Naturalist inventories: from practices to government modes. Introduction

Isabelle Arpin, Florian Charvolin, Agnès Fortier

THE NATURALIST INVENTORIES: FROM PRACTICES TO MODES OF GOVERNMENT

Introduction

Isabelle Arpin, Florian Charvolin, Agnès Fortier

Editions de l'E.H.E.S.S. | « Études rurales »

2015/1 No 195 | pages 11 - 26

ISSN 0014-2182
ISBN 9782713224713

This document is the English version of:

Isabelle Arpin *et al.*, « Les inventaires naturalistes : des pratiques aux modes de gouvernement », *Études rurales* 2015/1 (No 195), p. 11-26.

Translated from the French by Cadenza Academic Translations

Available online at :

---

https://www.cairn-int.info/article-E_ETRU_195_0011--the-naturalist-inventories-from-practice.htm

---

How to cite this article :

Isabelle Arpin *et al.*, « Les inventaires naturalistes : des pratiques aux modes de gouvernement », *Études rurales* 2015/1 (No 195), p. 11-26.

THE NATURALIST INVENTORIES: FROM PRACTICES TO MODES OF GOVERNMENT

INTRODUCTION

Isabelle Arpin, Florian Charvolin, and Agnès Fortier

Isabelle Arpin, Université Grenoble Alpes, National Research Institute of Science and Technology for Environment and Agriculture (Irstea), Mountain Ecosystems and Societies Laboratory (UR LESSEM)

Agnès Fortier, National Institut of Agronomic Research (INRA), Department: Social Sciences Agriculture, Alimentation, Space and Environment (SAE2), Unit: Farming systems and development, activities, products, territories (SADAPT) Ivry-sur-Seine

Florian Charvolin, CNRS senior researcher at the Centre Max Weber, Lyon.

Translated by Cadenza Academic Translations

From the designation of Zones Naturelles d'Intérêt Écologique, Faunistique et Floristique (ZNIEFF) [Natural Zones of Ecological Interest, Fauna, and Flora] to the inventory of different groups of species (flora, fauna, funghi)[1] and habitats that form ecosystems, to measuring the evolution of certain taxons in the context of what is now known as citizen science, the range of inventories is particularly rich and diversified. This diversity concerns both objects—from the most symbolic to the most ordinary—, objectives—from regular monitoring to impact studies—, levels—from the local to the global. It is also connected to the status of the actors involved in drawing up the inventories—from the professional or the experienced amateur to the ordinary citizen—to the methods and tools deployed—from the simple field survey to the rigorous procedure mobilizing computer or genome technologies.

The current period is also marked by a revival and a transformation in naturalist inventories. The rhetoric of environmental crisis and emergency is connected to this renewal of interest (Mauz 2011). The assertion of a sixth mass species extinction (Teyssèdre 2004) justifies drawing up an inventory to assess the situations of known species, to identify the many living creatures that are still unknown, and so to put in place policies intended to combat losses in biodiversity. The evolution of inventories is a more fundamental reflection of the transformations at work in the field of science and technology, within the state apparatus and society as a whole.

Three major changes characterize the naturalist inventories in the modern era. First, their digitization. In the information society era, we are seeing a proliferation of data intended to circulate via the infrastructures of knowledge that are databases. The other innovation is institutional. As measuring tools designed to list the treasures of the nation's natural heritage, inventories are now a frame of reference to legitimize public action. With other tools, (Lascoumes and Le Galès 2004), they represent a way of rationalizing the construction of knowledge and are an

1. Organisms commonly called mushrooms. Mycology is the science that studies these.

essential support for decision-making. Finally, inventories' topicality is inseparable from their political meaning. In a context of neoliberal globalization, they represent an instrumental vision of living creatures, mainly intended to sustain a plan for a material expansion of our societies. These changes should be located in the long history of inventories. As Émilie-Anne Pépy recalls in this volume, an inventory of species has been produced since Antiquity and this increased significantly in the eighteenth century with the invention of systematics and the growth of colonial expeditions. At that time, there were no inventories but "flora," "herbariums," "collections," "specimens."

This introduction proposes a general observation on inventories, organized around three sections: the process of producing inventories and their transcription in databases, their institutionalization—or how nature is captured by the state—and finally the inventory as the reflection and tool of a neoliberal government of living creatures. Moreover, it aims to present the diversity of academic work combined in this volume of *Études rurales*. To these analyses that are firmly turned towards the social sciences (modern and contemporary history, anthropology, sociology, political sciences), we thought it appropriate to add the viewpoint of Olivier Piron, a key actor in setting up the ZNIEFFs, which represent an important reference in the field of naturalist inventories in France.

Knowledge on nature: From *in situ* observation to relocation in databanks

How is the knowledge produced in the context of inventories carried out in the field? And how is it included[2] in databases? This continuous process is principally characterized by the values and the relationship with nature of those who carry this out. In addition, moving from observations realized outdoors to their representation in databank form results in many tensions and questions.

The terrain of inventories

Let us examine the practices of inventories that are based on observation in situ. This concerns identifying the presence and abundance of species in an area and extracting data from the terrain specifying, as a minimum, the name of the species, the date, and the place of observation, as well as the name of the observer. These elements are recorded in different media, such as notebooks, computer files, and spreadsheets. In relation to the diversity of the forms of nature outings, the inventories are like mechanisms based on more or less rigorous procedures that aim to set boundaries to the observation work, to satisfy a certain number of methodological and scientific guarantees, and to coordinate the actors remotely. They are based on a standardization, a normalization of data collection, required for their comparative or historical use, and correspond to a certain way of having knowledge. This is shown by the article by Corinne Beck and Élisabeth Rémy (this volume), whose socio-historical analysis uses the example of the otter and emphasizes the plurality of forms of knowledge on nature.

These inventories are shaped by actors. As many works by historians, anthropologists, and sociologists have shown (Ellis and Waterton 2004; Kohler 2006; Charvolin *et al.* 2007;

2. In Bruno Latour's meaning (2007), namely all the types of transformations by which an entity materializes as a sign, a record, a document, a piece of paper, a mark.

Roux *et al.* 2013; Alphandéry and Fortier 2013; Faugère and Sénépart 2012; Manceron 2015), one of the special features of naturalist sciences is to call on a varied range of actors, from professionals paid for their activities, to more or less experienced amateurs, or simple citizens who make available their skills and some of their free time to collect data as volunteers. The world in which inventories are drawn up is therefore filled with people from different social worlds, whose motivations and resources are often dissimilar. Nevertheless, most of them see this activity mainly as a hobby, a leisure activity or even a passion, including professionals. The observation of living creatures in their environment is often perceived by volunteers as a way of fulfilling their desire for knowledge about nature. It has its roots in an experience, a personal history, combined with an affect and a special relationship with some taxonomic species or groups (birds, lichens, or a genus of mushroom like russula), while at the same time often being associated with social connections and a special relationship with a territory. The production of knowledge through participation in data collection falls into a very broad category of motivations, between personal interests (curiosity, passion, self-realization, desire to belong to a group, recognition by one's peers), professional interests, and a feeling of responsibility with regard to nature. Thus, although it is based on readings by isolated individuals, as is particularly the case with some citizen science operations, the inventory work largely mobilizes the nonprofit world and its networks of amateur naturalists. This inventory work also concerns institutions such as public establishments in charge of the management or conservation of nature (botanical conservation areas, Office national de la chasse et de la faune sauvage (ONCFS), [National Hunting and Wildlife Agency], national parks. . .), research centers, and private structures like research consultancies.

However, belonging to a community (association, learned society) proves to be a prerequisite for those who wish to develop and refine their skills. Observing living creatures in situ is in fact complex. As Kohler (2002, 473) observed, "In nature, knowledge is produced in particular places, and there is no guarantee that what is true in one place is true generally." Some species, such as birds, prove difficult to identify because of their mobility; others are often difficult to spot, not to mention the risks of confusion between species presenting similar characteristics. To guide their observations, naturalists use different media, such as lists of species that appear in protocols, identification guides, identification keys, or personal field sheets used as an aide-mémoire to recognize certain plants (Waterton 2013). Although the levels of skills mobilized vary greatly from one inventory to another, observation and data collection on the ground uses an expanded record of knowledge that goes beyond the knowledge listed in the guides. This is based on the ability to mobilize certain senses, such as sight, hearing, smell, or intuition. An "art de faire" [way of doing] (De Certeau 2008), in short, which conveys a relationship that is sensitive to an environment and the living creatures that live in it. The ability of the mycologist to find the locations that mushrooms like, or the ornithologist to identify the variety of bird songs, most often derives from a tacit, integrated knowledge, which is acquired by experience and contact with other people. Field trips, training sessions organized by the associations or

learned societies, the inventories that these bodies initiate or to which they contribute as part of expanded networks, are all opportunities for amateurs to broaden their knowledge. They are also the opportunity to measure their skills, in particular in relation to professionals or the most experienced members, and to discern the limits of these skills. Observation and data collection therefore require a process of learning, "an education of attention," according to the expression of Isabelle Arpin, Coralie Mounet, and David Geoffroy, who endeavor to show in this volume how drawing up naturalist inventories in the green spaces of the city of Grenoble contributes to changing the system of how these spaces are perceived. In a similar category, the participation of some farmers in the Observatoire de la biodiversité agricole [Agricultural Observatory for Biodiversity] analyzed by Suzie Deschamps and Élise Demeulenaere (this volume) contributes to their overall training, thus enabling farmers to regain control over the natural environment in which they work.

If observation and the data collection of inventories assume the attributes of science by relying on systematics or by resorting to increasingly refined measures, as we have just seen, they cannot be separated from the social conditions of their realization. Knowledge of living creatures is, to use Karl Polanyi's expression mobilized by Pierre Alphandéry and Agnès Fortier in this volume concerning the transparency of naturalist data, "embedded" in forms of attachment, social relations, often special links to an area. So many elements that express a "human," "emotional," depth of knowledge that new information and communication technologies reduce by normalizing this.

Entering inventories into databanks

Although field observations collected as part of the inventories have long been recorded in notebooks, marked in maps or atlases—fragile and ephemeral media—, digital information systems allow us to consider other dimensions to manage these data. The development of databases intended to encourage the accumulation, processing, diffusion, and storage of information represents a major innovation of the last few decades. These form new media for the production, presentation, and linking of knowledge (Heaton and Millerand 2013; Bowker 2000; Waterton 2010). This process of entering data invites questioning, both on the conditions of its production, its methods, but also from the viewpoint of its consequences for the organization of knowledge and its uses (scientific but also political or economic). In other words, how do we move from experienced knowledge, perceptible, to an abstract, robust, objectified knowledge, that can be disseminated in databanks?

The history and sociology of sciences and technologies have significantly contributed to understanding the functioning of information and communication technologies. Databanks can be assimilated into what Bruno Latour (2007) describes as a computing center, namely sites where information that can be aggregated, be the subject of cross-sectional analysis and comparisons, and be easily distributed, is organized. The creation of this infrastructure founded on an instrumental logic is based on a process of distancing, of delocalization, which is carried out through standards and quantification operations (Tsoukas 1997; Bowker and Star 2000; Bowker 2000; 2006; Zimmerman 2008; Turnhout and Boonman-Berson 2011).

One of the main characteristics of standards in this particular case consists of describing, in an objectified and abstract manner, what data are by agreeing a minimum of common parameters.[3] Data are therefore reduced to figures and extracted from their context, in other words, separated, "disembedded" (Alphandéry and Fortier, this volume), from the ecological, but also social, cultural and technical, conditions[4] of their production (Bowker 2000; Heaton and Millerand 2013). Consequently, their dissemination proves to be increasingly detached from the issues defined at the level of territories, and raises the question of their interpretation, and the uses that could be made of it. Another central element of the process of standardization lies in the adoption of a system of taxonomic classification that is essential for naming living creatures. These operations to standardize and quantify data correspond to what Desrosières (1999) describes as "conventions of equivalence." They involve comparisons, negotiations, compromises, translations, reductions, registrations, and coding. Quantification and the use of standards consequently appear to be exemplary tools of objectivation that tend to substitute the language of reason for that of passions. This distancing therefore facilitates the political or economic uses of ecological realities, reduced to computer data.

Contrary to a widespread idea, databases cannot be reduced to simple technical tools or to storage devices; they show a particular representation of reality through operations of quantification, ranking, categorization that they undertake (Bowker 2000; Bowker and Star 2000; Turnhout and Boonman-Berson 2011; Millerand 2011; Desrosières 1999). But the performative dimension of databanks also lies in the tendency to perceive these as the reflection of the state of a certain biodiversity. And yet, the knowledge we have on living creatures is extremely distorted because some groups such as mammals, birds, flowering plants, and terrestrial environments are studied more than invertebrates, mushrooms, micro-organisms, and marine environments. Large sections of biodiversity are thus to a great extent ignored: only species that are known, counted, and represented in databases are taken into account and are likely to be protected. Such selectivity of course results from a historical scientific practice that goes with this modern vision of policies shaping the living world. But it also contributes to this neoliberal evolution, which strengthens the instrumental approach to the living creature.

If databases exert a certain fascination through the possibilities and promises that they reveal in terms of the production of new knowledge (cross-sectional analyses, comparisons, etc.), the circulation of information, they are still the subject of many questions and tensions. As well as the artifacts that we have just mentioned, these infrastructures of knowledge raise the question of their inertial force and irreversibility faced with the constant evolution of systems of classification, the financial and time-related constraints resulting from their updates (Bowker 2006; Heaton and

3. Commonly called "standard format," which includes the name of the taxon, the date and place of observation, as well as the name of the observer.

4. To compensate for this deficiency, the data are accompanied by metadata that aim to provide a series of information on the conditions of their production (context, date, place, methods, etc.).

Millerand 2013). Furthermore, they pose the problem of the diversity of ranking systems or the taxonomic frame of reference used, which for now makes the interoperability of databases difficult (Bowker 2006; Turnhout and Boonman-Berson 2011). But the creation of these databases also generates tensions between the values and motivations of volunteers, marked by a certain kind of relationship with nature, and where we have seen that they were based on different forms of attachment, and the ideals of scientificity based on reliability, objectivity, interoperability, embodied by expert systems[5] (Lawrence and Turnhout 2010; Alphandéry and Fortier, this volume). These disagreements show more broadly the existence of different concepts of data. Finally, the digitization of knowledge reveals other, no less crucial, questions relating to the status of data, to its conditions of access and dissemination,[6] and the use and interpretation that can be made of these.[7]

The inventory as an institution or nature captured by the state

As we have just seen, the inventory raises the question of the construction of naturalist "data." This is not simple data as it comes from the social world of naturalists and the evolutions of the procedures and methods used. Beyond the flora, from the collection of trees or the list of places for bird migration, the inventory is also related to an institution and constitutes a "frame of reference" to frame political action. As such, "the Inventory" is written with a capital letter. With historical monuments, the sites and landscapes and the ZNIEFFs (Piron, this volume), elements are "inscribed" in the Inventory, like an official administrative registration. Consequently, they are redescribed to become a national asset, a heritage; hence the current name of the database that manages these listed elements in France: l'Inventaire National du Patrimoine Naturel [National Inventory of Natural Heritage]. Nature is not only made an inventory of; it is also related to national greatness, as a component of the country, in the same way as topography, geography, or the areas covered by the Institut géographique national [National Geographical Institute].

The inventory is thus an "institutional" matter. It can be considered as a way of understanding reality and to regulate the action of the state in its territories. First it poses the question of the formalization of data by state science, a kind of statistics of nature. The "Inventory" institution consequently presents an affinity with other organizations responsible for counting and mapping the riches or the demography of a country. Recent research on public policies also allows us to approach the naturalist inventory as a place of power, which ought to be studied less as a political forum intended to resolve an operational problem, than as a mechanism, the main effect of which is the attribution of a sense of reality and its visibility.

5. In Giddens' meaning (1990), in other words based on standardized and abstract knowledge detached from any reference to local conditions of interactions.

6. As mainly provided for by the Aarhus Convention adopted in 1998 on the right of access to information, participation of the public in the decision-making process, and environmental justice.

7. The elimination of conditions for producing data in fact makes their interpretation difficult.

The naturalist inventory, population, and statistics

The naturalist inventory is designed to give indications on nature in numbers and/or in species. It shows an aggregated representation of nature to which outdoor observers do not have direct access and particularly helps to talk about what has been called since the end of the nineteenth century "populations," or censuses in the Anglo-Saxon world (Manceron 2015). The idea of "population" consolidates a framework of intelligibility through fixing, in a kind of snapshot, and for a given territory, the uninterrupted flows of living creatures. Birds are allocated in a particular locality—particularly by looking for nesting birds—or plants are listed in stations with more or less large numbers of endemic wildlife. This definition related to population marks the power of modern states endeavoring to stabilize resources in people, values, goods and, finally, in natural assets, in the context of national borders.

Counting the population in nature is inspired by the movement of "statistics," initially invented to take a census of the human population and national assets. To govern, the modern state links legitimacy established on the monopoly of violence to legitimacy derived from the control of information and the capacity to stabilize this in "static" counts, related to spaces that are relatively fixed. In general, this is about making visible, in stable and reliable frameworks, information that is more or less unstable, derived from the field, by inventing the culture of precision at the scientific and political level (Wise 1995), which is essential for planning. It was in this context that statistics considered as a state science (Desrosières 1999; Didier 2009) was affirmed in the eighteenth century. However, it differed from inventories in one crucial point: the latter concerned natural elements and not humans. As regards statistics, even censuses, the categories used to summarize the variables studied contributed at the same time to normalizing the practices of individuals. The socioprofessional category, for example, is both descriptive of a population and also a standard resource for this same population in guiding its choices and its behavior. Nothing of the sort for naturalist inventories, where non-humans do not react directly by reclaiming the categories used to describe them. We must turn to the spokespersons who are scientists to make the natural elements that are deprived of human language visible and to give them a voice. So the question arises about the relationship between the social world of "producers" of inventories and that of politico-administrative actors charged with proposing a meaning, in a society that is increasingly complex.

The inventory as a form of cognitive government using instruments

The attention given to instruments of public action recently repeated the question of expertise in governing societies, including the institutionalization of the naturalist inventory (Lascoumes and Le Galès 2004). The term instrument of public action refers to the efficiency of public policy deployed in real achievements in the field, rather than in the organization of a right of access to public decision-making, or in respecting key legal principles. Mainly directed towards implementing the policy of managing nature, the naturalist inventory contributes, through its foundation in outdoor practice, in renewing the variety of public action instruments since the Second

World War. Its appearance on the agenda is relatively recent in France because it dates from the 1960s (Charvolin, this volume). The inventory has not been studied much in these terms until now and this volume of Études rurales relates to a modern approach of public policies focused on their implementation in the field, rather than on their genesis in ministries.

The interview with Olivier Piron (this volume) clearly explains the distinction between regulation of natural spaces based on rules or an array of vertically-applied legal and economic constraints, and regulation through an inventory, such as that of the ZNIEFFs. Without having legal force, the inventory provides a cognitive framework (Muller 2000), a frame of reference in the sense of an interpretative framework for the world, which allows a group of actors to share the same point of view. It defines a form of expression and visibilization of nature that can contain debate and controversy, as in the case of Natura 2000 concerning the species and habitats that should be considered. It represents an offer of meaning, both at the level of perception and its nurturing (Arpin *et al.*, this volume), and in the exploration of old records and their comparison with current knowledge or evidence, as shown by Corinne Beck and Élisabeth Rémy (this volume) concerning the otter.

With this in mind, the inventory is not a precondition to action, as if one had to know first before acting. It demonstrates the fact that public action proceeds through a very localized reduction in uncertainty on the state of the world and the measures to take (Callon *et al.* 2001). Technical discussions on the choice of evidence, clarification of the scale, indicators, calculation algorithms, all these operations that are found in inventories and other sciences of government (Ihl *et al.* 2003) are inspired by political choices to favor certain frameworks for thinking and standards for action rather than others. They fully configure public action in the field, more certainly than enforcement by regulation and by derivation from national legislation. As an "institutional form," the inventory joins other instruments of surveillance of the territory and the list of demographic or economic assets that are essential for the creation of modern states. Among these surveillance instruments are atlases (Rémy 1995; Le Bourhis 2007) but mainly maps. Cartography, particularly of plants (Gauquelin *et al.* 2005), has existed for a long time. It provides public action with services that we are still a long way from knowing about in detail (Le Bourhis 2003).

This contribution of inventories, at the national scale or that of major expeditions (Dumoulin and Faugère, this volume) not only exists in a unified and globalized way. The naturalist inventory also represents a form of micro-politics for associations dealing with local matters or groups applying to manage a nature reserve or mastery of a planning case. Conservatoires départementaux des espaces naturels [Departmental Conservatories of Natural Spaces], associations like the Ligue pour la Protection des Oiseaux [League for the Protection of Birds], or others formed on the occasion of a dispute all use what some people call "little tools of knowledge" (Becker and Clark 2001). It becomes advantageous, for negotiations on a more or less limited area, to be able to produce "10,000" naturalist data. The generalization of thematic monitoring centers (Deschamps and Demeulenaere, this volume) and the regionalization of indicators (Bornand *et al.* 2012) contribute to mobilizing

knowledge in public affairs, so that each actor can emphasize his/her own data to support his/her viewpoint. Beyond its sole cognitive qualities, the inventory has become an element that is used strategically to succeed in an increasingly complex public action. More broadly, inventories represent methods of learning, reflection, and evaluation of public policy. They contribute to reducing the time between a public decision and measuring its effectiveness. This imperative to measure everything goes, then, with the consequent concern for the greatest "transparency" of data and decision-making (Alphandéry and Fortier, this volume), and the neoliberalization of our world.

Modern changes in naturalist inventories and the government of life

The recent changes in naturalist inventories are contributing to a relatively rapid transformation in the ways taken to be legitimate of thinking about and dealing with living creatures and engaging with them. These changes consequently have a political significance, the meaning of which should be questioned. Drawing up inventories, in fact, not only means collecting and storing data on the living world for the purposes of knowledge. It also means establishing a certain kind of relationship with these living creatures and exerting a certain power on them and through them.

By using the writing of Foucault and his followers on biopower and biopolitics,[8] we defend the idea that modern changes in inventories are both the reflection and one of the tools of a new way of governing human and non-human populations. Foucault described the emergence in the eighteenth century of a power centered on the regulation of life—which for this reason he calls "biopower"—, which plans to organize and guide the existence of individuals from birth to death, through a discipline of the body and a diffuse group of measures to manage populations. Modern inventories contribute to extending biopower to non-human populations and this extension occurs under the control of a neoliberal system of thought. Although correlated, these two aspects (extension of biopower to the non-human living creature and inclusion of the latter in a neoliberal system of thought) are presented in succession in this paper for the sake of clarity.

The extension of biopower to the non-human living creature

Biopower is inseparable from the production of knowledge on the situation and evolution of the populations targeted. Collecting information on populations and individuals proves necessary to be able to manage them and monitor them effectively. In his work, Foucault was mainly interested in human populations. But there has been a gradual movement to extend the power of regulation to non-human living creatures for several decades (Darier 1999).

This movement began in the scientific sphere with the emergence, in the 1980s, of the biology of conservation, which marked an important stage in the project of knowing about living creatures (Biermann and Mansfield 2014). Conservation biologists are behind the idea of biodiversity and its inclusion on scientific and political agendas (Takacs 1996). They are motivated by a sense of mission (Meine *et al.* 2006) and plan to give themselves the

8. (Foucault 2016; 2004). On the difference between biopower and biopolitics, see (Lazzarato 2000).

means to maintain biodiversity in a state of "good health" on a global scale. Their logic contrasts sharply with that of conservationists, who were characterized by a double separation: a separation between man and nature on the one hand, and on the other hand, a division between relations with nature according to species and spaces (living creatures are used, fought or protected, depending on the species to which they belong and the place where they are found). As for the conservation biologists, they include humans and their activities in biodiversity; they highlight the threats that hang over the latter and advocate a logic of management (Blandin 2009), applicable everywhere and to every living creature, with the aim of preserving biodiversity (Micoud 1997).

The growth in standardized tools for knowledge of the living creature deployed globally clearly shows this expansion of the desire to know. Thus, for example, the Global Biodiversity Inventory Facility (GBIF) is a digital infrastructure that links many international databases and claims to be a global information system on biodiversity; another initiative, the Barcoding of Life Initiative (BOLI), aims, eventually, to contain a standardized genetic sequence of the greatest possible number of species listed on the planet (Mauz and Faugère 2013; Waterton *et al.* 2013). In a particularly illuminating article, Rafi Youatt (2008) used the case of the Global Biodiversity Census to demonstrate the interest in extending the concept of biopower to non-human living creatures.

As the tool of choice for knowledge about life, in fact inventories are placed at the service of a globalized management of the living creature. They are increasingly presented as the first stage in monitoring, which aims to objectify the demographic or epidemiological evolution of animal or plant populations, and which are supposed to lead to conservation measures on biodiversity (Granjou *et al.* 2014). "Moving from the inventory to monitoring" has thus become one of the watchwords of modern nature management. Inventories are also increasingly mobilized in operations to model changes in the numbers and spatial distribution of species, directed towards anticipating and alleviating the consequences of human activities. They seem to be the scientific and historical basis for a globalized group of technologies of knowledge and control of life that is in the process of being drawn up and structured.

Michel Foucault (2004) emphasized the simultaneity of the emergence of biopower and the increasing power of neoliberalization. The analysis also seems to apply to living creatures: the extension of biopower, which is expressed in changes to naturalist inventories, is contemporaneous with a movement of the neoliberalization of nature and its conservation, which is beginning to be well described and analyzed (Castree 2008a; 2008b; Igoe and Brockington 2007; Fletcher 2010; Sullivan 2013).

The neoliberalization of nature and its conservation

Neoliberalization is characterized by the spread of a market logic to areas of society where it had until then been absent, such as justice or relations within the family. In a neoliberal regime, the role of the state is to make sure that the rationality of the market is disseminated to new sectors and to organize competition between individuals, each of

them absorbed into a homo œconomicus who is eager to maximize his/her profit. The enterprise is at the heart of neoliberal thinking; it is this that allows the individual to express her/his economic rationality and to be thought of, and led to think, as an enterprise, which s/he is responsible for developing. S/he is a permanent self-entrepreneur, as well as being an entrepreneur of economic activities.

Several aspects of recent changes in naturalist inventories strongly recall these features of neoliberalization. The development of citizen science enables the individual to be seen as a potential entrepreneur of naturalist inventories. In fact, citizen science contains the idea that everyone can contribute to knowledge of biodiversity, mainly thanks to the use of "easy-to-use" electronic equipment, which the promotors of citizen science stress even illiterate populations can use (Bonney *et al.* 2014). Beside the role that is frequently highlighted of the "empowerment" of citizen science, we can point out that its dissemination tends to make individuals responsible for their own (lack of) knowledge of living creatures and the state in which this living creature-resource is found. Knowledge of living creatures and the ability to look after these appears to be new capital that individuals are responsible for developing, as well as their financial, social, cultural, and health capital.[9]

As for scientist entrepreneurs of large-scale inventories, they should learn to join forces with private financiers and sponsors and enter a market of naturalist inventories and data, whose flows and stocks are now managed from the local to the global (Faugère 2008; Dumoulin and Faugère, this volume). Having to find funding to launch and successfully complete inventories, and for the data collected to then have a commercial value, is certainly not new. In contrast, what is new is the growing competition between producers of naturalist data (Alphandéry and Fortier, this volume], which is a characteristic of neoliberalization.

But it is also increasingly the living creature itself that is thought of as modeled on the enterprise. In this regard it is symptomatic that Robert Barbault and Jacques Weber (2010), two major figures in the science of biodiversity in France, called their work: "Life, what an enterprise!" Several studies point out the current interest in the ability of living creatures to undertake activities and achieve self-realization by continually developing their own abilities and potential. In her thesis on the neoliberalization of nature in cities, Marion Ernwein (2015) links the increase in the use of perennial plants to the detriment of annual plants to the fact that the former are more independent than the second, which have to be sown each year. Perennial plants have, in a way, the merit of being self-sustaining. There is a similar idea in the identification and mobilization of beneficial insects in managing green spaces in Grenoble (Arpin *et al.*, this volume).

If living creatures have long been assigned to two major categories—useful, to encourage, harmful, to be eradicated—to which was subsequently added the category of heritage to protect and to transmit, today they also appear to be, in relation to the paradigm of biodiversity, a resource to be productive (Costanza *et al.* 1997). Fauna and flora are therefore increasingly described as "resources" and visitors to protected spaces as "customers." As Sullivan

9. On the link between responsibility and neoliberalism, see (Hache 2007; Ernwein 2015).

(2013, 200) noted, Kathleen McAfee's phrase (1999)—"selling nature to save it"—is about to be reversed: "it also is the putative saving of nature to trade it." Managers of protected spaces understood it well, increasingly working to show that the protection of nature is likely to contribute to wealth locally. As rarity is valued in the economy, there is also an economic logic to first being interested in the rarest species. Inventories are, therefore, the way to know precisely what "natural capital" is available and to identify species that are currently disappearing.

Modern inventories thus appear to be strongly marked by the combined extension of biopower and neoliberal thinking to nature and conservation. In conclusion, with Castree (2008a, 150), we would like to point out the inherent ambiguity of these evolutions. The technologies on which they are based, and particularly inventories, can in fact lead both to actions to protect and to destroy species and their habitats. This is the case, for example, when the inventory data are used to improve the quality of impact studies, or in the calculation and management of compensatory measures. By producing detailed naturalist knowledge, inventories help to propose measures to reduce and offset the impacts of planning projects (protective actions); by so doing, they facilitate the acceptance and realization of these projects, which inevitably causes more or less irreversible damage (destructive actions).

But we should also put the evolutions that we have described into perspective. On the one hand, rationalizing the collection, dissemination, and commodification of data meets with forms of protest and opposition, in naturalist associations as in public organizations responsible for collecting data. These reactions are expressed, for example, by a refusal to transmit data. Whether linked to a rejection of neoliberalization or a desire to preserve a personal and perceptive relationship with the data, they limit modern changes to naturalist inventories. On the other hand, the broadening to all living creatures of a desire for knowledge and control produces new prospects for weakening this power-knowledge (Youatt 2008). Due to their particularly developed ability to avoid the monitoring systems that target them, non-human living creatures represent a possible source of inspiration for human groups seeking emancipation and new ways of circumvention, escape, and resistance.

References

Alphandéry, Pierre, and Agnès Fortier. 2013. "Les données sur la nature entre rationalisation et passion." *Revue du MAUSS* 2, no. 42: 202-220. DOI: 10.3917/rdm.042.0202.

— 2015. "Quelle professionnalisation pour les associations naturalistes productrices de données?" In *Activités professionnelles à l'épreuve de l'environnement*, edited by Isabelle Arpin, Gabrielle Bouleau, Jacqueline Candau, and Audrey Richard-Ferroudji, 15-33. Toulouse: Octarès.

Barbault, Robert, and Jacques Weber. 2010. *La vie, quelle entreprise! Pour une révolution écologique de l'économie*. Paris: Le Seuil.

Becker, Peter, and William Clark, eds. 2001. *Little Tools of Knowledge*. Ann Arbor: The University of Michigan Press.

Biermann, Christine, and Becky Mansfield. 2014. "Biodiversity, Purity, and Death: Conservation Biology as Biopolitics." *Environment and Planning D: Society and Space* 32, no. 2: 257-273.

Blandin, Patrick. 2009. *De la protection de la nature au pilotage de la biodiversité*. Paris: Éditions Quae.

Bonney, Rick, Jennifer L. Shirk, Tina B. Phillips, Andrea Wiggins, Heidi L. Ballard, Abraham J. Miller-Rushing, and Julia K. Parrish. 2014. "Next Steps for Citizen Science." *Science* 343, no. 6178: 1436-1437.

Bornand, Éric, Martine Mespoulet, and Éric Verdier, eds. 2012. *Les politiques de la mesure*. Paris: Éditions Karthala et Sciences Po Aix.

Bowker, Geoffrey C. 2000. "Biodiversity Datadiversity." *Social Studies of Science* 30, no. 5: 643-683.

— 2006. *Memory Practices in the Sciences*. Cambridge, MA: The MIT Press.

Bowker, Geoffrey C., and Susan Leigh Star. 2000. *Sorting Things Out. Classification and Its Consequences*. Cambridge, MA: The MIT Press.

Callon, Michel, Pierre Lascoumes, and Yannick Barthe. 2001. *Acting in an Uncertain World*. Translated by Graham Burchell. Cambridge, USA: The MIT Press.

Castree, Noel. 2008a. "Neoliberalising Nature: The Logics of Deregulation and Reregulation." *Environment and Planning A* 40, no. 1: 131-152.

— 2008b. "Neoliberalising Nature: Processes, Effects, and Evaluations." *Environment and Planning A* 40, no. 1: 153-173.

Charvolin, Florian, André Micoud, and Lynn K. Nyhart, eds. 2007. *Des sciences citoyennes? La question de l'amateur dans les sciences naturalistes*. La Tour d'Aigues, Éditions de l'Aube.

Costanza, Robert, Ralph d'Arge, Rudolf de Groot, Stephen Farber, Monica Grasso, Bruce Hannon, Karin Limburg, Shahid Naeem, Robert V. O'Neill, Jose Paruelo, Robert G. Raskin, Paul Sutton, and Marjan ven den Belt. 1997. "The Value of the World's Ecosystem Services and Natural Capital." *Nature* 387: 253-260.

Darier, Éric. 1999. "Foucault and the Environment: An Introduction." In *Discourses of the environment*, edited by Éric Darier, 1-33. Oxford: Blackwell.

De Certeau, Michel. 2008. *The Practice of Everyday Life [1]*. Berkeley, CA: University of California Press.

Desrosières, Alain. 1999. *The Politics of Large Numbers. A History of Statistical Reasoning*. Sacramento: California State University.

— 2014. *Prouver et gouverner*. Paris: La Découverte.

Didier, Emmanuel. 2009. *En quoi consiste l'Amérique*. Paris: La Découverte.

Ellis, Rebecca, and Claire Waterton. 2004. "Environmental Citizenship in the Making. The Participation of Volunteer Naturalists in UK Biological Recording and Biodiversity Policy." *Science and Public Policy* 31, no. 2: 95-105.

Ernwein, Marion. 2015. "Jardiner la ville néolibérale. La fabrique urbaine de la nature." PhD Dissertation in Economic and Social Science, Degree in Geography. Geneva: Université de Genève.

Faugère, Elsa. 2008. "L'exploration contemporaine de la biodiversité. Approche anthropologique de l'expédition Santo 2006." *Le journal de la société des océanistes* [Online], no. 126-127: 195-206.

Faugère, Elsa, and Ingrid Sénépart. 2012. "Itinéraires de coquillages." *Techniques et culture*, no. 59.

Fletcher, Robert. 2010. "Neoliberal Environmentality: Towards a Poststructuralist Political Ecology of the Conservation Debate." *Conservation and Society* 8, no. 3: 171-181.

Foucault, Michel. 2016. *The History of Sexuality*. Volume I. Paris: Gallimard.
— 2004. *The Birth of Biopolitics. Lectures at the Collège de France (1978-1979)*. Paris, EHESS: Gallimard, Le Seuil.
Gauquelin, Thierry, Marcel Delpoux, Guy Durrieu, André Fabre, Jacques Fontès, Pierrette Gouaux, Philippe Le Caro, and Marie-Hélène O'Donoghue. 2005. "Histoire du Service de la carte de la végétation de la France 1." *La revue pour l'histoire du CNRS*. Available at: http://histoire-cnrs.revues.org/1697.
Giddens, Anthony. 1990. *The Consequences of Modernity*. Stanford: Stanford University Press.
Granjou, Céline, and Isabelle Mauz. 2009. "Quand l'identité de l'objet frontière se construit chemin faisant." *Revue d'anthropologie des connaissances* 3, no. 1: 29-49.
Granjou, Céline, Isabelle Mauz, Marc Barbier, and Philippe Breucker. 2014. "Making Taxonomy Environmentally Relevant. Insights from an All Taxa Biodiversity Inventory." *Environmental Science & Policy* 38: 254-262. Available at: http://dx.doi.org/10.1016/j.envsci.2014.01.004.
Hache, Émilie. 2007. "Néolibéralisme et responsabilité." *Raisons politiques* 28: 5-9.
Heaton, Lorna, and Florence Millerand. 2013. "La mise en base de données de matériaux de recherche en botanique et en écologie." *Revue d'Anthropologie des Connaissances* 4, no. 7: 885-913.
Igoe, Jim, and Dan Brockington. 2007. "Neoliberal Conservation: A Brief Introduction." *Conservation and Society* 5, no. 4: 432-449.
Ihl, Olivier, Martine Kaluszynski, and Gilles Pollet, eds. 2003. *Les sciences de gouvernement*. Paris: Economica.
Kohler, Robert E. 2002. "Labscapes. Naturalizing the lab." *History of Science* 40, no. 4: 473-501.
— 2006. *All Creatures: Naturalists, Collectors, and Biodiversity, 1850-1950*. Princeton: Princeton University Press.
Lascoumes, Pierre. 1994. *L'éco-pouvoir. Environnements et politiques*. Paris: La Découverte.
Lascoumes, Pierre, and Patrick Le Galès, eds. 2004. *Gouverner par les instruments*. Paris: Presses de Science Po.
Latour, Bruno. 2007. *L'espoir de Pandore. Pour une version réaliste de l'activité scientifique*. Paris: La Découverte.
Lawrence, Anna, and Esther Turnhout. 2010. "Personal Meaning in the Public Sphere. The Standardisation and Rationalisation of Biodiversity Data in the UK and the Netherlands." *Journal of Rural Studies* 26, no. 4: 353-360.
Lazzarato, Maurizio. 2000. "Du biopouvoir à la biopolitique." *Multitudes* 1, no. 1: 45-57.
Le Bourhis, Jean-Pierre. 2003. "Quadriller le territoire. La cartographie au service de l'action publique contre les risques naturels." In *Les sciences de gouvernement*, edited by Olivier Ihl, Martine Kaluszynski, and Gilles Pollet, 157-167. Paris: Economica.
— 2007. "Du savoir cartographique au pouvoir bureaucratique. Les cartes des zones inondables dans la politique des risques (1970-2000)." *Genèses* 68, no. 3: 75-96.
Manceron, Vanessa. 2015. "Avant que nature meure... inventorier. Le cas des naturalistes amateurs en Angleterre." *Ethnologie française* 45, no. 1: 31-43.
Mauz, Isabelle. 2011. "Le renouveau des inventaires naturalistes au début du XXIe siècle." *Quaderni* 76: 13-23.
Mauz, Isabelle, and Elsa Faugère. 2013. "Les systématiciens à l'épreuve du barcoding. Une étude des pratiques d'enrôlement scientifique." *Revue d'anthropologie des connaissances* 7, no. 2: 433-459.
McAfee, Kathleen. 1999. "Selling Nature to Save It? Biodiversity and Green Developmentalism." *Environment and Planning D: Society and Space* 17, no. 2: 133–154.
Meine, Curt, Michael Soulé, and Reed Noss. 2006. "A Mission-Driven Discipline: The Growth of Conservation Biology." *Conservation Biology* 20, no. 3: 631-651.
Micoud, André. 1997. "En somme, cultiver tout le vivant." In *La biodiversité: tout exploiter ou tout conserver*, edited by Marie-Hélène Parizeau, 137-151. Brussels: De Boeck Université.
Millerand, Florence. 2011. "Le partage des données scientifiques à l'ère de l'e-science: l'instrumentation des pratiques au sein d'un collectif multidisciplinaire." *Terrains & Travaux* 1, no. 18: 215-237.

Muller, Pierre. 2000. "L'analyse cognitive des politiques publiques." *Revue française de science politique* 50, no. 2: 189-207.
Rémy, Élisabeth. 1995. "L'élaboration d'un savoir naturaliste." *Études rurales,* no. 137: 55-72.
Roux, Jacques, Florian Charvolin, and Aurélie Dumain. 2013. *Passions cognitives*. Paris: Éditions des archives contemporaines.
Sullivan, Sian. 2013. "Banking Nature? The Spectacular Financialisation of Environmental Conservation." *Antipode* 45, no. 1: 198-217.
Takacs, David. 1996. *Ideas of Biodiversity*. *Philosophies of Paradise*. Baltimore: The Johns Hopkins University Press.
Teyssèdre, Anne. 2004. "Vers une sixième grande crise d'extinctions?" In *Biodiversité et changements globaux*, edited by Robert Barbault and Bernard Chevassus-au-Louis, 25-49. Paris: Ministère des affaires étrangères.
Tsoukas, Haridimos. 1997. "The Tyranny of Light. The Temptations and Paradoxes of Information Society." *Futures* 29, no. 9: 827-843.
Turnhout, Esther, and Susan Boonman-Berson. 2011. "Databases, Scaling Practices, and the Globalization of Biodiversity." *Ecology and Society* 16, no. 1: 35. Available at www.ecologyandsociety.org/vol16/iss1/art35/
Waterton, Claire. 2010. "Experimenting with the Archive: STS-ers as Analysts and Co-Constructors of Databases and Other Archival Forms." *Science, Technology, & Human Values* 35, no. 5: 645-676.
— 2013. "Publics expérimentaux? Les politiques de participation au prisme des affiliations avec les objets." In *Passions cognitives*, edited by Jacques Roux, Florian Charvolin, and Aurélie Dumain, 175-205. Paris: Éditions des archives contemporaines.
Waterton, Claire, Rebecca Ellis, and Brian Wynne. 2013. *Barcoding Nature. Shifting Cultures of Taxonomy in an Age of Biodiversity Loss.* London and New York: Routledge.
Wise, Norton, **ed.** 1995. *The Values of Precision*. Princeton: Princeton University Press.
Youatt, Rafi. 2008. "Counting Species: Biopower and the Global Biodiversity Census." *Environmental Values* 17: 393-417.
Zimmerman, Ann. S. 2008. "New Knowledge from Old Data. The Role of Standards in the Sharing and Reuse of Ecological Data." *Science, Technology, & Human Values* 33, no. 5: 631-652.