership of an environmental conservation association and living in the suburbs (in which demand for nature is certainly higher). On the contrary, WTA decreases for people with a low educational level.

We may also note that the correlation among all the variables indicated by Carson et al. (2001) to verify the so-called construct validity was correct and significant.

Hypothesising that the respondents may have referred WTA in general terms to all forests in Italy, and that they may have been unable to give correct estimates for specific Italian forest areas, an estimate of TEV was made for Italian woodland as a whole. Average and median WTA was calculated using the logistic function shown in table 2. In this way, we could correct to a certain extent any bias resulting from the peculiarity of the sample. The model included average national values for: family income; the percentage of people over 20 having only completed primary school education; the percentage of people who are members of environmental conservation associations; and the percentage of people living in the suburbs (a cautious figure of 40%). As a result of this estimate, the median WTA was €202.5 per family a year (95% confidence interval: 174.5 ÷ 248.6), while the average was €208.8 per family a year (95% confidence interval: 179.9 ÷ 256.3). These figures were therefore lower than those obtained for the sample of respondents. The total WTA for all Italian families (thus representing total benefits resulting from woodland conservation) would be €4507.9m/year, corresponding approximately to €665.8/year per hectare of woodland.

In order to estimate the TEV of Italian woodland, the extractive direct benefits of forests would need to be added to this sum, i.e. the addition of timber and undergrowth products. According to the Italian Central Statistics Institute (ISTAT) in 2000 the added value of Italian woodland was €326.2m giving a figure of €46.5/ha. Moreover, it has been estimated that the value of undergrowth products in the Region of Trentino-Alto Adige (Gios and Goio 2003)

Table 2. Model interpreting the factors that affect forest landscape conservation WTA.

Dependent = Prob. NO

-2 Log Likelihood	416.92
Nagelkerke - R^2	0.54
CHI squared	255.81
% responses estimated correctly	77.57

variable	coefficient	p values
Constant	1.6377	0.0000
Bid (thousands of Lire)	-0.0064	0.0000
dummy holidays in the hills	2.0994	0.0067
dummy residence in the suburbs	0.5663	0.0269
dummy primary school education	-1.3291	0.0630
income (millions of Lire)	0.0202	0.0005
dummy members of environmental conservation associations	1.2705	0.0083

and the Region of Friuli Venezia Giulia (Marangon and Gottardo 2001) is between €17.2/ha. and €14.4/ha. The use value from extraction would therefore be €61.9/ha. per year.

The TEV of Italian forest landscapes would be €722.6/ha. per year. However, this figure is higher than that obtained by adding up the value of the different forest functions. Gios and Goio (2003) estimated a TEV of €166/ha. per year for the Trentino-Alto Adige region, while Marangon and Gottardo (2001) estimated a value of €373.7/ha. per year for Friuli Venezia Giulia. Clearly, it is particularly difficult to establish whether the CV estimate is more correct than estimates obtained by other methods. Nevertheless, since the values recorded by Gios and Goio are very different from those of Marangon and Gottardo we probably cannot say a priori that using CV is better or worse than using other approaches.

5. Conclusions

To a certain extent the results of our research can be said to be contradictory. The convergence between the WTAs of woodland in the Veneto region and Italian woodland as a whole is correct: the two simulated referenda refer to two different geographical and administrative contexts. If the referendum takes place at a regional level, only woodland located in that region is evaluated, hence in the case at hand only residents in the Veneto region take part. If the referendum takes place nationally, all Italian woodland is evaluated and it is the whole Italian population that has to pay. Therefore, the WTA of regional residents should be similar in both contexts. Any difference between regional and national evaluation of forest landscapes should only result from the absence of non-extraction direct use value. It is evident that residents in the Veneto region are less likely to be able to use forests in other regions for recreational purposes.

On the contrary, it is far more difficult to explain perfect embedding in the Colli Euganei area. In the questionnaire it was made clear that the referendum involved the Veneto population as a whole, and not just those living in the Colli Euganei. The estimate is clearly wrong because the value per hectare of woodland for the Colli Euganei area, which was obtained after aggregating the WTA of all residents in the Veneto region, is not plausible.

A possible explanation could be linked to the mental accounting phenomenon suggested by Thaler (1985): the respondents may believe that the money already set aside for a specific environmental project through tax corresponds to a sum that they assign for that purpose (or that is allocated by the public authorities on their behalf). According to Thaler, this sum is fixed and does not correspond to the quality and quantity of the goods. The effect of mental accounting could be increased by fairness. In this case a proportion of the respondents may have considered that the sum proposed in the referendum was fair and therefore corresponded to the amount that every citizen should actually pay in order to protect the forests of the Colli Euganei. Consequently, CV should be used to estimate local goods with extreme caution since factors such as perfect embedding are more common in these cases, especially if the goods are of a very symbolic or evocative nature. In order to estimate the TEV of these kinds of goods it would be more appropriate to carry out a wide-scale evaluation and then divide the value obtained for the whole category among all the components of the good.

In conclusion, the results were partly positive and partly negative. A sum of €722.6/ha. per year was obtained for woodland TEV. This figure is higher than the estimates achieved in other studies using private-sector valuation methods (Gios and Goio 2003; Marangon and Gottardo 2001). Although the relationship between recreational benefits, non-use value and indirect use value is in line with similar studies in international literature, the fact that the use of CV may have led to overestimated values cannot be excluded[6]. In any case, we believe that these methods should be experimented at national level, thus reducing the large gap that separates, the Italian experience from the international context in this field.

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Effects of Environmental Benefits from Afforestation on Optimal Harvesting Age in a Mediterranean Marginal Area

Valentina C. Tassone[1,2]*, Justus Wesseler*[1]*, Hans Kros*[3] *and Francesco S. Nesci*[2]

[1] Environmental Economics and Natural Resource Group, Wageningen University, The Netherlands

[2] Department of Agricultural, Forestry and Environmental Science and Technology, University of Reggio Calabria, Italy

[3]Alterra, Green World Research, Soil Science Centre, Wageningen, The Netherlands

Abstract

This study compares the effect of environmental benefits and subsidies under EU afforestation measures on optimal rotation for new multi-purpose plantation forests in Calabria, a Mediterranean marginal area in the South of Italy. The environmental benefits considered are groundwater recharge, soil erosion reduction and carbon sequestration for three types of marginal land such as arable, pasture and non-cultivated land. Results show, if environmental benefits are considered in the economic valuation of forest plantations the optimal rotation age is increased. Environmental benefits can contribute up to 278 €/ha and year for selected tree species. Furthermore, results show that, in terms of groundwater recharge and soil erosion reduction, afforestation of pasture and non-cultivated land, results in a cost to society that can vary between 35 €/ha and 168 €/ha. Afforestation of arable land provides a benefit that can vary between 61 €/ha and 115 €/ha.

Keywords: afforestation; multi-purpose plantation forest; environmental benefits; Faustmann approach

1. Introduction

An important aspect in the analysis of benefits from plantation forests is the choice of the optimal timber extraction. As pointed out by Hartman (1976) information provided by models, such as the Faustmann model, that consider timber benefits only, may be incorrect as the

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inclusion of environmental benefits may change the optimal harvesting age. However, as shown by Bowes and Krutilla (1989) the effect on optimal age depends very much on the kind of environmental benefits that are considered. As indicated by Pearce (1991, 1994) afforestation does not always provide net environmental benefits as the overall impact depends on several factors such as the changes in carbon sequestration, soil erosion, and the water balance.

Since 1992 afforestation of land was supported by the European Union (EU) through Regulation EEC 2080/92 with the objective of controlling agricultural production and providing environmental benefits. In 1999 several rural development measures previously applied, including Regulation EEC 2080/92, were unified in a single legislative document. This was the Regulation EC 1257/99, modified in 2003 by Regulation EC 1783/2003. However these last two legislations do not bring in any new elements in the afforestation measures already implemented through Regulation EEC 2080/92.

By using the data related to the afforestation measures implemented in Calabria under EU Regulation EEC 2080/92, Tassone, Wesseler and Nesci (TWN) in a previous work (2004) analyze the impact of carbon sequestration benefits on the optimal harvesting age of plantation forests. TWN show that the inclusion of carbon sequestration benefits lengthens the optimal rotation age whereas the provision of financial incentives to encourage afforestation as set under EU Regulation EEC 2080/92 shortens it; moreover they show that harvesting choices based upon private interests, especially under a subsidy scheme, can lead to a considerable social loss.

In this study we expand the previous research of TWN by including additional environmental effects provided through afforestation such as groundwater recharge and soil erosion reduction. We compare the optimal rotation age with and without environmental benefits. If the rotation ages do not differ, we can conclude that private incentives comply with social incentives. Social incentives are defined as the optimal rotation age of a plantation forest where private plus net environmental benefits are maximized. When the rotation ages differ, private incentives diverge from social ones. In this case, subsidies can be used to provide private incentives for changing the rotation age towards the socially desirable one. Consequently, we add to our analysis the payment of subsidies as set under Regulation EEC 2080/92 and analyze whether they provide incentives for the private forest owner to meet or at least to come closer to the socially desirable rotation age. Moreover, we show the environmental gains and losses for each environmental effect for three types of marginal land afforested.

The paper is divided into 6 sections. A brief description of the study area and background data is provided in Section 2. An evaluation of environmental benefits from afforestation is given in Section 3. Section 4 deals with the monetary quantification of the estimated environmental benefits. Results and conclusions are presented in Sections 5 and Section 6.

2. Evaluation of environmental benefits from afforestation

To assess the environmental benefits promoted through afforestation, it is important to consider that Calabria is a region with a very complex geological structure and an uneven landscape (Regione Calabria 2000). Therefore, we restrict our analysis to a representative area from the region. The selection of this area was not an easy task as some data indispensable for the analysis such as precipitation and evapotranspiration are only available for some areas of the Calabria region. Considering these aspects the Petrace watershed was chosen with an extension of 407 km^2 and an average altitude of 568 m. (Maione et al. 2002) with cambisol as the main soil type present using the FAO-UNESCO (1981) classification.

According to the data provided by the Calabrian Regional Councillorship (2003), 74% of the total land afforested under Regulation EEC 2080/92 was arable land, 24% pasture land and the remaining 2% was non-cultivated land. In our analysis, we differentiate between these three types of land. As farmers can choose between several trees species for afforestation, three representative species were chosen for this study among the three common types of plantation forests (conifer, walnut and cherry, other broadleaf) that are supported in Calabria under Regulation EEC 2080/92. The selected species are silver fir (*Abies alba*) as a representative species for conifers, walnut (*Juglans regia*) to represent walnut and cherry plantations, and beech (*Fagus sylvatica*) to represent other broadleaves. We include walnut and cherry plantations separately as they are distinct by wood quality, growth rate and ground water recharge from other broad leafs planted in the area.

We evaluate the environmental benefits from groundwater recharge and soil erosion reduction when each of the typology of marginal land considered in the analysis is afforested. We refer only to soil erosion due to rainfall events. The estimation of the amount of groundwater recharge is based on the integrated model DSS (Spatial Decision Support system for effects of afforestation on groundwater recharge on a large scale) developed by Kros et al. (subm.) For the evaluation of soil erosion we refer to the Revised Universal Soil Loss Equation whose factors were calibrated for the study area by Aronica et al. (2002).

2.1 Groundwater recharge

The groundwater recharge (GR) in year (t) calculated for each land use, arable land, pasture, non-cultivated land and forest land and expressed in m^3/ha/yr is the precipitation reaching the ground, the precipitation excess, PE, minus the runoff and equal to:

$$GR(t) = PE(t) \cdot (1 - fr) \cdot \Omega \quad (1)$$

The precipitation excess *PE* in mm/yr, given for each land use type and at each *t*, is multiplied by the hydrological runoff fraction for each land use *fr* and then converted into m^3/ha/yr by using the factor Ω with $\Omega = 10$ m^2/ha. The amount of precipitation excess is the difference between the precipitation and the sum of the rainfall evaporated and caught by the vegetation calculated as follows:

$$PE(t) = P(t) - rfLAI(t) \cdot [IN(t) + EV(t)] \quad (2)$$

$P(t)$ is the precipitation in mm/yr, $IN(t)$ and $EV(t)$ in mm/yr represent the interception of the canopy and the evapotranspiration for each type of land use, $rfLAI(t)$ is a reduction function for the leaf area index (LAI). The interception of the canopy $IN(t)$ is calculated as a fraction (f) of precipitation:

$$IN(t) = f \cdot P(t) \quad (3)$$

where *f* is equal to 0.1 for arable land (grain production), 0.05 for pasture and non-cultivated land and 0.2 for forest land (Kros 2002). In the case of forest land the values given to *IN* and *EV* refer to a mature forest with a stable canopy. In our analysis we consider the life-span of a forest plantation from planting to harvesting and therefore use the leaf area index, *rfLAI,* to correct for a growing canopy till year 40 where we assume the plantations reaches a stable canopy. The age at stable canopy of the forest is different from the age at maturity of the forest, which is assumed to be 100 yr. The $rfLAI(t)$ is equal to 1 in the case of arable land, pasture and non-cultivated land. The leaf area index increases for new forest plantation over time. In the case of forest land the $rfLAI(t)$ can be expressed as:

$$rfLAI(t) = \frac{1}{1+e^{-K_{gl}\left(age_{vg}+t-\frac{1}{3}T_{N1/2}\right)}}, \quad (4)$$

where K_{gl} in (l/yr) is the logistic average growth rate constant of the tree stem, age_{vg} is the initial age of plantation trees planted and t is the current age of the plantation forest. The last term in the brackets, $\frac{1}{3}T_{N1/2}$, reflects the common assumption (Kros 2002) that the life-time for leaves is three times as low as the natural half life-time at maturity, $T_{N1/2}$, for stems, assuming $T_{N1/2}$ to be 50 yr.

For the value of K_{gl} we use general values for a medium class of soil fertility as provided by De Vries et al. (1990) According to these values, K_{gl} is equal to 0.042 1/yr for beech and 0.090 1/yr for fir. As values for walnut are not reported we use the same as for beech. With regard to the initial age of the forest, after examining several projects presented to the Calabrian Regional Councillorship for the afforestation of marginal land under Regulation EEC 2080/92, we found that bedding plants of about 2 years were planted. Therefore, age_{vg} is set equal to two.

The average precipitation, P in the Petrace watershed is equal to 1238 mm/yr. This value is obtained by calculating the mean of the precipitation data of several weather stations in the watershed namely Cittanova, Gioia Tauro, Molochio, Oppido, Palmi, Rizziconi, Santa Cristina d'Aspromonte, Santa Eufemia, Scilla and Sinopoli as provided by Ciancio (1971).The only data available for the study area on evapotranspiration (EV) are those for grassland by Cantore and Pontecorvo (1988). These data are available for various stations within the Petrace watershed. We have thus used the mean value of the EV for grassland in the study area which is equal to 600 mm/yr. In our analysis grassland is not included among the land uses considered, but we assume that the EV of grassland is equal to the one of pasture and non-cultivated land. EV in the case of arable land and forest within the study area will be estimated as a percentage of the EV for pasture and non-cultivated land. According to Kros (2002) EV in the case of arable land is about 38% of that for pasture and non-cultivated land and about 84% for forest land. Therefore, in the Petrace watershed EV is equal to 220 mm/yr for arable land and 500 mm/yr for plantation forests.

To obtain the value for ground water recharge, GR (Eq. 1), once the PE is calculated, it is necessary to calculate the hydrological runoff fraction, fr, where fr represents that fraction of precipitation excess that does not contribute to groundwater recharge. The runoff fractions vary according to various factors such as the type of land use, the soil characteristics, the intensity of precipitation and the slope (Maione 2002: 286). For the choice of the fractions to be used in this analysis we first searched for studies that have been carried out in Calabria. The few studies available e.g. Avolio et al.1980; Ferrari et al. 2002) refer to specific sites with specific conditions and therefore the runoff values vary considerably. This limits the choice of an average value. We therefore decided to use standard values generally accepted within the literature. According to Costantinidis (1981) and Schwab et al. (1955) considering medium condition of soil and slope (10%) the value of the runoff fraction, fr, is for arable land 0.60, pasture 0.36 and forest land 0.35. As data for non-cultivated land are not available we assume that the runoff fraction for this typology of land equals the one for pasture land. At year zero when trees are planted we assume the runoff fraction in the new plantation forests equals the value of the runoff fraction given for arable land (0.60). From there onwards the runoff fraction linearly decreases to 0.35 at year 40 and is assumed to remain constant thereafter.

As a result, the total groundwater recharge for the different types of land use is about 570 mm/yr for agriculture land and 734 mm/yr for pasture and non-cultivated land. For forest plantations from 40 years of age onwards they are about 679 mm/yr for conifers and about 771 mm/yr for broadleaves (walnut and beech). Generally, during the early growth periods trees use more water than any other vegetation. Hence, water recharge in forests during the early years is less than under arable land. In general, the decrease in water recharge is larger when coniferous species than broadleaves are planted.

2.2 Soil erosion

We follow the study by Aronica et al. (2002) to quantify the soil erosion in the Petrace Watershed and assess annual soil erosion at each station and for each of the four typologies of land. We interpret the mean value for each type of land as the mean annual soil erosion $SE(t)$ in the Petrace watershed. The values are 11.35 tons/ha/yr for arable land, 3.50 tons/ha/yr for pasture and non-cultivated land, and 0.13 tons/ha/yr as an average value for forest land. In our analysis, we consider a plantation forest. Thus we assume that at year zero the value of soil erosion for the plantation forest equals the one for arable land (11.35 tons/ha/yr) and linearly decreases till year 40 when it is equal to the value given for a mature forest and remains constant for the following years.

3. Monetary quantification of environmental benefits

3.1 Methodology

This section presents three possible scenarios to estimate the optimal harvesting age T and the corresponding annuity of plantation forests set up through EU afforestation measures in Calabria. We refer to the afforestation measures implemented under Regulation EEC 2080/92 since the application of other subsequent legislations do not bring any relevant changes. We first calculate the optimal rotation age considering timber benefits only. We then add afforestation subsidies and recalculate the optimal harvesting age. Finally, we add environmental benefits.

We assume that all trees are harvested simultaneously, costs, prices of timber, value of environmental benefits, discount rates and growth function of the trees remain constant over time and there are no scale effects. We consider an infinite rotation model. The reader can refer to the previous work by TWN for a detailed description and explanation of private costs and benefits used in the analysis (wood volume data, prices of timber, costs of afforestation, maintenance costs, opportunity costs of land, represented by farmers' loss of income as a consequence of the afforestation of agricultural land, harvesting costs assuming a clear-cut).

Furthermore, the discount rate r applied in this analysis corresponds to the same one used by TWN and is set equal to 5.2%. All results presented refer to the incremental benefits of one ha of afforested land. We differentiate between private benefits, environmental benefits and social benefits (the sum of private and environmental benefits). All scenarios present the incremental net-benefits from afforestation. The opportunity costs of land are included under the annual costs.

- *Scenario A: Private harvesting age - timber benefits only -*
  Optimal private harvesting age, T^*, and corresponding average annual return (annuity) are calculated considering only the benefits of timber sale (Faustmann approach) as presented in TWN using the following objective function:

$$\max_T \{[B_P(T) - C(T)] \cdot CRF\} \quad (5)$$

where $B_p(T)$ are the private benefits and $C(T)$ the private costs over time period T expressed in present value. The terms are multiplied by the Capital Recovery Factor (*CRF*) to obtain the annuity. The discounted value of private benefits is equal to:

$$B_P(T) = P \cdot v(T) \cdot q^{-T} \quad (6)$$

where the price of timber (P) is multiplied by the volume of wood (v) at T and multiplied by the discount factor q^{-T}.

The present value of the costs is calculated as:

$$C(T) = C_h(T) \cdot q^{-T} + \sum_0^T C_p(t) \cdot q^{-t} \quad (7)$$

The harvesting costs, (C_h) at T are discounted by q^{-T}. The annual costs (C_p) include afforestation costs, maintenance costs of woodland and the constant opportunity costs of land. They are discounted by q^{-t} and summed up over T years.

- *Scenario B: Private harvesting age* - *with subsidy* -
  The private benefits include not only timber value but also the subsidies provided under Regulation 2080/92. As set by the Regulation, harvesting is not permitted until 20 years after planting. Considering the constraint T>20 the optimal rotation age and annuity for all plantations are calculated according to

$$\max_T \left\{ \left[B_P(T) - C(T) + S(C,T) \right] \cdot CRF \middle| T > 20 \right\} \quad (8)$$

$S(C,T)$ presents the total amount of subsidies paid out over 20 years in present value terms. The subsidies under EEC 2080/92 cover the establishment and maintenance costs of the timber plantation during the first ten years. They are reimbursed after farmers' have submitted an application. As the subsidies are not independent from planting trees they do affect the optimal rotation rate. In fact, they reduce the optimal rotation rate as benefits at the early age of the forest do increase.

- *Scenario C: Optimal harvesting age* - *with environmental benefits* -
  Optimal rotation age T^* is found by adding environmental benefits $B_E(T)$ to Eq. (5). We thus define the objective function as:

$$\max_T \left\{ \left[B_P(T) + B_E(T) - C(T) \right] \cdot CRF \right\} \quad (9)$$

The present value of environmental benefits is given by:

$$B_E = NPV_{GR}(T) + NPV_{SE}(T) + NPV_{CS}(T) \quad (10)$$

The terms NPV_{GR}, NPV_{ER}, and NPV_{CS} represent the net-present value (NPV) for groundwater recharge, soil erosion reduction and carbon sequestration over time period T, respectively.

Subsidies are not included in Scenario C as they are considered to be income transfers. Furthermore, we also calculate the optimal harvest time considering only one environmental benefit at a time.

Finally, all calculations are made for each land use type and each species considered in the analysis. However, where we do not distinct between values for type of land or species we refer to their mean value.

3.2 Benefits and costs of groundwater recharge

The net present value of the groundwater recharge, NPV_{GR}, at harvesting time T, when afforesting land is equal to:

$$NPV_{GR}(T) = P_{GR}\sum_{0}^{T}\left[\Delta GR(t)\cdot q^{-t}\right] \quad (11)$$

where P_{GR} is the price of groundwater, $\Delta GR(t)$ in m^3/ha/yr the net yearly increase (or decrease) in groundwater recharge due to afforestation and q^{-t} as defined before. In this paper we value groundwater by the price for water from a well. According to the Land Reclamation Cooperative of Reggio Calabria the average market price of water from a well is equal to 0.06 € per cubic meter of water and equals the social price of water.

3.3 Benefits and costs of soil erosion

The net present value of soil erosion reduction NPV_{SE} at T is equal to:

$$NPV_{SE}(T) = \sum_{0}^{T} B_{SE}(t)\cdot q^{-t} \quad (12)$$

where $B_{SE}(t)$ represents the benefits of soil erosion reduction, for each year t, due to afforestation of marginal land.

To show how we proceeded for the estimation of B_{SE} let us assume for a moment that instead of quantifying soil erosion reduction we want to quantify soil erosion. Soil erosion is recognized as a cost to society, however to measure the costs is a controversial issue (e.g. Van Kooten et al. 1989a; Van Kooten et al. 1989b; Van Vuuren and Fox 1989). For the evaluation of soil erosion we need to consider on-site and off-site effects. There are several on-site and off-site damages due to water such as loss of productivity, loss of soil and plant nutrient, textural change, structural damage, field dissection, and sedimentation (Troeh et al. 1991). The main on-site effect is considered to be the loss of agricultural productivity (Miranowski 1984; Van Kooten 1993; Palmquist and Danielson 1989). However, in our analysis, which focuses on the on-site effect data regarding the loss of crop yield are not available for the study region. As an alternative we choose the replacement-cost approach (RCA) as suggested by Hufschmidt et al. (1983) and applied in a number of studies such as Abeygunawardana and Smarakoon (1994) Kim and Dixon (1986) Vieth et al. (2001), to name only a few. The RCA measures the cost of replacing productive assets, in our case the soil, that have been damaged, in our case by erosion. We consider that the process of soil erosion removes a certain amount of soil containing several components required for plant growth (FAO 1986). Consequently, the costs of soil erosion can be calculated by pricing the loss of nutrients, organic matter and soil volume. The benefit of a change in soil erosion $B_{SE}(t)$ in €/ha/yr can be expressed as:

$$B_{SE}(t) = \Delta SER(t)\left[\sum_{j=1}^{n}\left(N_j p_{n_j}\right) + C_f + C_r\right] \quad (13)$$

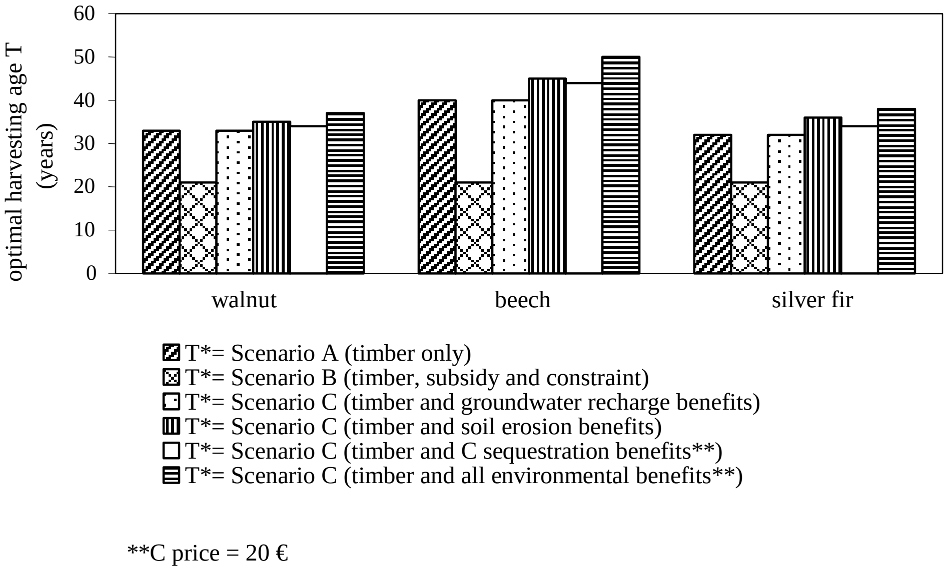

Figure 1. Optimal harvesting age $T*$ under different scenarios.

where $\Delta SER(t)$ is the change in soil erosion in t/ha/yr multiplied by the value of a ton of soil, the terms in the brackets. The value of a unit of soil is the sum of the soil organic matter and the soil nutrients per unit of soil, multiplied by the market price, $\sum_{j=0}^{n}\left(N_j p_{n_j}\right)$, plus the costs for replacing the soil including freight, C_f, and spreading costs, C_s. N_j for $j = 1, \ldots, n$ is defined as $N_j \equiv n_j \cdot \rho \cdot \phi$ for $j = 1, \ldots, n$ with n_j representing the content of the n^{th} nutrient in mg/liter of soil multiplied by the bulk density factor ρ of ρ=1.5 kg/l and converted into kg/ton by using the factor ϕ= 1000. N_j for $j = 0$ is defined as $N_j \equiv n_0 \Phi$ and provides the contents of organic matter in mg/kg of soil again converted into kg/ton by using factor ϕ. We use for n_j, $j = 1, \ldots n$ and N_0 data published by FAO (Sillanpää 1982). For the content of phosphorus, potassium, magnesium, and calcium we refer to average values given for a Cambisol. These values are equal to 29.5, 179.0, 271.0, 2549.0 mg/litre of soil respectively. The data for nitrogen content in a Cambisol are missing; we use therefore an average value for nitrogen for all soil types in Italy equal to 2674.5 mg/litre of soil. The content of organic matter, n_0, in a Cambisol is equal to $58 \cdot 10^3$ mg/kg of soil. Finally, data regarding average prices of nutrients, organic matter, replacing costs of fertilizer and soil are those used in several projects presented lately at the Calabrian Regional Councillorship of Agriculture (2002). The p_j is equal to 0.15, 0.31, 0.60, 0.30, 0.15 and 0.25 €/kg for phosphorus, potassium, magnesium, calcium, nitrogen and organic matter, respectively. The values for C_f and C_r are equal to 0.05 €/kg and 10 €/ton respectively. Using these data the value of a ton of soil can be calculated. The annual soil erosion reduction, $\Delta SER(t)$, is the difference between the mean annual soil erosion $SE(t)$ from afforested land and from land, differentiated by land use, before afforestation.

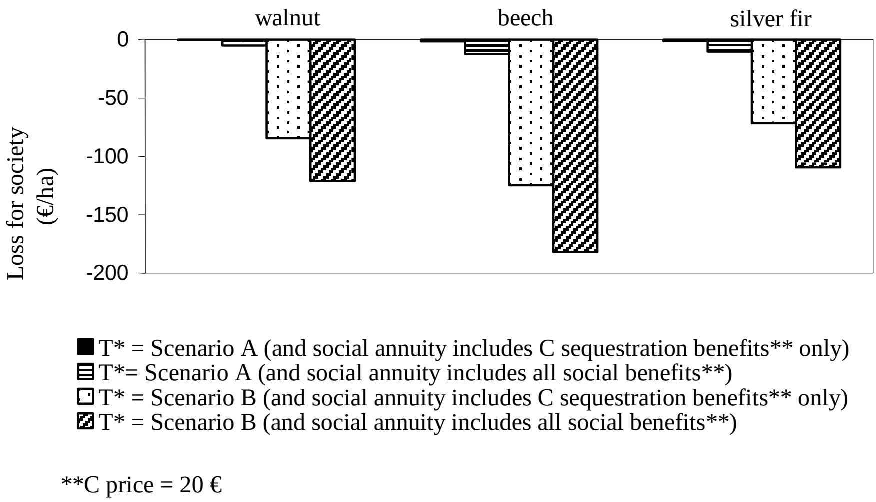

Figure 2. Losses when *T** is set according to Scenario A or B.

4. Results

Figure 1 shows the optimal rotation age under the different scenarios. Under Scenario A the optimal harvesting age *T** is equal to 33, 40 and 32 years for walnut, beech and silver fir, respectively. If the subsidies under Regulation EEC 2080/92 (Scenario B) are added the optimal rotation age is shortened to 21 years for all species. Including environmental benefits (Scenario C) lengthens the rotation age for each species. The optimal rotation age shifts to 37, 50 and 38 years, respectively. The private and the social optimal rotation ages differ and consequently, private incentives do not meet the socially desirable outcome.

The difference between the private and social optimal rotation ages increase under the subsidy scheme as do the social losses as shown Figure 2. Considering carbon sequestration benefits only, the difference between Scenario A and Scenario C is about 0.2 €/ha and year when afforesting with walnut, 1.4 €/ha and year when afforesting with beech and 1 €/ha and year when afforesting with silver fir. If all environmental benefits are considered, the differences increase to about 5 €/ha, 12 €/ha and 10 €/ha and year, respectively. The social losses due to a private optimal rotation rate and the socially desirable one are small. When the rotation age is set according to Scenario B, the social losses increase substantially. When considering only carbon sequestration benefits, the losses are equal to approximately 84 €/ha, 125 €/ha, and 71 €/ha per year in the case of afforestation with walnut, beech and silver fir, respectively. Considering all environmental benefits, the losses increase to 121 €/ha, 182 €/ha and 109 €/ha and year respectively.

Figure 3 shows the social loss or gain on average per year for each of the environmental benefits when afforesting various types of marginal land. No distinction is made between species, thus the annuities considered are the mean values with respect to the three species included in the analysis. The results show when *T** is set according to Scenario A, in terms of groundwater recharge benefits there is a gain of 61 €/ha when afforesting arable land and a

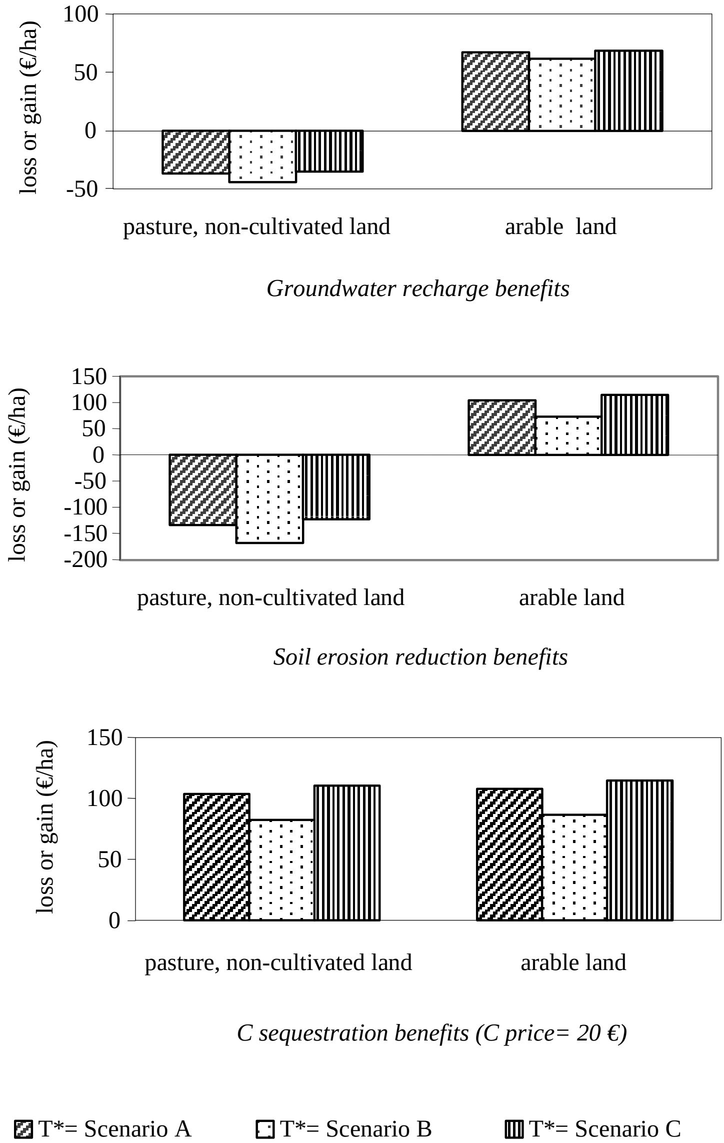

Figure 3. Social losses and gains for different types of land under Scenario A, B, or C.

loss of 44 €/ha in the case of pasture and non-cultivated land. In terms of soil erosion reduction, there is a gain of 73 €/ha in the case of arable land and a loss of 168 €/ha for pasture and non-cultivated land. With regard to carbon sequestration there is a gain equal to 87 €/ha for arable land and 82 €/ha for pasture and non-cultivated land. When the optimal harvesting age is set according to Scenario B, for each type of marginal land afforested losses increase and gains decrease. A lower loss or higher gain is achieved by changing harvesting age *T** according to Scenario C. In fact, for Scenario C, in terms of groundwater recharge the gain increases to 69 €/ha for arable land and the loss is reduced to 35 €/ha for pasture and

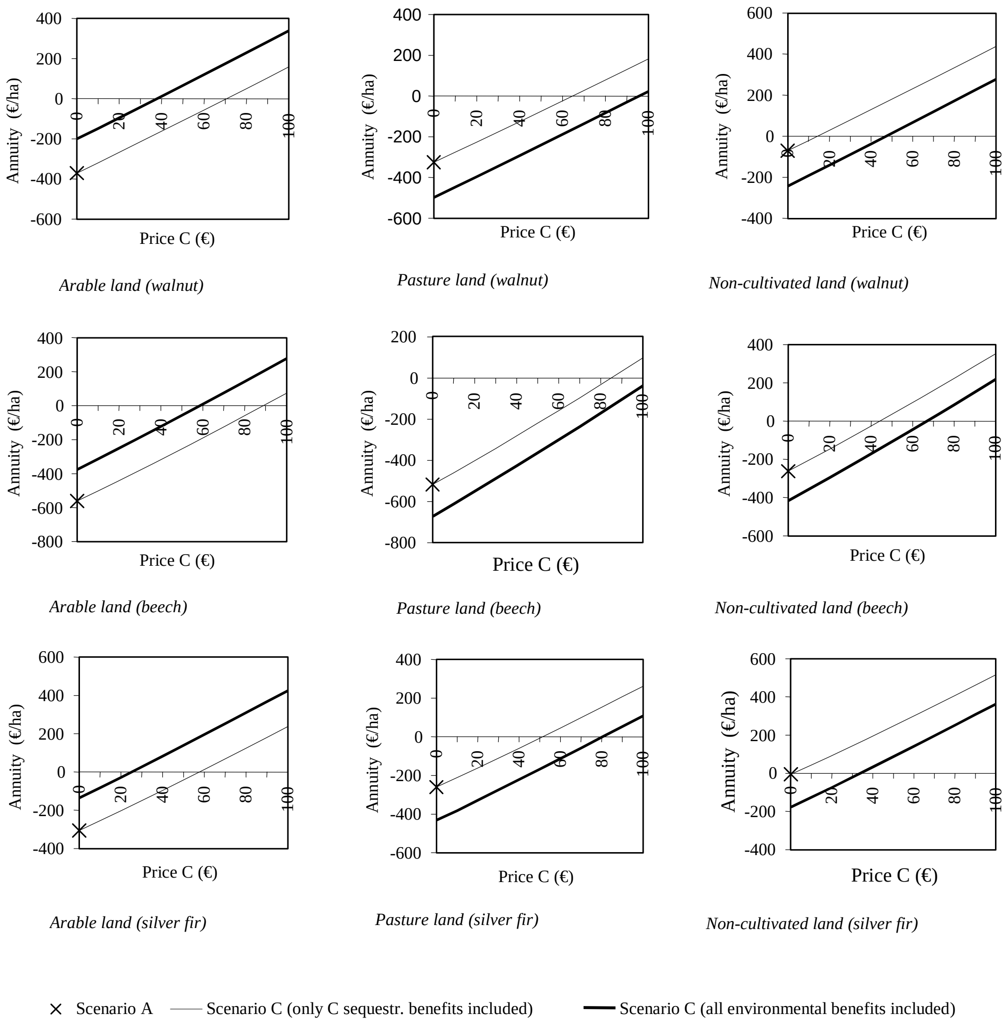

Figure 4. Maximum annuity for each typology of land, species, and carbon prices calculated according to Scenario A and C.

non-cultivated land. In terms of soil erosion reduction, the gain is 114 €/ha in the case of arable land and the loss 123 €/ha for pasture and non-cultivated land. Considering carbon sequestration the gain increases to 115 €/ha for arable land and to 110 €/ha for pasture and non-cultivated land.

Figure 4 presents for each species and type of land use the private maximum annuities under Scenario A, and the social maximum annuities under Scenario C. Scenario C is differentiated between including carbon sequestration benefits only and including all environmental benefits. The annuities are calculated for a range of carbon prices from 0 to 100 €/ton of carbon sequestrated. The private maximum annuity is depicted in each graph of fig. 4 at the left-hand-side where the price carbon is set to zero. As the results indicate, the social benefits do increase with an increase in carbon price (carbon price > 0). This applies for all species and all types of land use. Moreover, when considering carbon sequestration benefits only, higher values of social annuities are given for non-cultivated land followed by pasture and arable land. Results differ when we consider additional environmental effects. For a *T** calculated according to Scenario C including all environmental benefits and for a carbon price of zero, maximum social annuities are lower than the private ones for the case of non cultivated land and pasture and are higher for arable land. In the case of a positive carbon price and considering afforestation of pasture and non cultivated land, the maximum social annuities given for Scenario C, with all social benefits included, are lower than the ones calculated, for the same carbon price, when including carbon sequestration benefits only. The results are reversed for afforestation of arable land. Fig. 4 shows also the minimum price of carbon that provides a positive annuity for each of the land use types and for each species. The × in Fig. 4 indicates the average private benefits from afforestation. They are negative for all types of land use and tree species. This indicates that indeed an afforestation policy is necessary if an increase in forest coverage is wanted. The quantitative results underlying the graphs are available upon request from the authors.

5. Conclusions

This study provides two main results. Firstly, the inclusion of environmental benefits such as groundwater recharge and soil erosion reduction lengthen the optimal rotation age even more than when carbon sequestration benefits only are included. Similar results have been found by Creedy et al. (2001). Harvesting choices made without taking into consideration groundwater recharge and soil erosion reduction benefits lead to a social loss that cannot be ignored. The provision of subsidies to support afforestation sets private incentives that increase the social losses.

Secondly, although afforestation is expected to provide certain benefits for society, findings of this paper indicate that afforestation does not necessarily lead to an improvement of environmental quality and that its social effect depends largely on the type of environmental benefits and land use considered. Our analysis shows that in terms of groundwater recharge and soil erosion reduction, afforestation of pasture and non cultivated land results in economic losses, whereas in terms of carbon sequestration in economic benefits. Nevertheless, afforestation of arable land contributes considerably to an increase of all the three environmental benefits and to an improvement of the state of the environment. However, from the carbon sequestration point of view, afforesting arable land does not provide the highest gain and does not represent the best choice.

As clearly shown, not only private and social interests diverge but also social interests among themselves. Conditional subsidies that consider environmental effects would certainly help to reduce the loss, however, the environmental costs due to a reduction of groundwater recharge and an increase in soil erosion, as a consequence of afforestation of pasture and non cultivated land, would be inevitable. Applying an afforestation policy that has multiple environmental benefits as an objective, as in the case of Regulation 2080/92, can be difficult and often impossible. In the specific case we consider, only if the price for carbon increases above 100€/t does afforestation provide social benefits regardless of the type of land afforested or the type of tree used. If the price for carbon is low, positive social benefits depend on the type of land and type of tree used for afforestation. This requires afforestation policies differentiated by tree species and type of land. A differentiated afforestation policy will not necessarily result in higher economic benefits as the administrative costs of such a policy have to be considered.

It is necessary to point out that the results presented in this paper highlight some environmental effects rather than a detailed quantification of the social consequences of afforestation in the study area. Moreover, in our analysis we do not include the estimation of other important effects of forests such as recreational benefits and amenity values (Pearce 1991, 1994). However, we expect that their inclusion would lengthen the social optimal harvesting age as recreational and amenity values increases with an increase in age of the forest.

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Multi-Purpose Forest Planning with Mathematical Optimization Techniques: A Case Study

Sedat Keleş, Uzay Karahalil, Fatih Sivrikaya, Günay Çakir and E. Zeki Başkent
Karadeniz Technical University, Faculty of Forestry, Trabzon, Turkey

Abstract

Forest ecosystems present various goods and services such as timber, recreation, quality water, biodiversity, carbon storage, oxygen production and soil protection. Forest management focuses on the control of forest ecosystems based on the sustainable use of forest values without damaging ecological integrity. To achieve this vital task, it requires identification and quantification of forest values and use of decision support tools such as operations research techniques.

This study tackles the integration of five important selected forest values like timber, water, soil protection, carbon storage and oxygen production in a small planning unit. Firstly, timber production values were developed with the help of growth and yield tables corresponding to commercial tree species. Other forest values were functionally linked to stand basal area. Forest values were integrated into different forest planning models including linear programming (LP) and goal programming (GP) and solved by a commercial matrix solver (LİNDO™). Model outputs were presented considering the quantities at the end of the planning horizon and planning periods. Finally, it was concluded that mathematical optimization techniques can be used effectively in the process of multi-purpose forest planning and quantification of forest values other than timber.

Keywords: forest management, forest ecosystem values, mathematical optimization techniques

1. Introduction

Forests have in most cases traditionally presented a number of values. These values include various goods and services such as soil protection, activities linked to recreation, regulating water resources and provision of timber products. Forest ecosystems also supply various non-

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wood forest products such as rattan, resin, berries and mushrooms, and some forests have cultural and religious significance for local people.

In recent years, the meaning of sustainable forest management has broadened from sustained yield management to include additional features such as the quality of forest operations, biodiversity, multiple-use and quality of life. As the concept of multiple-use forestry became more widely accepted, forest planning was practiced based on a more holistic approach where the multiple uses of the forest were considered simultaneously. While multiple-use forestry is accepted as a sound and viable forest management policy, there is still a need to develop planning models that adequately consider the multiple uses of the forest, and the multiple objectives or purposes of the forest users (Pukkala et al. 1995; Pukkala 2002; Keleş and Karahalil 2004).

Numerical methods enable more efficient and more detailed timber production planning than simple regulation methods. However, mathematical methods require that all goals must be expressed numerically. The lack of numerical measures for several goal variables has greatly reduced the possibilities for using numerical search and optimization methods in multiple-use forest planning (Pukkala 2002).

The outputs of nontimber goods in general depend on the quantity and the structure of the forest. However, a forest state most suitable for the production of one good is usually not optimal with respect to another good. Typically, there is not a set of management activities that simultaneously maximize the outputs of timber and all other goods (Baskent and Jordan 1996; Pukkala 2002).

The many difficulties connected with the numerical measurement of nonwood forest outputs should not be used as an excuse for not using numerical models and numerical optimization. Numerical predictions and solutions of optimization problems usually tell part of the story. The solution proposed by optimization is efficient if the models and assumptions are correct. Efficiency means that pursuing a given management objective minimizes loses in the other, usually conflicting goals (Gong 2002; Pukkala 2002).

In this paper, four forest values are functionally linked to stand basal area. These values are then integrated into different forest planning models including linear programming and goal programming. Finally, model outputs are summarized and discussed.

2. Case study area

The study area of Karanlıkdere planning unit comprises 26118 hectares. In the context of this paper, only 2005 hectares are subject to harvest scheduling. The main tree species are fir (*Abies nordmanniana*) and pine (*Pinus silvestris*). The planning area consists of 147 sub-compartments (or stands) that are subject to certain management interventions.

3. Forest values

In this paper, five forest values are taken into consideration explicitly as main forest goods and services such as timber, water and oxygen production, soil protection and carbon storage.

Water and oxygen production, carbon storage and soil protection values of the sub-compartments are assumed to be in function of the stand basal area. For this reason, the following equations developed by Keleş (2003) for water production, Yolasığmaz (2004) for oxygen production and carbon storage and Karahalil (2003) for soil protection in the same region are used, respectively.

WP=6.1599-0.0632 * BA (for softwood species); WP: water production (10^3 ton/ha/year) and BA: residual basal area (m^2 /ha).

OP = 0. 7811 * BA $^{0.6358}$ (for softwood species), OP: oxygen production (ton/ha/year) and BA: residual basal area (m^2 /ha).

CS = 55. 0325 + 5. 6988 * BA + 0.157 * BA^2 (for softwood species), CS: the amount of carbon storage (ton/ha) and BA: residual basal area (m^2 /ha).

lnSL=2.553079 - 0.065 * BA (for softwood species); SL: the quantity of soil loss (ton/ha/year) and BA: residual basal area (m^2 /ha).

4. Model development

In this paper, before alternative forest planning scenarios are developed, some assumptions are made. Planning horizon is 100 years and planning period is 20 years. Stands younger than 90 years old could not be regenerated. All stands can be naturally regenerated or planted. All stands can be cut once in 100 years. Stands whose crown closure is 1 (10–40%) cannot be thinned, but regenerated. It is assumed that harvesting occurs at mid-point of each period. Spatial and adjacency constraints are not taken into consideration. All forest values are integrated into different forest planning models including LP and goal programming, and model I approach are used (Johnson and Scheurman 1977).

4.1 Linear programming

LP is an optimization method applicable for the solution of problems in which the objective function and constraints appear as linear functions of decision variables. The constraint equations in an LP problem may be in the form of equalities or inequalities. In all the applications of LP, there is a single overriding management objective such as maximizing forest value. This objective is represented by the objective function. Other objectives, for example, maintaining an even flow of timber production and stable water production in a forest ecosystem, are expressed by constraints. In this paper, eight LP based planning scenarios are developed. These scenarios are given in Table 1.

4.2 Goal programming

Goal programming provides a way of allocating resources efficiently in decision-making situations that involve multi-objectives. A GP decision situation is generally characterized by multiple objectives. Some of these may be complementary, while others may be conflicting in nature. GP allows the decision maker to specify a target for each objective. A solution of the complete problem minimizes the total deviations from the prescribed set of target values.

Table 1. Linear Programming based forest management planning scenarios.

Scenarios	Objective	Constraint
S1	Wood production (max)	-
S2	Soil loss (min)	-
S3	Water production (max)	-
S4	Oxygen production (max)	-
S5	Carbon storage (max)	-
S6	Wood production (max)	Soil loss <= 800 000 ton
S7	Soil loss (min)	Water production >= 900 000 ton
S8	Water production (max)	Soil loss <= 1 200 000 ton

Table 2. Goal Programming based forest planning scenario.

Goals	Forest Values	Target values	Deviations* to be minimized
G1	Wood production	550 000	n1
G2	Soil loss	720 000	p2
G3	Water production	1 050 000	n3
G4	Carbon storage	3 750 000	n4
G5	Oxygen production	1 360 000	n5

* *n: negative deviation and p: positive deviation*

In this paper, a GP based planning scenario is developed because preferences and weights for each forest value/goal cannot be determined in planning region. The model, goals and target values for each goal are given in Table 2.

5. Results and discussion

Results for each planning scenario are given in Figures 1 to 6. The highest wood production volume among scenarios is produced in S1 scenario as expected (Figure 1). S3 scenario has the lowest wood volume. In reality, this result is unexpected because water production values of forest ecosystems are compatible with timber production. But, existing growing stock or forest basal area is very low. After harvesting, forest basal area and growing stock are more than that of the preceding/existing forest condition. For this reason, when a smaller area is harvested, more water volume is produced. S2 scenario is to minimize the amount of forest soil loss over time. Although forest soil protection value is incompatible with wood production, the amount of wood production harvested in S2 is considerably larger. In this scenario, most of the stands are harvested in the first period and immediately regenerated, thus, more basal area than that of the existing forest is produced in the following periods. Also, regenerated stands are subject to thinning in the following periods and then clear-cutting.

The amount of soil losses of alternative scenarios in forest management planning process is shown in Figure 2. As expected S2 scenario has the lowest soil loss, and S4 and S5 scenarios

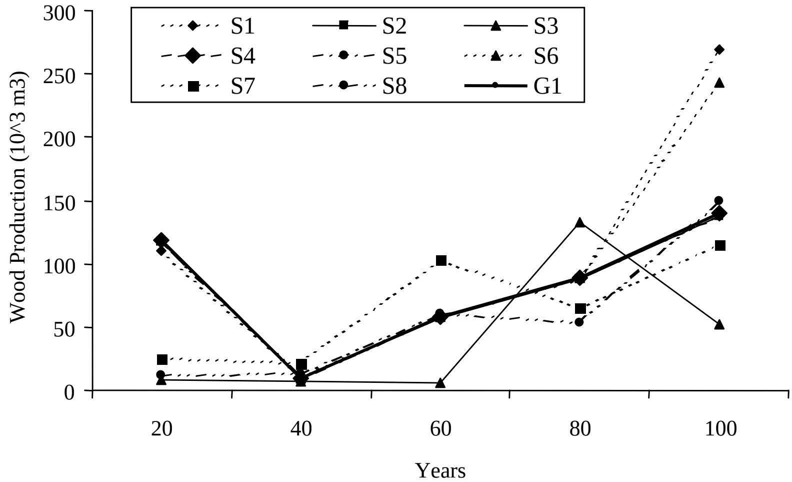

Figure 1. Amount of wood production over 100 years of simulation.

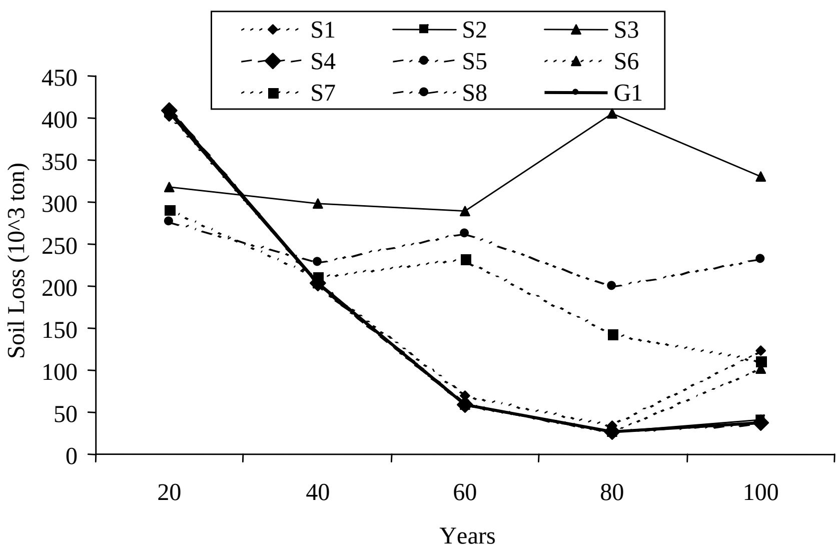

Figure 2. Amount of soil losses over time.

follow S2. In these scenarios, most of the existing stands are harvested in the first period, thus, total forest basal area is increased because regenerated stands have more basal area or growing stock than that existing forest condition (Figure 3). S3 and S8 scenarios have the highest soil loss. In these scenarios, most of the existing stands are harvested in the last two periods. As shown, soil protection value of theforest ecosystem is compatible with oxygen production and carbon storage values, but is incompatible with water production value.

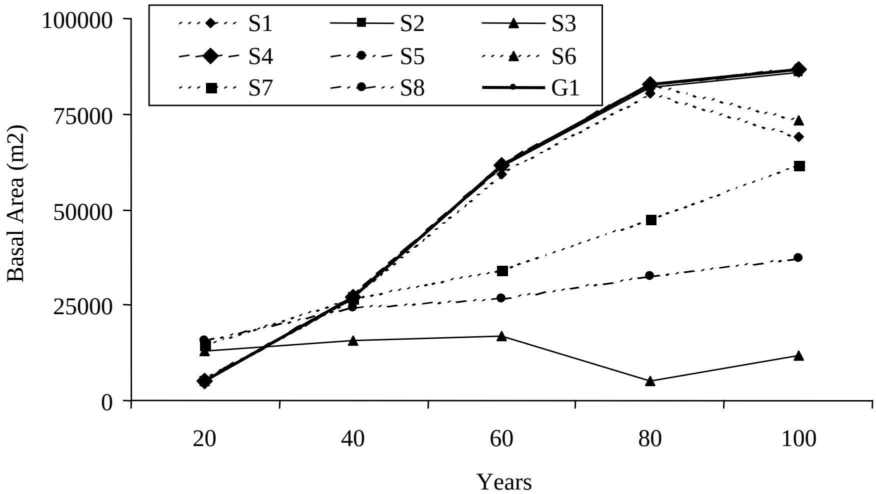

Figure 3. Amount of basal area of scenarios over time.

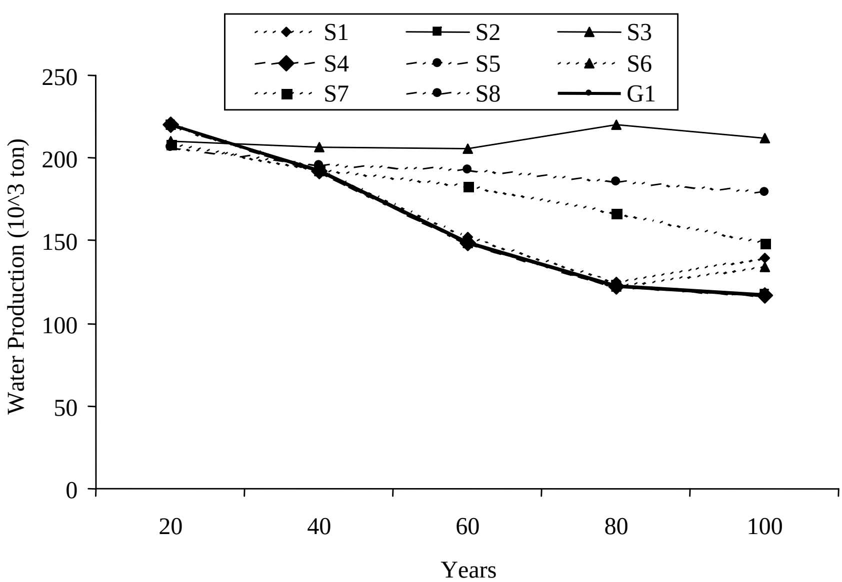

Figure 4. Amount of water production of scenarios over time.

Water production volumes of alternative forest planning scenarios are given in Figure 4. As expected, S3 and S8 scenarios have the highest water volumes. As mentioned earlier, in these scenarios most of the existing stands are harvested in the fourth and last period, thus, optimal development of forest stands is prevented. In conclusion, stand basal area in the existing forest ecosystem is lower than the optimal forest condition (Figure 3). In S7 scenario, the water production constraint has negative effects on forest soil protection value.

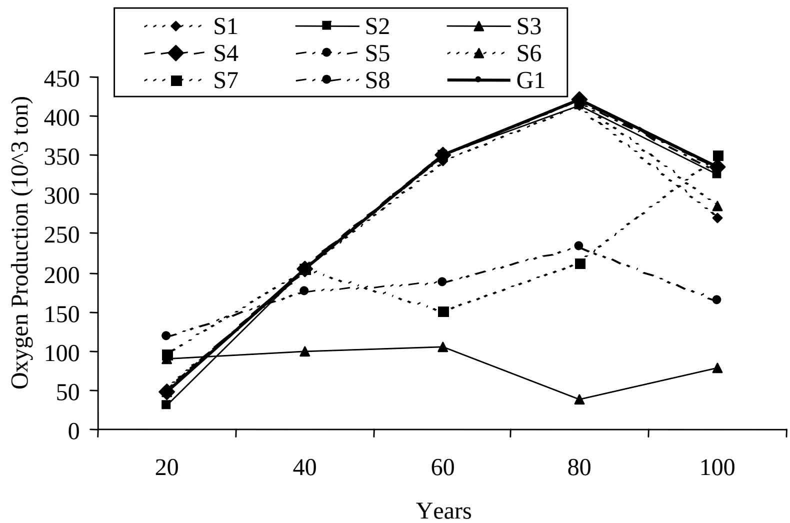

Figure 5. Amount of oxygen production of scenarios over time.

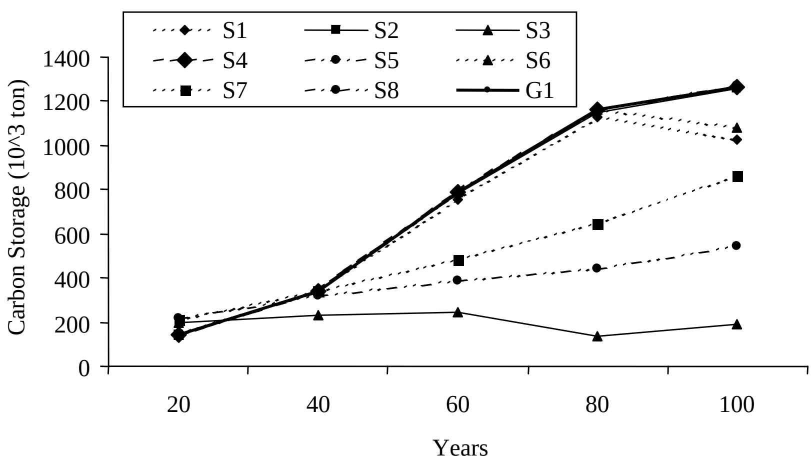

Figure 6. Amount of carbon storage of scenarios over time.

Figures 5 and 6 show the trends of carbon storage and oxygen production values of forest planning scenarios over time. The highest volumes of these forest values are produced in S2, S4 and S5 planning scenarios because they have the highest basal area.

The S3 and S8 scenarios have the lowest volumes of carbon storage and oxygen production. It is thus shown that carbon and oxygen values of forest ecosystems are incompatible with the water production value.

Goal programming based planning scenario produces considerably good results. In this scenario, values of unwanted decision variables are n1: 135511, p2: 15519, n3: 249438, n4:

51792 and n5: 1058. The results show that goal programming can simultaneously produce good harvest schedules compatible with high levels of other forest values relative to standard linear programming.

6. Conclusions

The structure of a forest ecosystem may have certain impacts on various forest values including goods and services. There are, however, always a number of conflicts among various forest goods and services. So, wood and non-wood products as well as services should be explicitly incorporated into a forest management planning process because multiple-use forest management requires that forest ecosystems should be managed to generate an optimal mix of forest goods and services.

Mathematical optimization techniques such as linear programming and goal programming in forest management generate an optimal schedule among management decision alternatives. These techniques can incorporate all the complexities of multiple-use forest planning and allow the users to make optimal decisions that meet the objectives of sustainable forest management.

In this study, five appealing forest values including water, timber and oxygen production, carbon storage and prevention of soil erosion were integrated into forest management planning with linear and goal programming. The results show that some forest values are compatible or incompatible with some others. A number of planning alternatives were produced and analyzed with mathematical optimization techniques. In the applications of LP, while there was a single overriding management objective, other objectives were expressed by constraints. Yet, in the application of goal programming, all goals and goal variables were in the objective function. Goal programming could also be set at any level without leading to infeasibilities. In practice, these are advantages relative to standard LP based forest planning models. But determination of the relative importance of each goal in goal programming applications, especially in forestry, is difficult.

In short, the quantitative models encourage forest managers and decision-makers to solve complex forest management problems including ecological, economical and social concerns such as biodiversity, water and soil protection.

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Assessing the Value of Wastewater Purification Carried Out by Forest Filter Areas: A First Attempt in the Venetian Plain

Giustino Mezzalira[1], Marco Monaci[1], Alessia Cogato[1], Laura Astolfi[2]

[1]Paulownia Italia, Mestre (VE), Italy
[2]AATO Bacchiglione, Villaverla (VI), Italy

Abstract

While during recent years water pollution has represented a threat to the health of rivers and ecosystems, it is widely acknowledged that trees contribute towards purifying water and the uptake of nutrients. Thanks to improved knowledge on trees growth and forest ecosystems, it is now possible to replace linear forestry structures with articulated structure plantations, buffer forest systems, created for the post-treatment of municipal and industrial wastewater and fertiliser pollution. This research represents a first attempt to evaluate the value of a wastewater purification system by buffer forests.

Keywords: buffer forest systems; wastewater purification; nutrients uptake

1. Introduction

The legislation that currently disciplines the water system in Italy (Act 5, Jan 1994 no. 36, the so-called "Galli Act"), establishes that the management of water services must be vertically integrated, thus including all the activities connected to the water system (public services such as uptake, adduction and distribution of water for civil use; public services of sewage and purification of wastewater – article 4, paragraph 1, letter f). This legislation also recognises the "Autorità d'Ambito Territoriale Ottimale" (AATO) – public local territorial authorities – as those in charge of regulating, planning and monitoring the integrated water system.

The reorganization of water services introduced by the Galli Act contrasts with the previous fragmented system – having complex and heavy management costs – which could not efficiently serve wide areas. The new organization intends to create an integrated system, both from a territorial viewpoint (with the definition of smaller areas possibly correspondent to hydrographical basins) and from a functional one, considering in a global way all the different activities involved in the water cycle, ranging from uptake to discharge. It also aims to achieve an entrepreneurial management with full coverage of all management and investment costs by applying appropriate fees corresponding to the water service received.

The Galli Act assigned to the Regions the task of issuing rules to fix territorial boundaries and defining the institutional cooperation form between local authorities belonging to the AATO territory (Town-councils, Provinces and Managing Authorities for public services).

Article 11 (paragraph 3) of National Act 36/94 established that AATOs must be managed according to a specific territorial plan divided in four sections: survey of water infrastructures, intervention programme, financial plan, management and organizational model. This plan is a tool to define strategic aims to be pursued in the assigned area, in order to satisfy economic, social and environmental needs of the population being served.

The territorial plan includes a programme for infrastructural investments and the achievement of adequate service standards, defining the financial needs and suitable levels of water tariffs.

AATO are therefore in charge of programming, organizing, and monitoring the integrated water system, but do not have any managing function (article 3, paragraph 6, LR 5/98). Managing functions are assigned by the AATO to a managing authority according to a specific Agreement (a contract defining relationships between the AATO and the managing authority).

The AATO Bacchiglione, from the name of its main river, includes 144 town-councils (61 in the Province of Padua, 1 in the Province of Venice and 82 in the Province of Vicenza) and covers a total area of 3097 km^2, with a population of 1,048,628 inhabitants and the need of 7,253 litre/second of potable water.

As required by the legislation in force, the AATO Bacchiglione surveyed the existing plants and networks in 2001, thereafter approving by means of a Territorial Plan (AATO, 2004), the planning of necessary investments over the next 30 years and established fees according to the “normalized method” prepared by the Government (Ministerial Decree of 1 August 1996). Starting from the signature of the Agreement, valid from 2003 to 2006, the AATO ensures that the six managing authorities carry out the planned investments, keep adequate technical and organizational standards and apply fees correctly.

The final purpose of this process is to protect the water resource and to guarantee an efficient and effective management of the service.

Two very important goals of the Galli Act are the fulfilment of the European Union directives – formalized by National Act 152/99 – regarding sewage networks and plants, and the recycling of wastewater.

The Law 152/99, reporting ‘Norms to protect water from pollution and application of the 91/676/EEC Directive on water protection from agricultural nitrate pollution’ considers natural wastewater treatments – such as phyto-purification and forest filter systems – as an adequate solution for small agglomerates (50–2000 Inhabitants Equivalent) as well as a valid support for the purification of wastewater from larger agglomerates. The Territorial Plan of the AATO Bacchiglione (2004) particularly emphasises these aspects.

Specific studies have assessed the suitability of adopting the “use of phyto-purification technologies in water integrated-cycle plants” and have carried out investigation on the possibility of using forest filter systems for the finishing of water of municipal purification plants.

2. What are Forest Filter Systems

The words 'Forest Filter System' (FFSs) are used to identify different kinds of forest vegetation actively involved in water purification processes. When forest trees cover small strips, these formations are termed 'wooded buffer strips', when they cover wider areas, they are termed 'forest filter areas'. FFFs can be considered as a real phyto-purification system, where the structural elements of the system are the soil and the forest vegetation (trees and shrubs).

Forest vegetation carries out important purifying activities on surface and sub-surface runoff. The basic functioning principle FFS is based on the interaction of water, soil, micro-organisms, and woody plants. Woody plants (trees and shrubs) supply energy to the system, providing the top soil layer (a few metres high) with organic matter. Micro-organisms (mostly bacteria) are responsible for the main biochemical reactions that purify water; the soil, besides hosting the micro-organisms and the root of woody plants, plays a very important filtration role in order to control pollutants adsorbed to soil colloids.

The purifying function occurs thanks to different and complex actions, including the uptake, transformation and storage of soil nutrients, the retention of adsorbed sediments and pollutants and the support to metabolic activity by means of soil micro-organisms, particularly denitrifying bacteria that help to definitively remove nitrogen from the system.

In detail, the process consists of different phases:

- the heterotrophic bacteria which live in deepest water-logged soil layers in conditions of anoxia use the nitrate molecules instead of oxygen during respiratory processes;
- the consequence of their respiratory process is the reduction of nitrogen from nitric (NO_2) to molecular (N_2);
- the molecular nitrogen is a gas that goes through soil layers and is dispersed in the atmosphere, adding to the enormous quantity of atmospheric molecular nitrogen;
- denitrifying bacteria need organic matter to metabolize for their survival;
- only woody plants can transfer significant quantities of organic matter (root exudates, dead roots, litter moved by earthworm activity) to the anoxic deepest layers of the soil, where denitrifying bacteria live;
- in deep organic soil layers, the activity of denitrifying bacteria is very efficient and can eliminate as much as 80–90% of nitrates from the solution;
- plants, besides being highly efficient in controlling nitrogen, are also good at controlling phosphorus and pesticides, which move into soil adsorbed in the sediments, especially with heavy rainfalls;
- riverbanks with vegetation are highly permeable (less compact soils); therefore they enhance surface water infiltration, with consequent deposition of suspended sediments;
- plants can adsorb directly some water pollutants which are growth elements.

In recent years special attention has been paid to studies on denitrification (Groffman et al. 1993; Starr and Gillham 1993; Hanson et al. 1994; Clements et al. 2002), as the only process capable of definitely removing nitrogen while retaining an efficient buffer function over the years.

In the nitrification process, nitrogen oxides are removed from soil and water, releasing gaseous nitrogen in the atmosphere. The denitrification process is carried out by bacteria that can live in anaerobic conditions; these can use nitrates (NO_3) in their respiratory processes when oxygen is lacking (anaerobic microbial respiration):

$$2\ NO_3 \rightarrow 2\ NO_2 \rightarrow 2NO \rightarrow N2O \rightarrow N_2$$

Anoxia takes place when the soil becomes saturated by water during floods in the case of natural riparian strips, or by careful management of water levels in the case of artificial forest filter systems.

Besides anaerobic conditions, other necessary conditions in the denitrification process are the availability of organic carbon and a sufficient quantity of nitrates, which are in turn connected to litter decomposition processes (organic matter mineralization) and to nutrients carried by runoff water. The vegetation plays an indirect role in the denitrification process, as it helps to support microbial populations (including denitrifying bacteria) by supplying energy through litter decomposition and providing the most favourable habitat for the soil micro-organisms, i.e. the rhizosphere, rich in root exudates.

Most of the literature on buffer areas (Groffman and Tiedje 1989; Haycock et al. 1993; Castelle et al. 1994) underlines their efficiency in fighting diffuse pollution, most of which is of agricultural origin. The studies focus on nitrogen, phosphorus and pesticide removal. According to BOD, COD and other bacteriological parameters, it is possible to assimilate buffer strips to constructed wetlands for the treatment of wastewater, therefore making use to the same prediction models.

In order to carry out effectively is purifying function, a wooded area had to be intersected by a sub-surface flow of polluted water; the purifying action occurs at the rhizosphere level, within an active layer a few metres beneath the surface. The good functioning of the system depends on several factors, including soil intermingling, water-table depth, soil saturation, slope and, especially, careful planning of the hydraulic system. Once it has gone through the wooded area, purified water can be directly released in a watercourse having lost most of its pollutants.

Recent studies on the efficiency and effectiveness of natural systems (wetlands, forest systems) in controlling pollutants support the use of remunerated crops primarily aimed at pollution control (Fennessy 1993; Lowrance et al. 1995; Burt 1997). Cultivating herbaceous and woody plants in flooded and dry areas for the removal of pollutants (mainly nutrients) from deep or surface water bodies, can be combined with exploitation of the biomass produced (vegetable amendments, biofuels, etc.), thus providing double dividends: remuneration for the service supplied, and the market value of products.

The most remarkable cases of FFS in Italy today are *constructed wetlands*, used both to purify water coming from municipal and industrial purification plants and to reduce the number of nutrients in fluvial systems, and *buffer forest areas*, used to intercept directly nutrients from single fields (monitoring of diffuse pollution), to finish water coming from treatment plants, using the same principles as for wetlands, or to purify wastewater from qualitatively compromised waterbodies.

The use of woody plants to control water pollution in Italy started in the mid-90s, when in the Veneto Region the Azienda Regionale delle Foreste (Regional Forest Authority/ Enterprise, now Veneto Agricoltura) promoted the use of wooded buffer strips to manage non-point agricultural pollution. Shortly later, again in the Veneto Region, and thanks to the Dese Sile Land Reclamation Consortium based in Mestre, the first forest filter area was created to treat the water of one of the main rivers in the Venice lagoon watershed (Zero river project, created within the "NICOLAS" European Programme).

Through the sale of wood for energy production and thanks to carbon trading, together with full mechanization of all the forest works, the profitability of forest filter systems is now comparable to that of traditional cereal crops.

After a pioneering stage, wooded buffer strips began to spread in many Italian regions (Veneto, Lombardy, Emilia Romagna, Umbria, etc.), boosted by several initiatives. Their main function is to control the release of nutrients from agricultural activities and they are best located next to the drainage network, in the central and low-lying plain.

The use of forest filter areas is now spreading within two different contexts:

- improvement of river water quality, as tested in the Zero river: using marginal farmland such as that along river banks, controlled water flows are transferred from the river to the fields where a complex system of dispersal and drainage ditches operates, then releasing the purified water to the surface water system;

- finishing of the water of municipal sewage treatment plants: in this case the water, coming from a plant, has been treated to a certain extent but still contains residues of nutrients and pollutants. If this water is discharged as such into the receiving water body (usually of small capacity in the Italian context), it would damage its quality thus violating the principles of the EU/2000/60 Directive, about to be applied in Italy. Also in this case, the water is purified and released in the surrounding environment through a system of dispersal and drainage ditches.

3. Methodology to identify qualified areas for forest filter systems in the AATO Bacchiglione area

The AATO Bacchiglione has recently surveyed its territory in order to identify suitable areas for the establishment of forest filter systems and to identify purification plants that may use forest filter systems for the finishing of wastewater.

Qualified areas have been identified through the “Map of the intrinsic vulnerability of the water-table of the Veneto Plain” (prepared in compliance of the Water Protection Plan of the Veneto Region – Law 152/99) and the draft “Map of the capability of soils in relation to protection of groundwater in the Veneto Plain” (ARPAV 2005).

The Vulnerability Map has been created using the SINTACS calculation model, which implies determination and quantification of seven hydro-geological parameters (SINTACS is actually the acronym of the seven parameters expressed in Italian): i) the water-table level, ii) the effective infiltration, iii) the self-purification effect of the non-saturated area, iv) the typology of the vegetation coverage, v) the hydro-geological features of the aquifer, vi) the hydraulic conductivity of the saturated area and vii) the slope of the terrain. Vulnerability is described according to six categories: Extremely low, Low, Medium, High, Elevated, Extremely elevated.

The capability of the soils of the Po plain of acting as filters of nutrients coming from mineral and organic fertilizations, has on the other hand been assessed through quantitative approaches providing estimations of water and nitrates flows both through leaching and surface runoff.

MACRO, a simulation model of the water balance (Jarvis 1994) has been used for this purpose. This model is based on the functional behaviour of the soil, given specific climate and crop conditions: the estimated water flows, expressed as percentages of the rainfall and of the irrigation, have been used to assess the protective capability of different soils in four categories: Low, Slightly low, Slightly high, High.

By overlapping and comparing the two maps, the territory has been divided in six vulnerability classes, of which the first three (Extremely low, Low, and Medium vulnerability) have been considered suitable for the use of forest filter systems, with decreasing qualification.

The qualification of purification plants has been defined by comparing the suitability of the surrounding areas, evaluated as described above, with the information of water quality.

The first draft product, still under verification by the Technical Group and the AATO Bacchiglione , is the *“Map of purification plants suitable for the use of forest filter systems”* (Figure 1), based on the intrinsic vulnerability of the water-table and the protective capacity of soils. Future investigations will have to definitively approve the map and identify a few qualified purification plants for pilot experiments.

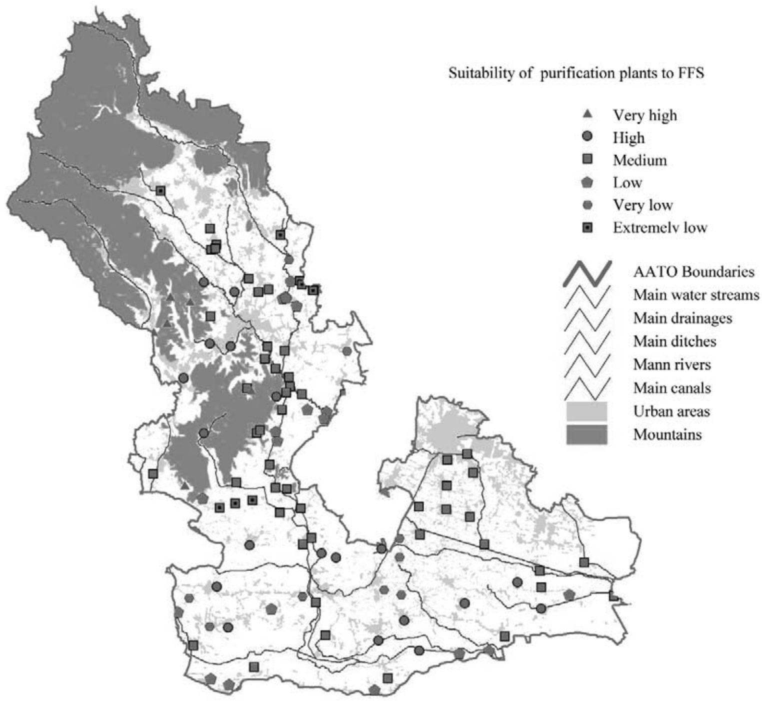

Figure 1. Map of purification plants suitable for the use of forest filter systems.

4. Some reflections on normative issues

Groundwater improvement is one of the main purposes of Act 152/99, and this is why it puts particular care to regulate water discharges into the soil. As a matter of fact it forbids discharges on the ground, both in surface and on the underground layers (article 29), with some exceptions for:

a. isolated settlements, installations and buildings discharging domestic wastewater (for these, the Regions identify specific adequate public and private systems)
b. mechanisms of control of the water level in sewage treatment plants and networks
c. urban and industrial wastewater discharges for which it is technically impossible or not cost-efficient (if compared to the achieved environmental benefits), to be conveyed to surface water bodies, provided that they comply with to the criteria and standards fixed by the Regions
d. discharges of water coming from industrial processing of natural rock and mineral substances, as far as the sludge produced is made of water and natural aggregates, and does not damage the water-table or induce soil instability
e. rainwater discharges conveyed in separate sewage networks.

Besides these exceptions, the superficial discharges existing before the enforcement of a new version of the ACT (August 2000), must be conveyed into surface water bodies through sewage networks, i.e. they must be recycled (article 29, p. 2).

The use of wastewater in FFSs brings to light a problem of legal interpretation. The FFSs that are on private land and where discharge runoffs can only be partially controlled, can hardly ever – from a normative point of view – be considered part of the purification plant, even if one of the basic goals of FFSs is to take advantage of the self-purifying capacity of natural systems, also by involving private initiatives in innovative forms of project financing.

Recent normative developments focus on the possibility of interpreting wastewater in forest filter systems in terms of recycling of agricultural wastes. This solution is highly recommended by the Decree 152/99, by the recent 2000/60 Directive, and by several EU and national programming documents.

This issue has recently been regulated by the Ministerial Decree 185/2003, which establishes specific quality standards for wastewater coming from purification plants. This Decree also establishes limits of 50 (for 80% of the samples) and 200 UFC/100 ml (maximum value) for *Escherichia coli* in recycled wastewater coming from lagooning or phyto-purification. These limits are more favourable if compared with those of conventional purification plants, thus making operating conditions more beneficial conditions for FFSs.

The criteria for identifying suitable areas for FFSs should include:

a. exclusion of vulnerable areas, where the water-table is in danger of contamination
b. identification of more efficient purification plants, which already discharge water whose quality complies to the criteria of the Ministerial Decree 185/03
c. identification of those purification plants that, although not reaching the quality standards for recycling, are provided with natural post-treatment (phyto-purification) systems which allow them to finally reach such standards.

5. Analysis of investment, management and monitoring costs for FFSs

The studies currently undertaken by the AATO Bacchiglione show that FFSs for wastewater finishing could be used in several areas. However, it is important to assess whether they would be profitable for the private landowners.

A list of costs and relative estimates of monetary values is given below for creating FFSs and for carrying out those monitoring activities so essential in ensuring that underground and surface water bodies are not damaged by the finishing process.

Monetary values are estimated in an ex-ante approach since no system has yet been definitely designed or built.

Hydro-geological study: to create an adequate forest filter system it is necessary to conduct a detailed hydro-geological study in order to analyse the water-flow movements within the area. Independently on the area of the FFS, which must anyway occupy several tens of hectares to be able to finish the water of a medium-sized municipal purification plant, the total cost of this analysis is about € 20,000, plus the costs of detailed soil sampling and analysis, if the case.

Designing and planting a one-hectare FFS: costs refer to the creation of an one hectare plantation, including a system of diffusion and drainage ditches in a “comb-like” distribution at a distance of 10–15 m from one another, where trees are grown according to short rotation forest systems with around 1000–2000 trees per hectare depending on species and rotation. In the Venetian Po plain afforestation costs are around € 5,000/ha plus € 2,500/ha for ground preparation.

Monitoring: monitoring of N and P (in their different forms) in the soil and in water entering and leaving the FFS is also part of the project.

A very high cost is represented by the possible installation of a meteo station, wherever it is not possible to use already-existing ones.

Other costs to be taken into account are those connected to the purchase of monitoring equipment such as daily sampler, measurer of the watertable level, thermometers, data loggers, etc.), needed for analytical studies on site. The estimated cost for an adequate monitoring-station equipment is € 55,000.

Sample gathering and laboratory analyses: costs under this heading related to soil and water analyses according to the Regional Environmental Agency Official Pricelist (2003). Specific analyses of denitrification activities should also be considered, which include both field and lab surveys with dedicated equipment. The estimated cost is € 50,000/year.

6. FFSs profitability

The competitiveness of growing trees on farmland versus traditional cereal crops has lately been supported by the EU Common Agricultural Policy (CAP). A new phase in the afforestation of agricultural soils began in the 1990s thanks to the CAP reform. The afforestation of cultivated agricultural fields (often occurring on very fertile land) has been promoted in order to achieve some important goals, like the of reduction of agricultural surpluses.

In Europe, between 1994 and 1999, and according to the EEC/2080/92 Regulation, over 1 million hectares of cultivated farmland were afforested, and of this more than 100,000 hectares in Italy.

The next phase of the CAP reform (whose strategic goals are described in “Agenda 2000”), started in 2000, did not allow, at least in Italy, to continue on the path started by Regulation 2080/92, mostly because of the lack of a specific normative instrument for the afforestation of farmland. Although the measure remained in the Rural Development Programmes of the Italian Regions, in fact it stopped being applied as the rural world became more attracted by other measures.

Since 2003, a new and radical CAP reform began to take shape. This was necessary, given the extremely rapid evolution in the international political and economic scenario (GATT agreements, market globalization, EU enlargement, etc.). It definitely took shape in 2004 with the so-called “Fishler Reform” (named after the European Commissioner for Agriculture), which established the decoupling of agricultural subsidies from quantities produced and eco-conditionality. From 2007, in the new CAP round which will last until 2013, farmers will still benefit from subsidies according to the number of hectares under cultivation, regardless to the type of crop, provided that they respect specific environment protection standards. Farmers will be free to choose between extremely short and short rotation forestry (arboriculture of non-coniferous species such as poplar, paulownia, etc.), or ordinary agricultural crops. This is entirely new compared with the past 2080/92 Regulation, when the possibility of growing trees was subject to a specific authorization and was limited to a number of eligible areas on a regional, national and EU scale.

In the meantime, the profitability of the main crop in the Po Valley – maize – has been constantly reducing, and its profitability is now heavily dependent solely on the CAP support scheme.

According to recent investigation by Veneto Agricoltura (2003), the direct production cost of maize in the Veneto plain has increased to 739.5 €/ha (for an average productivity of 8-10 t/ha), of course depending mainly on the farm size. Large farms can keep a production cost of no more than 70 €/t, while small farms with a UAA (Used Agricultural Area) of less than 10 ha have higher production costs. Fixed costs should be added to this, in average 709.5 €/ha. The total average production cost of maize totals therefore 1499.0 €/ha. Given that the selling price of maize is about 115-120.0 €/t, almost as much as the production cost, basically what farmers really gets is the CAP subsidy.

In the new decoupled policy, FFSs with short rotation forestry and cereal crops will have the same starting line. However the former will benefit from some more favourable conditions:

- annual costs of tree growing are very low given that maintenance operations between planting and harvesting (usually with 5–6 years rotations) are practically inexistent;
- the main product from short rotation forestry – chipped wood – has an increasing market value thanks to the increased use of wood for energy production; its cost can be as much as 60–70 €/t. This guarantees a net profit per hectare of at least 150–200 €/year
- application of the Kyoto Protocol mechanisms allows carbon trading from C-sequestration by forests to be practiced. In Italy, the CIPE 123 resolution of 19 Dec 2002 identified appropriate initiatives for the reduction of CO_2 emissions, and gave great emphasis to afforestation activities. The current value of one carbon credit is estimated to range from 4 €/t (pessimistic hypothesis) to 20 €/t (optimistic hypothesis). In a normal short rotation forestry producing about 10 t of dry matter/ha/year, the value of credits will range from 100 to 500 €/ha per year
- finally, the finishing service will paid for by the managing authority of the purification plant to the owner of the area hosting the forest filter system. The farmers interested in such a possibility have declared that a profitable remuneration would be around 300–500 €/ha per year.

All these aspects depict a highly favourable economic scenario for the spread of FFSs in the Po Valley and Venetian plain, provided that some initial expenses connected to the establishment of the FFSs – like preliminary investigations; instruments for monitoring outflow water and analyses costs – have not to be meet by the private landowners.

7. Conclusions

This paper has shown that in the area of the AATO Bacchiglione territory, Veneto plain there are favourable conditions for the creation of FFSs to be used for the finishing of wastewater from municipal purification plants. Besides contributing to the purification of wastewater, making it pure enough to be released into surface water bodies (in compliance with the EC/2000/60 Directive), FFSs appear to be a new crop that can remunerate farmers and as such they deserve to be encouraged through financial mechanisms.

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Analysis of Stakeholders' Preferences Regarding Urban Parks

Lyudmula D. Zahvoyska

Department of Ecological Economics, Institute of Ecological Economics, National Forestry Engineering University of Ukraine, Lviv, Ukraine

Abstract

Identification and analysis of stakeholders' perceptions are very important for decision making regarding sustainable urban park management. This management deals with a variety of values. Within this framework stakeholders' preferences are dynamic, controversial and sometimes even exclusive. Nowadays there are many methods for environmental cost-benefit measurement. However, the diversity of approaches highlights the complexity of the task and recognition of its importance in public decision making. The main drawback of these methods is that they try to assign a monetary value to goods and services which cannot be measured in such a way.

The multi-group social choice approach and 3CM technique seems to be able to overcome methodological gaps and to reveal real stakeholders' preferences in a quite clear way. Our experience in applying this approach to Lviv urban park "Znesinnya" sustainable management is presented in this paper.

Keywords: perceptions, social choice approach, urban park management

1. Introduction

Since the proclamation of Ukrainian independence, sets of descriptive and normative challenges have arisen for Ukrainian economists. Market transformation of the national economy coincided with worldwide economic paradigms' alteration, driven by the guiding principle of sustainable development. A complicated tangle of old and new trends in economic growth, conflicting economic interests, and non-democratic political institutions disabled creation of a well-grounded doctrine of economic reforms. Ukrainian economists were unable in the short-term to solve the problem (Zlupko 2004) of creating a Ukrainian model of long-term economic growth.

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Trying to blend in with the global economic mainstream, Ukraine faced a deep economic crisis, which notably differed from cyclic crises of overproduction in the West. First, it appeared and extended in connection with the transformation of the centralized economic system into the market one. During this process the disproportions, took a place in the past and deepened. It meant that companies' production capacity levels significantly decreased, the system of payment worsened, and there was an avalanche in the collapse of manufacturing. An intensive transformational crisis also developed in such spheres as production of goods, the social sphere, public health services, and culture. The accelerated rates of formation of private property and a market infrastructure, plus relative freedom in pricing created an illusion of a successful transition to the market economy. But the market financial infrastructure formed by outstripping rates began to serve itself, instead of the real sector of the economy. The fact that the process of monetary capital formation preceded development in the industrial capital became the essential factor of destruction of the basic production assets of the country, instead of their re-structuring. The third crisis feature of the modern economy is the scale of corruption, its shadowiness, and a significant outflow of capital to foreign countries.

Being anxious for their own financial positions, newly-made businessmen, under the protection of the state administration, led the country into such a critical position, that Ukraine found itself placed no. 122 in the environmental sustainability index declared by the World Economic Forum in Davos in 2001 (World Economic Forum 2001). At the start of the 21st century, Ukraine apparently managed to escape the trap of transformational crisis and for the first time in the ten years of independence achieved significant economic indicators growth. But these traditional economic indicators, in contrast to a genuine savings indicator, do not reflect real natural capital depletion, which is the consequence of over-extraction of ore and coal, forest over-felling, environmental pollution, which resulted from heavy structural deformations of Ukrainian industry and expressed by the raw materials and energy intensity of its exports.

In order to stop an absurd technological race leading to environment degradation it is important for our country to create and promote eco-responsible management, to disseminate ecologically sound experience, and to shape an "enviro-mentality". We agree with Young on that to encourage sustainable use of natural resources, either national or local, it is necessary to grant formal rights of resource use and development to traditional land users, and then to enforce them conscientiously and consistently (Young 1992). To understand and incorporate local people's preferences and perceptions into decision-making we have at least to identify them.

This paper is devoted to one example of Ukrainian experience of local people's preferences regarding an urban park. The research was done as a pilot investigation (due to some objective and subjective factors) so the obtained results are only indicative, and the investigation will be continued and elaborated in a more precise way. But, on our opinion, they reflect new trends in our shift toward awareness of the crucial multifunctional role of parks in an urban environment and modern lifestyle.

2. General considerations on the methodology used in research

The modern world has been changing rapidly, which becomes apparent through such processes as globalization, liberalization and computerization. Rational *homo economicus* tries to measure all elements of natural capital, to attach a money equivalent and, in the end, to deal with them in decision-making like with ordinary elements of man-made capital. But the multitude of measurement studies and valuation methods that have been proposed (Arrow et al. 1993; Hanley and Spash 1998; Callan and Thomas 1996) and the huge amount of critical references (Hausman 1993, Portney 1994) show that this task is simultaneously very important and complicated.

In our opinion the root of such willingness to measure all environmental benefits in money-equivalent lies in an inappropriate interpretation of the role of the individual in a total human-nature system. We generally consider *homo economicus* as an individual who is integrated into the human-nature system in a fragmentary way. Perhaps, it is vital to create new knowledge about complex human-measured systems (Tarasevych 2004), in which both human and nature are self-valuable and equal-valuable sources (cradles), where man is integrated into the system continuously-infinitely. Realizing this, we have to rethink valuation methodology and the obtained results.

Both revealed and stated preference valuation techniques are in a sense extensions of market valuation, aimed to assign a monetary measure to all components of total economic value – use and non-use values. Although they provide useful information to environmentalists and decision-makers, particularly in the case of absence of market for some private and public goods (Bishop and Romano 1998, Jacobsson and Dragun 1996), questions about their methodological background and interpretation are keenly discussed in the modern economic resources and philosophy literature.

Kant has highlighted serious conceptual limitations of neo-classical economic paradigm, which currently provide the background to natural resource management (Kant 2003). Kant and Lee justly pointed out that use of market analogies for forest valuation "will not only be deceptive but also fully erroneous". And they consistently proved that an individual's preferences for the social states of the forest "can be determined through non-market-oriented stated preferences and/or preferences revealed through mechanisms other than the market" (Kant and Lee 2004). In addition to these reflections, the authors produce another six arguments in favor of non-market-oriented techniques and conclude that the emergence of sustainable forest management paradigm is itself a proof of the limitations of the market and market signals.

To avoid integrating non-meaningful monetary valuation into decision-making, which could lead to wrong decisions from inter- and intra-generation perspectives, Kant and Lee use 'multi-group social choice method' as the extension of social choice approach, which features such peculiarities of sustainable forest management as joint production of goods and environmental services, inter- and intra-generational (inter-stakeholder groups) distributional issues (Kant and Lee 2004). Besides, this approach deals much better with continuum of use and non-use values because it considers an individual as a rational and responsible citizen who does not only follow own profit and pleasure (Etzioni 1988). Such a position in the post-Brundtland society is more realistic and acceptable than the position of an aloof and indifferent observer.

According to sustainable resource management paradigm, different stakeholder groups should be involved in a decision-making process. To identify the values stakeholders associate with an urban park we used the technique similar to 'Conceptual Content Cognitive Mapping' (3CM) (Kearney and Kaplan 1997, cited in Kant and Lee 2004) because this method does not bring the respondent to a narrow corner of monetary valuation of non-market goods and associated externalities. On the contrary it provides a space to express (verbalize) personal preferences and perceptions regarding other stakeholders interests concerning the multifunctional role of parks in an urban environment. Respondents are supposed to point all relevant values associated with an urban park, to group, name and range them according to their own views and feelings. The eight steps of the 3CM exercise - 1) introduction, 2) visualization, 3) own preferences (values) identification, 4) grouping, 5) labeling, 6) ranking, 7) identification of perceptions of other stakeholders values, and 8) completing the exercise – are well described by Kant and Lee (2004) and Lee (2003).

3. Elicitation of individual preferences for values of an urban park

The shift toward sustainable development has also challenged city management within Ukraine. Lviv, as a pearl of Ukraine, is included to UNESCO World Heritage List (UNESCO) due to its valuable ancient architecture ensembles, which attract people from around the world. Its medieval urban topography, Baroque and later buildings have been preserved virtually intact. Several rings of city parks splendidly supplement magnificent medieval palaces and churches. Some are situated within a few minutes walk from the downtown. One of these parks is regional landscape park Znesinnya (in English "Ascension"), which stretches out on the picturesque hills close to the watershed between Baltic and Black seas and separates and protects historical south of Lviv from the expanding industrial north. Until the Second World War these hills were covered by native beech groves, with a soft microclimate and picture views of this part of the city. Nowadays the surviving part of these groves is under state protection.

This park is a favorite spot both in summer due to the coolness of several lakes and shady groves, and in winter due to its down-hill skiing. At the same time this park plays the important role in the cultural life of the city inasmuch as Museum of Folk Architecture and Custom (so-called Museum under the Sky) is located in the park. With its natural, historical and cultural environment the park often hosts concerts, festivals, summer schools, competitions and other entertainments. At the same time the park area is an attractive place for private house-building and business (railway, several streets and a high voltage line cross the park area, some factories are located here).

Hence, following sustainable development imperatives, the park managers have to deal with a continuum of values from use values to spiritual and cultural values (Kant 2003), which are relevant in this case. As in the case of sustainable forest management, these values are complementary and not substitutable. They satisfy different needs and wants and could not be meaningfully measured by monetary metric.

The park management faces divergent interests of multiple stakeholders, who appreciate environmental, cultural, historical, recreational and educational values. Besides this, newly-made business structures try to grab the park area for private house-building and locating new company offices. Keeping in mind previous performances of the proponents with respect to social and environmental responsibilities it is hard to expect them to care about the picturesque surroundings.

Hence we identified six stakeholders groups: local government, business establishments, NGO, educational establishments, local population, and mass media. We planned to collect data from about 15 people of each group. More than eighty people participated in our survey. Overall response rate was 85%, as only 10 people who were contacted refused to express their preferences. The overwhelming majority of them belong to business circles.

The dominant value themes were identified according to participants' grouping and expert's judgment. Obtained results enabled us to create a matrix with 6 value categories. We would like to note that we have not observed the variety of values we expected, so the categorization process was not complicated. Perhaps this indicates some shortcomings in our preliminary work with respondents or respondents' constraints in value identification.

As mentioned above, in the sixth step of the 3CM exercise participants ranked values they identified and in this way revealed their personal preferences. Following Bengston's (1994) and Lee's (2003) argumentation, we consider participants' ranks (group labels) as an expression of their preferences on one park value over another. The lowest rank indicates the highest interest in the value. Hence, analyzing participants' statements, we obtained a preliminary matrix of stakeholders' preferences regarding the park values (Table 1).

As Table 1 shows, ordinal preferences ranking makes valuation possible without use of a monetary metric. Five groups from six put recreational values in first place (e.g. walking,

Table 1. Stakeholders' preferences regarding urban park. Preliminary map (Belyakova 2005).

	Values					
Stakeholders	Recrea-tional	Environ-mental services	Aethe-tical	Historical and cultural	Educational	Economic
Local government	1	2	2	1	3	-
Business establishments	1	3	2	-	-	3
NGO	1	2	2	4	3	-
Educational establishments	1	1	2	3	-	-
Local population	1	1	2	2	-	-
Mass media	3	1	1	2	4	-

hiking, skiing, fishing etc.) and only the mass media consider aesthetical values and environmental services the most important. Preference for environmental services occupies second place but seems to be discrepant to different stakeholders – the most important to local population, mass media and educational establishments. Aesthetical values (hilly green area in the town makes the latter picturesque and shadows the cubic architecture forms of recent buildings) were put in third place (Figure 1), historical and cultural values seem to be fourth, and educational values are mentioned only by NGO, local government and mass media. Only business establishments stressed the economic values of an urban park (and in a very outwardly restrained form).

Analysing map by stakeholders' preferences profiles one can easily see that local government considers the most important recreational, historical, and cultural values, second place is given to aesthetical values and environmental services. Educational values are in third place (Figure 2).

Business establishments put recreational value in first place; aesthetical – in second, but environmental services and economic interests are of the same importance and occupy third place.

NGO, as all stakeholders, put recreational value in first place too, but consider environmental services and aesthetical values equal in value. Educational values are in third place, historical and cultural values are fourth.

Educational establishments and local population highlight recreational value and environmental services as the most important (that is logical), aesthetical values step them, historical and cultural values are in third or second place correspondingly.

Mass media (due to their own interests) consider the most important aesthetical value and environmental services, historical and cultural values are next, recreational possibilities they put in third place and educational – last.

Conclusion

Avoiding market-oriented approaches to the park value identification we obtained a preliminary map of stakeholders' preferences concerning the regional landscape park Znesinnya. It clearly showed divergent preferences of the six stakeholder groups and could assist managers in decision-making from a sustainable development perspective.

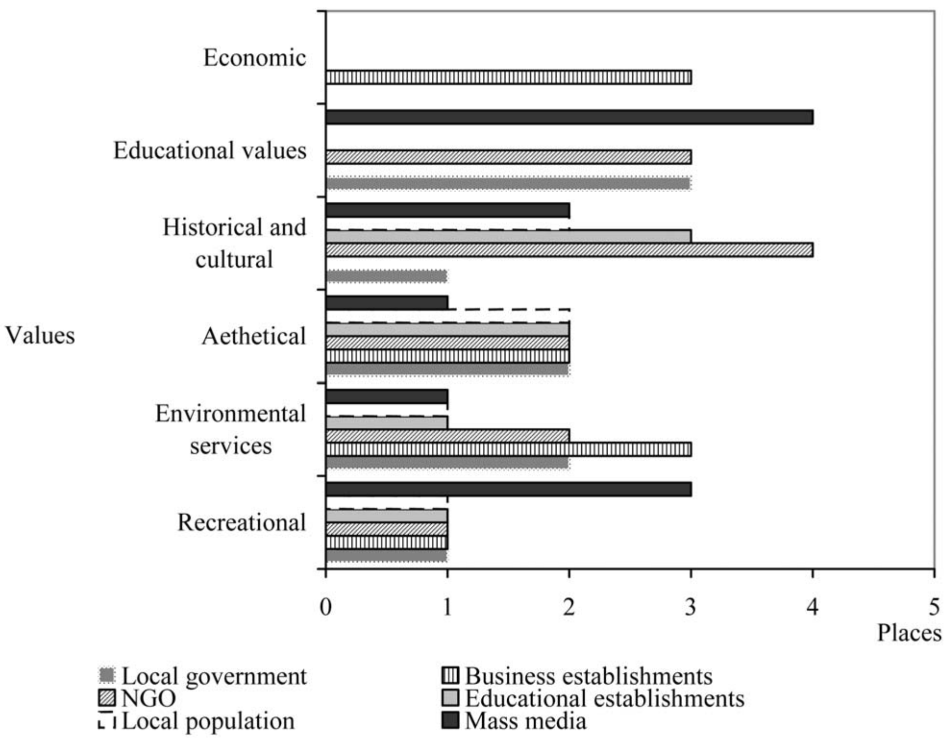

Figure 1. Map of preferences (by dominant park values).

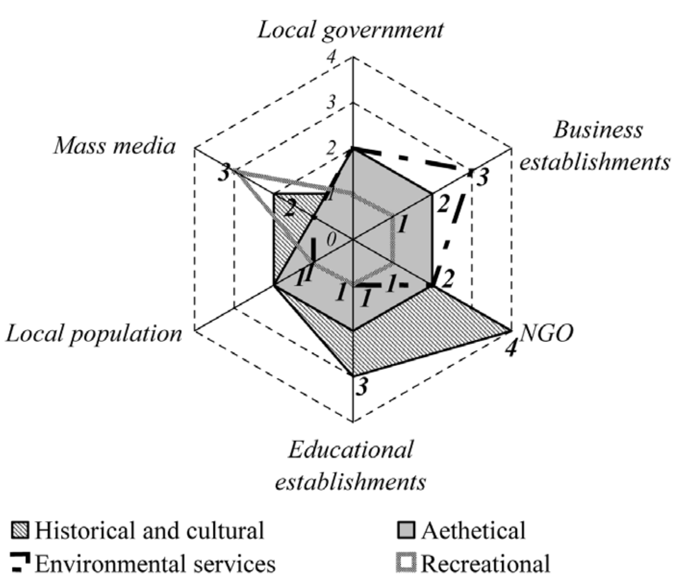

Figure 2. Map of preferences (by stakeholders).

Indeed, to draw up a sound map of preferences we have to extend the database, overcome shortages in the number of representatives in each group and use an accurate method of non-parametric statistical analysis to elaborate the results of observations. Recognition of the values continuum will plainly highlight common decisions and point out a set of values supposed to be carefully discussed from a co-management perspective.

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Forest Fire Valuation and Evaluation: A Survey

Pere Riera[1], Robert Mavsar[2] and Joan Mogas[3]

[1]Autonomous University of Barcelona and Centre Tecnològic Forestal de Catalunya, Spain
[2]Slovenian Forestry Institute, Slovenia
[3]Universitat Rovira i Virgili, Spain

Abstract

While the risk of forest fires has been a subject of study from different disciplines, its economic evaluation has received relatively little attention. This paper provides a literature review of studies dealing with the economic perspectives of wildfires and fire management regimes. It focuses on the methods applied and the results obtained. The studies can be grouped into those valuing the different damages caused by wildfires and the costs of the post fire restoration, and those evaluating various management measures. The valuation method used and the values obtained by the different authors are reported in this paper.

Keywords: forest fires, valuation, evaluation

1. Introduction

Forest fires cause ecological but also economical and social losses. The burned timber has less value in the market, houses and other premises can get damaged; many non-timber products are also affected, like mushroom or medicinal herbs production; recreationists experiment a loss in their welfare; the biodiversity of the area can be diminished; carbon stored by trees is released to the atmosphere; in hilly areas the risk of erosion increases significantly; people can experience health problem or even die. Therefore in addition to studies devoted to the different characteristics of forest fires (ignition, spreading, etc.) also studies on the economic and the social costs of forest fires are gaining more attention.

According to the objectives of such studies, they can be divided into two major groups. The first group aims at an estimation of the economic value of different damages caused by forest fires and the post fire restoration cost. While the second group of studies is oriented towards

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the assessment of different management measures. Also in this paper we will follow this pattern; first reviewing the studies related to wild fire damages and restoration costs, followed by a part on the management evaluation.

When valuing the different costs and benefits related to forest fires and forest fire management measures, people value various goods and services. Some of them are traded in markets (e.g. effected timber, houses, and cars) and their values can be directly observed through market prices, while others the value is not directly observable in existing markets (e.g. fresh air, recreation, landscape aesthetics). To value fire effects on such goods and services, different valuation methods were developed. Since some of the methods latter on appear in the text, a short explanation about them is given first. A more detailed description and use of these methods could be found in Camp et al. (2003), among many other references.

2. Economic valuation methods

Valuation by market prices

One way to estimate the value some of the goods or services affected by forest fires is by prices, when they are bought and sold in commercial markets. This approach can be used to value changes in either the quantity or the quality of a good or service. Assuming changes are not big enough to change prices, it is just a matter of multiplying the number of units times the price, to obtain the overall value.

Hedonic Pricing

The first non-market valuation method to be applied was the hedonic price method. It is used to estimate economic values for those goods and services that directly affect market prices of some other (related) goods or services. The basic premise of the hedonic pricing method is that the price of a marketed good is related to its characteristics, or the services it provides. For example, the price of a house reflects the characteristics of that house – size, age, comfort, location, air quality, etc. Therefore, we can value the individual characteristics of a house or some other good by looking at how the price people buy it for changes when the characteristics change. The hedonic pricing method is most often used to value environmental amenities that affect the price of residential properties (Rosen, 1974).

Travel Cost Method

The basic idea of the travel cost method is that the time and travel cost expenses that people incur on to visit a site represent the “price” of access to the site. Since those “prices” are different for different individuals, a demand curve can be derived, and the consumer surplus (or benefit associated to the good consumption) calculated. The travel cost method is used to estimate economic use values associated with ecosystems or sites that are used for recreation (Hotelling, 1949).

Contingent Valuation Method

The contingent valuation method involves directly asking people, in a survey, how much they would be willing to pay for specific environmental good or services, or in some cases, people are asked for the amount of compensation they would be willing to accept to give up specific environmental services. It is called “contingent” valuation, because people are asked to state their willingness to pay, contingent on a specific hypothetical scenario and description of the environmental service.

Contingent valuation is a way to assign monetary values to non-use values of the environment—values that do not involve market purchases and may not involve direct participation. These values are sometimes referred to as “passive use” values. They include everything from the basic life support functions associated with ecosystem health or biodiversity, to the enjoyment of a scenic vista or a wilderness experience, to appreciating the option to fish or bird watch in the future, or the right to bequest those options to your grandchildren. It also includes the value people place on simply knowing that giant pandas or whales exist. The contingent valuation method (CVM) can be used to estimate economic values for all kinds of ecosystem and environmental services (Mitchell and Carson, 1989).

Benefit transfer

The benefit transfer method is used to estimate economic values for ecosystem services by transferring available information from studies already completed in another location and/or context. For example, values for forest recreation in a particular area may be estimated by applying measures of forest recreation values from a study conducted in another location. Thus, the basic goal of benefit transfer is to estimate benefits for one context by adapting an estimate of benefits from some other context. Benefit transfer is often used when it is too expensive and/or there is too little time available to conduct an original valuation study, yet some measure of benefits is needed. Among other factors, the quality of a benefit transfer exercise is limited to the accuracy of the initial study.

3. Wild fire damage assessment

One of the main issue of economic studies related to forest fires, was the assessment of costs of wildfire suppression and the valuation of wild fire related damages (Kline, 2004), aiming at the assessment of the damages caused by forest fires or the effectiveness of different forest fire mitigation measures. The different damages and losses included in such studies can vary to a substantial extent. While some mainly aim at a precise valuation of the timber losses suffered due to wild fires, others include many different categories of losses and damages.

The major categories of damages and losses related to forest fires are: fire suppression costs, disaster relief expenditures, timber losses, property damage, economic activity losses, and human health effects. Of course also other potential costs and losses exist (e.g., lost wages, decreased quality of life, higher long-run fire fighting expenditures, landscape rehabilitation, and environmental degradation), but which are considered when estimating the overall impacts of forest fires, mainly depends on the availability and reliability of data.

In general, the economic aspects of the damages caused by forest fires occurring in proximity to settlements are difficult to measure and highly variable. Some aspects are straight forward and relatively easier to measure, such as fire suppression expenditures or property losses. Other aspects, however are more complex, such as the effect on a regional economy, or changes in recreation and tourism, are easily confounded by other factors, such as general economic downturns or a shift of economic activity from one location to another.

One of the early attempts to present the losses related to the occurrence of wild fires in forests, is given in Crosby (1977). A set of value concepts and methods for appraising damages from wildfire is presented. Emphasis is placed on the effects (positive and negative) of forest fires in terms of their affects on humans and forest management goal achievement.

In the next paragraphs we are addressing some of the categories of forest fire related damages. All values presented in the paper, are in 2004 €.

3.1 Damages of timber and other forest goods and services

Natural catastrophes such as wildfires can have short- and long-run effects on timber markets. Short-run effects (one to two years) include the immediate destruction of valuable standing timber and economic disequilibrium associated with the flooding of markets with salvaged timber. The big amount of salvaged timber drives prices downward temporarily, which affects owners of the killed timber, owners of undamaged timber, and timber consumers. Long-run effects on timber markets can arise from the loss of a large portion of standing volume, a loss that tends to drive prices upward for extended periods and produce a windfall for owners of undamaged timber. They also can create conditions favourable for a contraction in timber demand. Therefore, large-scale catastrophes often redistribute wealth among producers and consumers and cause a net economic loss (Prestemon and Holmes, 2004).

Mercer et al. (2000) calculated, due to the limited data available, only the economic effects of the wildfires on the northern Florida' southern pine saw timber and pulpwood markets and not considering the hardwood markets. Welfare effects were assessed based on the short-run losses and gains experienced by producers and consumers during the salvage period and the long-run losses and gains experienced by timber consumers and producers of undamaged timber. Long-run losses and gains were calculated based on a 3% real discount rate. It was calculated that the 1998 wildfires had overall negative effects on the northern Florida market for pine timber in the range from 322 million to 551 million €.

For the Indonesian 1997 forest fire, where an area of 5 million ha was burnt, 20% of which were forest, the total timber losses were estimated to 467.1 million €. Where these losses take into account the official estimates of timber stock, growth estimates of forests and net international timber prices. A net price of 47.3 €/m^3 was used (EEPSEA, 1998).

In addition, also other goods and services can be damaged by fires. Such as biodiversity, carbon sequestration, animal and plant habitats, recreation possibilities. Very often the value of such goods and services are estimated in studies where the public support for a fire mitigation plan is explored.

Thus, Loomis and Gonzalez-Caban (1998) applied the contingent valuation method to obtain estimates of willingness to pay for reducing the number and extent of wildfires within spotted owl habitat of California and Oregon's old-growth forests. Using a doubled-bounded dichotomous choice approach, the mean annual value per household for a fire management program in California was 74€ and 43€ for California and New England residents, respectively. This study points out that households receive benefits from fire protection of old-growth forests in states other than their own.

In the report on the Indonesian forest fire (EEPSEA, 1998) several other categories of forest goods and services are included (see Table 1). To calculate the direct forest benefits lost, a benefit transfer approach was used, drawing on average world values of tropical rainforest ecosystems, applying them only to the forest area in the sample (i.e. 1 million ha). Values for culture, timber and climate control/regulation and genetic resources were removed to avoid double counting with independent estimates described elsewhere. This yielded a net value lost of 501 €/ha/yr. It was assumed that non-timber forest products would be re-established over a period of 5 years.

For indirect forest benefits, a similar procedure to that described for direct forest services was applied, yielding a net value lost of 1,401 €/ha-year. It was further assumed that the losses applied only to the area 'effectively burnt' of forest, which was 50% of the actual forested area. It was assumed that indirect forest services would be re-established after 2 years.

The approach used to estimate the biodiversity lost was to value capturable biodiversity from Indonesia's perspective. The figure takes a value of 284 €/km^2-year. as an average of values found from various studies of willingness to pay to preserve tropical rainforest of various qualities.

Table 1. Other forest related losses for the Indonesian forest fire (in million € of 2004)

Type of damage	Loss[1]
Direct forest benefits	667.0
Indirect forest benefits	1,019.0
Biodiversity	28.4
Carbon sequestration	257.4
Total	1,971.9

[1] expressed in million €
Source: EEPSEA (1998).

Enormous quantities of carbon dioxide and methane were emitted during the fire. Such emissions increase global warming, which in turn is assumed to cause economic damage. From previous studies, for the Intergovernmental Panel on Climate Change, a value of up to 28 € on the damage caused by a ton of carbon emitted was estimated. In this study, a value of 9.5 €/ton was used.

3.2 Property losses

Very often, forest fires also cause other property losses, in addition to the damages caused to the timber. These might comprise private as well as public goods, including losses or damages to homes, business, infrastructure and other goods. The value of such losses is generally calculated trough market prices. However, even in this case where it might seem easy to valuate damages, a considerable amount of damages could be missed due to incomplete data.

In the study conducted by Mercer et al. (2000), it was estimated that 340 homes, 33 businesses, and several cars and boats were damaged by the wildfires totalling between 9-11 million €. But the estimates included only the losses to insured property and it was assumed, that the amount would double if also the losses to uninsured property would be included.

When calculating this category of damages for the Hynman fire, Kent et al. (2003) included only the value of all destroyed structures that had previously been listed on the County assessors’ tax roles and decreased land values associated with the fire were included. Property that was tax exempt and structures which were not listed on County assessors’ roles were not included in the loss estimates. According to the County assessors, private real property loss for the four Counties area directly impacted by the fire was valued at 20 million €, with an annual assessed value of 2.9 million €, resulting in an annual loss of revenue to the Counties of approximately 200,900 € per year. Additionally, the damage to power lines was estimated at 742.900 €. According to the insurance companies, the total damages caused by the fire to insured private property were estimated at 32.7 millions €.

3.3 Economic activity losses

Beside the direct property losses, forest fires can also influence the economic activity of a region. To assess this influence, appropriate geographical impact areas and influenced economic activities and industrial sectors have to be identified. One of the procedures to estimate such influences is to collect and analyse data on the economic activities before, between and after the fire occurrence.

For the 1998 fire, which occurred in Colorado, decreased tourism and sales due to forced evacuations, road closures, and negative publicity were expected to reduce actual gross sales. For the sales it was found that in the analysed period, they were about 1,000 million € higher than one would have expected without the fires. The increase was present only in the first part of the considered period, and corresponded to the height of the fire fighting costs. A significant decrease in sales was detected in the last part of the analysed period. It appears that the fires forced increases in present consumption at the expense of future purchases (Mercer et al., 2000).

In the same research, the impact of the fire towards the tourism was calculated on basis of the hotel revenue data. A net lost of 55.6 million € in hotel revenues for the considered area was estimated; although only August total losses were statistically significant. Further, if it was assumed an average tourist spends of 89 € per day (non-lodging related spending), with a loss of hotel nights of 70.3 million € in tourist spending during the analysed period (Mercer et al., 2000).

The direct impacts on the economic activities were also calculated for the Heynman fire. For this purpose, wages (including salaries), employment, and retail sales were used as the measures of economic activity. The results showed that the employment increased for almost 0.5% in the main fire impact area during and after the fire, wages decreased a 3%, and retail sales per month increased for almost 4%. Similar conclusions were drawn when considering only the wages paid in the tourism related sectors (eating and drinking establishments, lodging and recreation establishments). The authors could not prove that the fire had an overall negative impact on the regional economy. However, compared to the previous years, there were substantially more significant negative differences than significant positive differences. This may indicate that, at least in some areas and sectors modelled, the Hayman fire did decrease economic activity (Kent et al., 2003).

3.4 Fire suppression costs

The suppression costs include the costs such as field camps, use of equipment, tools and supplies expended or lost, mobilization and demobilization costs, etc, and related logistic costs, like evacuations, emergency operations centres, debris removal, and so on. Expenditures are corresponding to the area burnt and the phase (initial or extended) in which the fire is extinguished (the severity of the fire) (Kent et al., 2003).

According to the fire reporting system used by the US Forest Service, the cost of suppression measures in Colorado varied from 123€ to 1,088€ per hectare. A study conducted by the Rocky Mountain Research Station (RMRS) of the Forest Service, fires for the in fire years 1996 and 1997 in the western Forest Service regions of the United States showed that the costs averaged about 1,184 € per hectare, for fires greater than 2,000 hectares. The range of values found went from 62.5€ per hectare up to 6,084 € per hectare (Kent et al., 2003). In the period 2000-2002, for the whole USA, suppression costs ranged from a low of 321€ per hectare in 2001 to 482€ per hectare in 2002 (Omi, 2004).

The suppression costs calculated for the 1998 Colorado fire reported in Mercer et al. (2000) were between 45 and 91 million € for the fire fighting related actions, while the emergency measures reached 18 – 23 million €.

Kent et al. (2003) presented a break down of fire suppression costs for the Heyman fire (occurred in the fire year 2002). A summary of the costs is presented in Table 2.

The fire suppression costs mainly depend upon the fire size and severity. But also other parameters may influence the total or per hectare suppression costs. Donovan et al. (2002) tested whether the proximity to housing effects the suppression costs. The hypothesis was that suppression costs would increase if there are more houses in proximity to wildfire, because fire managers would maybe use more resources to protect the threatened houses. They tested several

Table 2. Fire suppression expenditures for the Hayman Fire, by category (in thousands € of 2004)

Category	Amount[1]
Personnel compensation	7,727
Personnel travel	1,111
Supplies and services	25,299
Other	222
Total	34,359

[1] expressed in 1000 €
Ssource: Kent *et al*., 2003

parameters which might influence the costs (housing density and total number of houses within the perimeter of each wildfire, fire size, fuel moisture, terrain difficulty, relative scarcity of suppression resources). Regression analysis showed that only fire size and extreme terrain conditions were significant. While neither total housing nor housing density explained any of the observed variation in suppression costs. The authors draw the attention to the fact that results should be interpreted with care. Fire size is in relation to the suppression costs. Therefore, this is not completely an exogenous variable, but rather costs and size are determined simultaneously. On the other hand the insignificance of the housing parameters could be explained by a small size and the truncation of the sample, since cases without losses to houses were not available.

3.5 Other damages caused by wildfires

Wildfires produce smoke that contains air pollutants such as particulates, volatile organics (hydrocarbons), carbon monoxide (CO), and nitrogen oxides (NO_x). Depending on meteorological conditions, the emission could impact also the health and well being of those outside the fire regions. The literature suggests that fires may have several different effects on the health and well-being of the population. The exposure to smoke – much like exposure to air pollution – is likely to affect upper respiratory morbidity. In particular, smoke can cause internal lung lesions and the airway's natural response to such damage is generally increasing inflammation that evolves over time. This inflammation reduces the size of the airway and can lead to more severe obstructive breathing disorders (Frankenberg et al., 2002).

For the extreme forest fires which occurred in 1997 in Indonesia, evidence of increased bronchial asthma and acute respiratory infection was found. For example, a report from the Provincial Health Office of Jambi, Kalimantan showed a 51% increase in cases of respiratory disease in that province during the haze period (Frankenberg et al., 2002).

In another study (Ruitenbeek 1999) it was estimated, that 20 million people were at risk for this hazard and the short term haze impacts resulted in over 946 million € of losses. This impact occurred during the three-month haze episode in 1997, and excludes long-term health-related losses. The calculation of losses included costs for increased treatments, lost workdays and individuals WTP to avoid illness.

For the Florida fire (Mercer et al., 2000) the yield of pollutant, were determined to be 8.5 kg/ton, 70 kg/ton, 12 kg/ton, and 2 kg/ton for total particulates, carbon monoxide, total hydrocarbons, and nitrogen oxides, respectively. Emissions were calculated for the 1998 summer wildfires only for a limited area, but it was estimated that they accounted for over 85% of the wildfire related pollution. To examine whether the extreme levels of wildfire in northern Florida could be linked to actual public health conditions, the admissions records for hospitals located in counties in the zone of greatest wildfire activity, were analysed. Emergency department visits increased for asthma (91%) and bronchitis with acute exacerbation (132%). However, the numbers of actual admissions were small and the frequency of some respiratory conditions even decreased, when compared to the previous year.

3.6 Post fire restoration measures

The economic analysis of post-fire restoration has received little attention. Expenditures for rehabilitation and restoration of the burnt sites can be divided into two groups. First, the burned area emergency rehabilitation treatments like, such as mulching, log erosion barriers, and seeding or scarification. Those should be conducted within a short period after the fire (up to a year) since their objective is partly to prevent erosion and to control noxious weeds. Second, the long-term rehabilitation and restoration project expeditures, such as reforestation, infrastructure reconstruction, or research projects (Kent et al., 2003).

The total burned area emergency rehabilitation costs for the Haynman fire were estimated to be around 11.8 million €. In addition, also other longer term (1 to 5 years) rehabilitation and restoration projects were planned in connection with the fire. These projects included: (1) land and facilities, like trail and road reconstruction, campground and heritage site reconstruction and restoration, (2) habitat restoration, (3) forest health, including noxious weed control, (4) planning and administration, (5) reforestation, (6) watershed restoration, and (7) research projects, such as analyzing soil productivity and the effectiveness of rehabilitation. Nearly 31.2 million € were estimated to be spent on those projects.

Some studies on forest restoration after fires have also examined the public's interest in recovery management of burnt forests (e.g. Kent et al., 2003; Caroll et al., 2000). Even if not directly involving the economics of fire related actions, they give information on public preferences.

4. Evaluation of management measures

The second broad group of forest fire related studies are those dealing with the economic effectiveness of planed or applied prevention measures. Prevention measures are basically fuel treatments, such as prescribed fires, thinning, pre-commercial harvesting and other measures (like chemical and mechanical treatments). One of the principal economic questions is whether the resources spent to reduce the wildfire risk may result in a net economic gain. Often, the objective of prevention measures on a given forest landscape is to maintain or enhance the annual flow of forest benefits and reduce costs associated with wild-fires, by reducing the intensity, severity, and likelihood of extreme wildfire events. Investing in fuel treatments in a location implies implicit tradeoffs between the benefits and costs (Kline, 2004), partly illustrated in table 3.

Although not guaranteed (see Donovan & Rideout, 2003; Rideout & Ziesler, 2004), the expectation is that fuel treatments over the long term will result in lower fire suppression and post fire restoration costs, less smoke, less wildfire-related property damage, and fewer lost of socio-economic and ecological forest benefits. Evaluating the changes in net benefits that can be expected from fuel treatments involves several things. Among them, there is the reduction of the likelihood of extreme wildfire events. This implies the reduction of wildfire intensity, severity, and scale, as well as the effects that treatments and wild-fires have on forest management costs and the variety of forest benefits (Kline, 2004).

Some of the studies concentrate on a detailed analysis of the costs of prevention measures and the comparison of the costs for different types of such measures.

Table 3. Examples of costs and benefits relevant to examining the net benefits resulting from fuel treatment scenarios.

Example costs	Example benefits
Fuel treatment costs	Timber and non-timber forest products
Fire suppression costs	Grazing
Smoke from wildfires and prescribed burns	Ecological benefits (wildlife, fish, water quality, clean air)
Fire-related damages to private property, public	Recreation
buildings, roads, and other infrastructure	Scenery and aesthetics
Post fire restoration and rehabilitation costs	Carbon sequestration

Source: Kline, 2004

For the Mediterranean forest ecosystems, Rodríguez (2004) compares the costs of prescribed burning with those from more traditional methods for eliminating excess fuel loading. The traditional methods considered included clearance (either manual or mechanical), removal and piling, and the elimination of the waste product (by burning or shredding). On the other hand, prescribed burning unifies the stages required by the former method into one single operation. A comparison of costs per hectare (average slope and density conditions) between the two methods highlights the competitive advantage of prescribed burning (where the ecological conditions of the forest area are appropriate) over traditional methods. Analysing the costs for different fuel types, the costs for prescribed burning are ranging from 228€/ha (herbaceous fuel <60cm with low brush content) to 1,976€/ha (debris), while the costs for the traditional system are ranging from 575€/ha to 2,468€/ha (in both cases for the same fuel types as before). So the cost ratios between the traditional method and prescribed burning are between 1.25 and 2.51.

The per-hectare costs of different types of prescribed burning in different geographic and administrative regions were examined and compared in Cleaves et al. (2000). The data was collected by a questionnaire sent to the US Forest Service fuel management officers. The questionnaire included questions about cost of prescribed burning and the factors influencing them. In the responses, the officers stated the average, maximal and minimal costs and appointed them into planning and project costs. Planning costs included burn-plan preparation, compliance with the legislation and public involvement, project planning appeals, post fire evaluation of effects, smoke management, interdisciplinary teamwork, and general overhead. The project costs were composed of site preparation, ignition and maintenance, mop-up, post fire monitoring, contractor or co-operator costs, and other related activities. Costs were summarised and compared across different regions, burn types and other parameters.

The results showed that slash burning is the most expensive (390 €/ha) type of prescribed burning, followed by prescribed natural fire (374 €/ha), while the management-ignited burns (182 €/ha) and brush, range and grassland burns (133 €/ha) were the least costly. The largest part of the total costs was appointed to the in project activities, followed by planning costs with an average of 21% of the total costs. It was also found that the main parameters influencing the cost differences within the same fire type were unit size, homogeneity of objectives, site characteristic, burning condition and management policy.

In the same line, Omi (2004) reports that increases in area to be burned result in lower unit costs of treatment execution. The study estimated the average costs of prescribed burning projects in the US for the period 1994-1999 to be 85€/ha during the recorded period, varying from a low of 37€/ha to a high of 177€/ha. The estimates were based on the annual expenditures for these treatments, reported by different agencies in the US.

In addition to private costs, a complete economic analysis should include the relevant social costs and benefits associated with fires. For example, it may appear that prescribed burning is more cost effective than mechanical treatments given the accounting costs per hectare, but if burning generates significant negative impacts, in the way of increased health costs from smoke and diminished aesthetics, for instance, the actual economic cost of burning may be higher than the cost of mechanical treatments. Those impacts may be particularly relevant in high-use recreational areas. However, this is not a great deal of studies focusing on the estimation of fire effects on non-market amenities.

In Prestemon et al. (2001), a public welfare maximization function is employed to simulate the publicly optimal level of prescribed burning in a county in Florida. A wildfire production function was developed. It was based on spatial wildfire simulations and on assumed prices of wildfire damages and prescribed fire costs. In the model, private decisions on the amount of applied prescribed fire in an individual forest stand were ignored. Instead, it focused on how prescribed fire could be used to maximize the sum of discounted expected producer and consumer surplus for a region. To find the optimal levels of vegetation management inputs, stochastic dominance techniques were used to maximize the discounted net present value of public welfare of each prescribed fire policy. The estimated results showed that only the current year's prescribed fire area was a statistically significant explainer of wildfire risk and that each 1 percent increase in prescribed fire area would lead to a seven-year reduction of the wildfire area by 0.07 percent. Consequently, each 1 percent increase in current wildfire area would lead to a 1.4 percent decrease in future wildfire area over the period of seven years.

The simulation results showed that, in the range of the alternative stationary prescribed fire policies considered, probability distributions of the objective function values crossed in the ranges of 3,240 hectares per year to 4,860 hectares of prescribed burning per year. The optimal policy was identified in 3,650 hectares per year. The mean value of the objective function for 3,650 hectares per year was -30.18 million €, for 2,830 hectares per year of prescribed fire -30.23 million €, and for 4,450 hectares per year -30.20 million €. Part of the explanation for the small differences among stationary policies in the 405-8,100 hectares per year, is the small differences in the reduced wildfire areas. When comparing the policy of prescribed burning of 8,100 hectares per year whit the one where we burn 405 hectares per year, the gain in reduced wildfire area are only 365 hectares per year. Nevertheless, because of the small cost of prescribed burning, the returns from doing the identified "best" level of prescribed burning compared to the smallest level consistent with the data are large. There are 176,400€ of additional costs if we increase the area treated (by prescribed burning) from 405 hectares per year to 3,650 hectares per year. At the same time the difference in the net value saved amounts to 3.2 million € – a marginal benefit to marginal cost ratio of 18. Beyond 3.650 hectares per year, given the prices considered, the marginal benefits are lower than the marginal costs of conducting more prescribed burning.

Loomis et al. (2003) compared the benefits from reduced sediment with the costs of prescribed burning to generate a more frequent and low intensity fire regime in the wild land-urban interface of the San Gabriel Mountains of Southern California. The aim of the comparison was to estimate the economics effects of prescribed burning under a frequency of 5 and 10 years. For that, a cost-benefit analysis approach was undertaken. A sediment yield model was developed, to test the influences of different fire frequencies on the debris quantity. Data from the model were used as one of the inputs for the benefit-cost analysis. The main benefit was the cost savings from reduced sediment yield, which lowers the costs of debris basin clean-out. The cost savings were estimated according to market prices. Further, also the value of recreation at risk of forest fires was valued. The approach chosen was a benefit transfer from previous studies. Afterwards, a benefit cost comparison for the different prescribed fire regimes (5 and 10 year frequency) was conducted. When only cost savings and recreation at risk of wild-fires were considered, the net present values (NPV) for both regimes were positive, and the 5-year frequency preferred. For the 5-year frequency the NPV was of 41,542 €/km^2, while for the 10-year frequency it amounted to 13,408 €/km^2. A sensitivity analysis of the results showed that considering different prices of the clean-out and recreation losses due to prescribed burning could lead to a negative NPV for both regimes.

Hesseln et al. (2003) examined the effects of fire on recreation using the travel cost method. The model was specified to calculate the consumer surplus and to indicate whether fire effects have an influence on visitation and value of trips taken, and how this differs between Colorado and Montana. As parameters describing the effect of fire, time since the last fire was used. The results showed that the average number of individual trips taken per site in a no-fire situation in Colorado was 10.28 with individual net benefits per trip averaging 47.2 €. The number of individual trips taken per site in Montana was similar (10.25), with individual net benefits of approximately 10.3 €. It was also shown that the time elapsed since the prescribed fire had a slightly positive effect on visitation in both states. With respect to fire effects, it was found that wild and prescribed fires have varying effects on recreation demand and benefit in each State. The overall annual recreational value for the prescribed fire areas increased significantly in Colorado (346%), while in Montana the change was not significant (1.7%). On the other hand, crown fires resulted in decreased recreational annual values of 69.3% in Colorado and 86.7% in Montana.

In another study, Loomis et al. (2001) looked at the effects of forest fires on the benefits from hiking and biking. Visitors to National Forests in Colorado were surveyed to determine whether the time elapsed from the last fire and the presence of crown fires effected differently to the amount of hiking and mountain biking recreational visits and their benefits. To estimate the latter, a count-data travel cost model combining actual and intended behaviour data was used. The intended behavior trip questions asked about changes in the number of trips due to the presence of a high-intensity crown fire, prescribed fire, and a 20-year-old high-intensity fire at the area respondents were visiting. Using the estimated recreational demand function, the number of years since a non-crown fire had a statistically significant positive effect on the trip demand of hikers. In contrast, presence of crown fires had no statistically significant effect on the quantity of hiker trips, but had a significant and negative effect on mountain biking trips. Crown fires also had a large effect on the value per trip, with crown fires increasing the value per hiking trip but lowering the value per mountain biking trip.

Kaval et al. (2004) interviewed Colorado residents living within the wild land urban interface to find out their preferences on various fire management prescriptions aiming at restoring Colorado forest natural ecosystem health. In a CVM setting, the respondents were asked for their preference and WTP on three programs: fire suppression, fire prevention and prescribed burning. The WTP questions were asked as dichotomous choices (willing or not willing to pay some given costs for the respective policies). The hypothesis was that WTP would be higher if the perceived fire danger increased. The results indicated that approximately 66% of the respondents would pay for prescribed fires and fire suppression, while 60% of the respondents would pay for fire prevention. WTP values for the various fire prescription methods ranged from 435 € to 561 € annually per respondent. The perceived fire danger influenced WTP. For prescribed fire, WTP was influenced by perceived fire danger (271 €) and perceived fire frequency (-6 € per year for each additional year of the fire interval). Fire suppression WTP was not influenced by the degree of fire risk or fire frequency. However, the WTP for prescribed fire was influenced by frequency (-6.9 € per year for each additional year of the fire interval).

Respondents were also asked which fire management technique they would like to see used if they only had one choice. Over 85% of respondents stated that they would prefer prescribed fires.

Loomis and Gonzalez-Caban (1996) used a combined telephone contact-mail booklet-telephone interview of California and New England households regarding their willingness to pay for fire management in California and Oregon's old-growth forests. The aim was to test hypotheses regarding the spatial extent of the public goods demand. Using a multiple-bounded contingent valuation question, the study found that the annual willingness to pay by New England households for the California and Oregon programs was statistically different from zero. This suggested that households receive benefits from fire protection of old-growth forests in states other than their own. In this case study, limiting the survey sample to State residents where the National Forest is located would reflect about 20% of the national benefits. However, using resident's value as a proxy for non-residents would overstate the national benefits by 75%, since the values per household are significantly different. This finding suggests that more emphasis should be put in future surveys on selecting an institutionally and economically relevant sample frame rather than an expedient one.

In another survey, conducted by Loomis et al. (2000), an attempt was made to determine the level of support of Florida residents ascribed to the Expanded Florida Fire Management Program according to the belonging to different ethnic groups and concerning their relative location to past large scale wildfire events. The program contemplated three alternative mitigation strategies: prescribed fire, mechanical mitigation, and herbicide application. An additional objective of this study was to compare knowledge and attitude responses concerning wild and prescribed fire with past surveys, across language groups, and after the introduction of educational information. A dichotomous choice CVM approach was used to elicit the willingness to pay (WTP) for three alternative wildfire mitigation techniques. The results of the survey are presented in table 4. The negative median for the herbicide treatment indicates that half of the respondents would have to be compensated 125 € a year before they would support the program.

After the introduction of educational information contained in the survey, 81% of the respondents declared to be willing to pay the average cost of the prescribed fire program, which was estimated in 101 € per household and year. The percentage of positive answers was found to be positively influenced by decreases on the average cost figure and improvements in effectiveness of the prescribed fire program, as perceived by people. With a cost of 0.9 € and 100 percent belief in the effectiveness of the program by all households, the percentage of votes in favour of the prescribed fire program would raise up to 89% only. In addition, statistically significant differences appeared between knowledge and attitude from Hispanic and English respondents. Hispanic respondents showed lower knowledge and a higher perception of risk toward wild and prescribed fire. Even after the introduction of the educational information, which increased knowledge and improved attitude for the entire sample, the gap continued to exist. However, race and living distance from past wildfires proved to be insignificant influences on the support rate for the three alternatives.

In Europe, Riera and Mogas (2004) also conducted a simulated referendum application. They looked at the approval rate for financing a program that would lower the risk of forest fires in Catalonia (Spain) to half of the number of hectares burned on average yearly. The cost was estimated to be of 6 € per person and year to be paid indefinitely. The results showed that 63% of the respondents would support and pay for the programme. The analysis also showed that people more likely to directly enjoy the forests are also more likely to agree to pay for the risk reduction program. Also a positive relationship between the acceptance of the programme and the membership in an environmental organisation was found to be significant. Furthermore, a significant correlation was found between the support of the programme and the age of the respondents, where older people were less likely to support the programme as the middle-aged and young people. Also respondents living in larger urban areas (municipalities of >100 000 people) and those with a higher income were much likely to support the programme. On the other hand it wasn't found that gender significantly influences the support of the programme (Farreras et al., 2005).

Table 4. The median and mean willingness to pay (WTP) for the different proposed treatments (in € of 2004, for household).

Treatment	Median WTP[1]	Mean WTP[1]
Prescribed fire	153.79	162.83
Mechanical	90.00	142.32
Herbicide	-125.48	126.85

[1] per household in €

5. Conclusions

The social and economic effects or consequences of forest fires can be extensive, long lasting, and complex to identify and value. However, the challenge for the discipline of economics has not received the attention that issues related to ecological forest fire have (Rideout, 2003). Some of the fire impacts that are relatively easy to determine, are those related to the destruction of private houses, public property, infrastructure, timber, and suppression costs. It is a bit more demanding to estimate the recreational losses, although there is a relatively considerable number of studies estimating such values. Other impacts, however, are more difficult to value (and even to predict) with confidence, since they will appear during the next several years. This category of damages can include reduced property values, lost sales tax and business revenues, damage to the health of individuals and resulting costs, increased water treatment costs and other (non-market) costs (e.g. aesthetics, habitat damage, reduced biological diversity, or climate change, among others). According to the diversity of goods and services which can be damaged by forest fires, the economic studies have used and combined different valuation methods.

Different policies and management practices have been developed to lower the risk of the appearance forest fires and the extend of the social cost they are causing. These policies tend to require high amounts of public funds. Consequently, some research has been conducted to check whether the funds bring the desired results (their effectiveness) and whether they are allocated efficiently (not wasting resources). Some of the studies have taken a referendum type of approach, while others have conducted more formal cost-benefit analysis.

From the survey it seems that more comprehensive studies, as well as specific ones, are needed, The geographical concentration of the studies in the USA also suggest that more efforts are needed in other parts of the world.

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In April 2005, over 70 scientists gathered to discuss forest multifunctionality and its different economic connotations. The fact that multifunctionality is deeply embedded in the nature of forests seems never to have been questioned. However, several definitions of multifunctionality have been proposed over the years from various perspectives: biological, ecological, functional and managerial. Forest economists themselves have been discussing the economic nature of multifunctionality and its consequences on resources allocation for a long time, but they all seem to agree that forest multifunctionality can be meant as the capacity of forests to provide a large array of goods and services – private and public, market and non-market – at the same time.

The presentations and discussions were gathered under five themes:

- Polices for shaping the rural environment
- Role of institutions in the decision-making process
- Database and information systems for managerial economics and green accounting
- Non-market forest products and services – methodological issues, policy and management implications

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