Timber insurance: perspectives from a legal case and a preliminary review of practices throughout the world

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Timber insurance: perspectives from a legal case and a preliminary review of practices throughout the world

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Abstract

Background: Timber insurance is a form of risk management that can be used to protect forest owners from the effects of various types of disaster.

Methods: A recent court ruling on a legal case in the United States is used to illustrate reasons for the lack of uptake of timber insurance and its effects on those dependent on forestry for their livelihood. Operational aspects of the timber insurance market are described and compared with markets for insurance of real estate and agricultural crops. The scope and implementation of timber insurance in several countries are reviewed, and some practical guidance is offered to those intending to develop a timber insurance programme to encourage investment in the growth of planted forests.

Results: Salient features of the forest insurance market are described and the markets in a number of countries are reviewed.

Conclusions: The development of timber insurance market requires some form of intervention by government or landowner associations.

Introduction

Insurance is defined here as the equitable transfer of risk of a loss from one entity to another in exchange for payment. It is primarily used to protect owners from the risk of a contingent, uncertain loss. Natural disasters such as fires and storms cause damage to timber assets and affect investment and management decisions made by forest landowners. The risk of timber loss associated with natural disasters could be managed through timber insurance. Yet, most forest owners in many countries do not insure their forest assets. This disparity has been recognised with the use of forest insurance being first proposed nearly 80 years ago in the U.S. Shepard (1935) pointed out that forest fire insurance in the United States was feasible from both landowner and insurer perspectives. In the 1930s, the U.S. Congress directed the Secretary of Agriculture to "investigate and promote practical methods of insuring standing timber on growing forests from losses by fire and other causes" (Munger and Shepard 1934). Studies made by the U.S. Forest Service and other agencies indicated that the risks involved in the insurance of timber are not unduly great (William 1949). However, none of these studies has led to noticeable development of the forest insurance market in the U.S. or elsewhere.

Interest in timber insurance has grown recently in some countries, partly because forest damage caused by disturbance is increasing (e.g. Schelhaas 2008). China, for example, adopted timber insurance following a winter storm in 2008 that destroyed approximately 10% of its forests. More recently, proposals for legislation and a timber insurance programme have been made in France following devastating losses, especially of planted forests

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in the Aquitaine region, caused by two winter storms in 1999 and 2009. Even so, only a small percentage of the world's private forests are insured, and it is unclear why this should be so. This raises a number of questions, such as: Do forest landowners have a low demand for timber insurance? Do insurers simply have no interests in providing timber insurance? What are the barriers for managing the risk of timber losses by using timber insurance?

The objective of this paper is to describe some of the barriers to the use of timber insurance. Some practical guidance, based on the experience of a few countries, is offered to those intending to develop a forest insurance market. This is done firstly by drawing attention to a legal case in the U.S., which shows that the lack of timber insurance can hurt landowners that rely heavily on timber income. Salient features of the forest insurance market are then described and the markets in a number of countries are reviewed, explaining why they have developed in some of them and not in others.

A legal case involving timber insurance

Alabama is the second largest timber-producing state in the U.S. On August 10, 2012, the Supreme Court of Alabama, USA made a final ruling on a legal case that involving timber insurance (Regions Bank v Lowrey, Alabama Supreme Court, 101 So.3d210 (2012)). The case lasted for nearly six years, and started when a group of beneficiaries of the Lowrey Trust (hereafter referred to as "the Trust") sued the trustee (Regions Bank), claiming that the trustee failed to protect and preserve the asset of the Trust and thus breached its fiduciary duty. The Trust had approximately 20,000 acres (8,165 hectares) of timberland in Monroe and Conecuh counties in the southern part of the state, and the primary allegation was that the trustee had failed to buy casualty-loss insurance for the standing timber on it. On September 16, 2004, Hurricane Ivan caused severe wind damage and destruction of much of the standing timber owned by the Trust amounting to approximately US$ 13,000,000. The beneficiaries had no recourse for their lost assets and income from the Trust. The Court stated that:

> "Other than showing that insurance of this type was available on a limited basis, the beneficiaries have provided no evidence–expert or otherwise–that any similarly situated trustee prior to Hurricane Ivan would have purchased, or even considered purchasing, standing timber insurance.... The beneficiaries' timber management expert whose firm manages some 100,000 acres of timberland testified that his firm does not have standing timber insurance on any of this timberland and that, in fact, he did not even know whether insurance was available."

The Court further noted that there was only one agent who had consistently offered standing timber insurance since 1990. This agent testified that large, institutional, timberland owners do not buy this type of insurance unless they have special short-term reasons for doing so. The Court concluded: "... the evidence in fact supports a finding that similarly situated fiduciaries would not have purchased any standing timber insurance prior to Hurricane Ivan."

Finally, the Court pointed out that the trustee had testified that it had inquired in a general way about the availability and cost of timber insurance prior to Hurricane Ivan and had concluded that it was too expensive. The risk of loss associated with timberland was considered to be small and the trustee acknowledged that it had not obtained any specific quotes or proposals for insurance coverage for the Trust. The decision not to buy insurance was made for all trusts administered by the trustee rather than separately for each trust. The Court ruled: "These points are entirely consistent with other evidence that large timber owners do not purchase standing timber insurance. Accordingly, the Court concludes that no breach-of-fiduciary-duty claim can be sustained on this basis."

The intention here is not to argue for or against the Court's ruling. However, it should be pointed out that institutional landowners with forests located in a number of different geographic areas are subject to a lower level of risk than landowners with only one or two forests. In applying the test of whether or not institutional owners normally take out insurance, the Court perhaps used an inappropriate criterion as the Trust's forest assets were not geographically diversified. Further, the trustee had not obtained quotes for individual trusts but its decision was made on behalf of all trusts. If the trustee based its decision on the geographical diversity of all the properties under its management, it used the same inappropriate criterion as the Court, because specific clients such as the Trust do not necessarily have forests that are geographically diversified.

Nonetheless, this case demonstrates the reality of the insurance market for standing timber in the United States. Very few acres of standing timber are insured for any kind of hazard, and only one company had consistently offered timber insurance prior to Hurricane Ivan in 2004. Furthermore, most landowners and their managers have not considered buying timber insurance. Those that do consider insuring their forests find that the premium is too high.

The insurance market for standing timber

The emergence and growth of an insurance market for standing timber depends on demand and supply: the

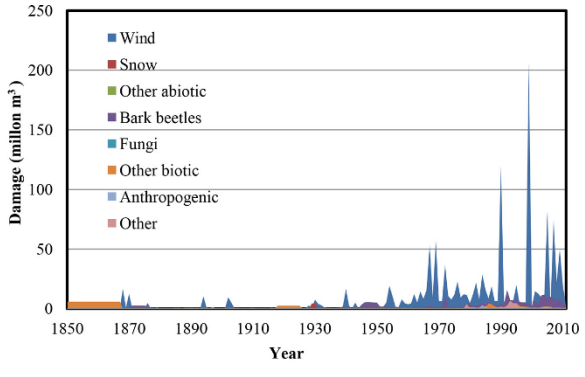
same factors as in other markets for various goods and services. When demand for timber casualty insurance in a country is low, the supply of such insurance is too costly, or a combination of both, the amount of standing timber insured there will be minimal. Thus, the following analysis of insurance markets for standing timber starts with demand and supply, and the interaction between them.

Demand

Damage to standing timber appears to be increasing over time (CEPF, 2010). The real and potential demand for standing timber insurance in many countries is therefore rising. Damage to standing timber in Europe has been increasing since 1930 (Figure 1). Timber mortality in the U.S. (Figure 2) doubled between 1952 and 2006 (Smith et al. 2009). In 2006, timber mortality in the U.S. reached 222 million m^3 and accounted for nearly 30% of standing timber (Smith et al. 2009). Much of the damage was caused by fire, storms, insects and diseases or drought.

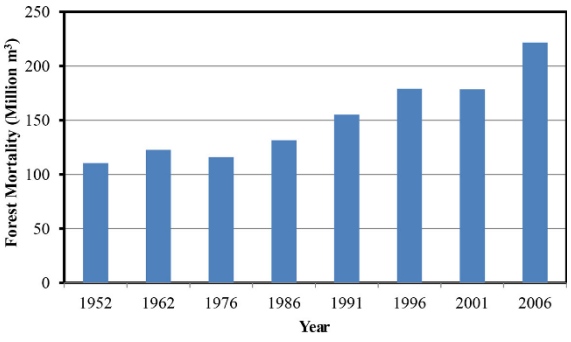
Natural disasters have a low probability of occurrence in any particular stand of timber but can cause extensive damage when they do occur. If the timber is uninsured, investors are directly exposed to the loss. Without the support of a well-developed insurance market, potential investors may be reluctant to consider forestry as an option, especially ventures involving planted forests. Absence of insurance is likely to have the greatest effect on landowners or investors who cannot take advantage of geographic diversification and who are most likely to be non-industrial private forest (NIPF) owners.

Although all business requires a minimum number of buyers (demanders), insurance is especially dependent on the law of large number. A critical mass of insurable forests is a prerequisite for the emergence and growth of a timber insurance market. In the U.S., approximately



Source: Schelhaas (2008, cited in European Forest Institute, 2010 and updated by Schelhaas, 2014, personal communication).

Figure 1 Volume of standing timber damaged by disturbances in Europe, 1850-2010.



Source: Smith et al. (2009)

Figure 2 Forest mortality (volume of standing timber affected) in the United States, 1952-2006.

37% of forests are owned by the Government. These forests may have been insured through political and public budgeting processes. If they are damaged, the agencies that manage them may receive additional public funding to cover all or part of the loss. So, public forests are not likely to be insured.

In the U.S., private forest land occupies approximately 540 million acres (or 220 million hectares). Large private enterprises, including forest industrial firms, institutional timberland owners and other corporations may own large tracts of forests (> 50,000 hectares) varying in age, species composition and location. They may self-insure by setting up a cash reserve. Because some of these landowners have forests in multiple locations, their level of risk is lower than that of landowners with small forests (≤ 250 hectares) in single locations. As such, the demand for timber insurance from these corporate forest landowners is probably lower than that of NIPF or family forest owners that collectively own some 97 million hectares of U.S. forest land (Butler, 2008). Other corporate forest owners may have a demand as high as NIPF landowners if their timber asset is concentrated.

Approximately 10.2 million of these NIPF owners are responsible for 1 acre (or 0.40 hectare) or more of standing forest in the U.S. The size of their holdings and the proportion of total family income derived from forestry vary significantly. Some, such as the Lowrey family, own a substantial area of timberland and draw much of their income from their forests. While it would be beneficial for these owners to buy timber insurance, others (with smaller holdings and income) may not need timber insurance at all. Butler (2008) reported that, in 2006, 1.2 million U.S. landowners, each with 50 acres (20 hectares) or more of timberland, collectively owned 173 million acres (70 million hectares) while 530,000 landowners were responsible for 132 million acres (or 53 million hectares or 53% of total NIPF holdings).

Recent transactions indicate that the timber on these lands is worth an average of US$900-1,100 per acre (or $365-445 per hectare) in the U.S. South which is the largest timber producing region, suggesting that the insurable timber assets in the U.S. are worth about $1.2-1.5 trillion. An insurance premium of 0.5-1% on these assets would generate between US$650 million and $1.5 billion in revenue. This represents a substantial potential market in the U.S. alone.

A recent survey of Mississippi forest landowners with more than 100 acres (or about 25 hectares) of forest has revealed an "effective" interest in standing timber insurance against all natural disasters, and a willingness to pay a premium rate of approximately 0.3% of the standing timber value (Deng and Munn 2011). This rate is similar to that found by the Confederation of European Forest Owners (CEPF 2012) who reported that insurance costs lower than the quotation rate of 0.3% would be more acceptable to forest owners. However, this rate is well below premium rates currently offered by insurance companies in the U.S. and other countries. It is also lower than the 2006 mortality rate (0.8%) for all forests in the U.S. (Smith et al. 2009).

Supply

Insurance companies will provide cover for anything if they can make a profit from it. However, unlike residential real estate, timber stands grow in volume and vary in value. Also, their rotation length is much longer than that of agricultural crops. Consequently, the valuation of standing timber must take tree growth rates and market conditions into consideration, which might be more complicated than valuing residential real estates or agricultural crops. Further, forests vary in age and species composition and occupy larger areas than buildings and agricultural crops. This makes it harder to value them and to assess the risks associated with various natural disasters. Finally, insurance companies need to have models derived from disaggregated and reliable data that allow them to estimate the probability of occurrence of various disasters and these are lacking of forestry. All these factors mean that the transaction costs of providing insurance cover for standing timber are higher than those for buildings or agricultural crops. All else being equal, the insurance premiums for standing timber would be consequently higher than those set for real estate or agricultural crops. Also, as timber takes many years to grow, the structural or sector-specific risk in forests could be higher than for agricultural crops, although the amount of accumulative risk in a rotation may be comparable.

Because provision of insurance for standing timber is more costly than that for many other assets, an insurance company interested in entering this market will initially set high premiums, which attract very few landowners. A low volume of business means the insurer is unable to reduce premiums due to the high risks of insurance. The risk to the insurer may be reduced by an increase in the number of policy holders because the average difference in mean payout in case of damage will not rise as rapidly as the percentage increase in the total number of insured parties. With a greater number of policy holders, the insurer can reduce his risk or reduce his price premium. For example, an empirical study in Southwest Germany shows that the premium for storm damage can be reduced by 90% if the insured area is increased from 1,400 hectares to 140,000 hectares (Holecy and Hanewinkel 2006).

High premiums deter landowners from taking timber insurance, and the fewer the number of policy holders, the higher the premium. This "vicious circle" represents market failure that could be avoided by intervention either from government or from non-government organisations such as landowner associations. If the gap between insurers and landowners could be closed by reducing transaction costs, the risk of insurance, and thus, the premium for timber insurance, could also be reduced. However, it is debatable whether or not a trustee managing a substantial area of timberland for many clients (e.g. the Regions Bank) could have done this kind of intervention collectively for all the timberlands it manages unless all of its clients are willing to do so.

The availability of timber insurance in some countries demonstrates that reduction of transaction costs by the government or by landowner associations is a possibility, and that this can assist the growth of the timber insurance business.

Review of timber insurance availability in selected countries

A literature review was conducted in order to estimate the extent of timber insurance globally. Also, a number of forest economist contacts in several countries on various continents were interviewed in February 2013. The information gathered is not comprehensive, but demonstrates the scope and feasibility of forest insurance.

Two main types of insurance are available (Table 1). Full Insurance covers the entire market value of the growing timber and is available in Sweden and South Africa, for example. In contrast, Risk Insurance covers only a portion of the total market value of growing timber. This type of insurance is available in Demark and Finland, for example. In the case of disaster damage, an owner with Full Insurance recovers the full market value of his timber minus salvage values. With Risk Insurance, only the insured amount, specified *ex ante* by the insurer or the owner, is paid out. In Denmark, Risk Insurance is capped at approximately 3,000 DKK (or US$550) ha^{-1}, but owners could receive a government subsidy for

Table 1 Standing timber insurance taken out by private landowners in specific countries, 2012.

Country	Area of forest covered (1,000 ha)	Proportion of forest covered (%)	Insurance model	Type of damage covered	Premium	Government or NGO involvement	Information source
Asia							
China	1,000,000	50	Risk (reforestation cost only)	Fire Storm	1%	Government pays 90% of premium	Tang, X. (2012, personal communication)
Japan	1,000	<10	Full	Climate Fire Geothermal activity	1-2%	Government forest insurance agency operates through a special government account	Kuboyama, H. (2013, personal communication)
Africa							
South Africa	172	13	Full	Fire Snow (limited amount)	1-3.5%	None	Bezuidenhout, R. (2012, personal communication)
Americas							
Chile	1,500	60% of planted forests	Full	Fire	1-2%	None	Arana, M.T. (2013, personal communication)
United States.	<4,000	<3% of all private forests			0.5-1%	None	Zhang, D.
Europe							
Denmark	179	50	Risk capped at 3,000 DKK (US $550) ha^{-1}	Storm Fire	0.2% to 1%	Insurance a prerequisite for government storm disaster reforestation subsidies of 10-20,000 DKK/ha	Thorsen, B.J. (2012, personal communication)
Finland	6,000	40 (NIPF)	Risk	Fire (80%) Storm (20%)		Finland Forest Owners Association	Munthe-Kaas (2012)
France	700-900	6		Fire Storm			de Saint-Vincent (2000)
Norway	6,600	35	Full	Fire (including insects, rodents) Storms	Fire 1-8.5 NOK (or US$0.17 - 1.4) ha^{-1}; Storm 0.8-18.3 NOK (or US$0.14-3.4) ha^{-1}	Skogbrand Forest Insurance (mutual insurance company)	Rørstad, K. (2013, personal communication)
Sweden	11,000	95 (NIPF)	Full	Fire (45%) Storm (55%)	19 SEK(or US$2.9) ha^{-1} (Fire only 2-5 SEK or US$0.30 - 0.80 ha^{-1}; Storm, including fire 12-58 SEK or US $1.8 - 8.8 ha^{-1}	Sweden Agricultural and Forest Landowners Association	Munthe-Kaas (2012)
Oceania							
New Zealand	580 (59% planted forest)	55-	Full	Fire (65.5%) Fire and wind (34.5%)	0.345%		Manley and Watt (2009)

restoration amounting to five times the insured value. In China, Risk Insurance against disaster damage is capped at the cost of reforestation. In the U.S., the company doing Full Insurance to timber since the 1990s began to offer Risk Insurance capped at reforestation cost in 2012, and a new insurance company were established in 2011 and started to offer Full Insurance.

Fire is the most common type of disaster, and all available forest insurance covers fire damage. Fire insurance in Norway, for example, started in 1898. In Germany and

Portugal, insurance covers fire damage only. In other countries, forest insurance cover has been extended to losses due to insects and disease, and more recently to storms.

Sweden has the highest proportion of forest area covered by insurance as more than 90% of NIPF landowners there have some type of insurance. Finland and Norway also have a high percentage of forest land insured. Each of these Scandinavian countries has a strong forestry landowners association that either sets up a mutual company offering forest insurance, or acts as a go-between by estimating demand from members and soliciting bid offers from insurance companies. The Norwegian Mutual Forest Fire Insurance Company (Det Norske gjensidige Skogbrandforsikingsselskap) was set up by Norwegian Forestry Association in 1912 (Nygaard, 1951). It provided fire insurance coverage to approximately 80% of forest landowners by 1950 and has continued to operate since then. The Agricultural and Forest Landowners Association in Sweden secured storm insurance for all NIPF landowners after major storms in 2005 and 2007. It served as an intermediary between its members and insurers, and requested the latter to tender insurance bids. The Forest Landowners Association in Finland took on a similar role. These landowner associations ensure that their members are informed and can participate in forest insurance. They also help insurance companies through avoidance of repeated negotiations with individual landowners, thereby reducing transaction costs and allowing them to offer broader coverage at lower premium rates.

Governments may also assist. The promotion of forest insurance by the Chinese government in recent years is one such example. In some provinces of China, timber insurance has covered both private and public forests. In Japan, the Forest Insurance Agency is part of Ministry of Agriculture, Forestry, and Fisheries and operates a special government account. In France, government law and private bidding organised by the French Forest Landowners Association both influence forest insurance. Under the Loi de Modernisation Agricole, (Loi No. 2010-874, 2010), the French Government offers assistance only to insured forest landowners in the event of windstorms before 2017. The termination of government assistance after 2017 has provided an impetus for the French Forest Landowners Association to negotiate with a private insurance company to provide timber insurance at a 40% discount of the market rate (Pomélie, 2013). The insured value is capped at 75% of 3,000 € (or 75% of US$ 4,100 ha^{-1} for fire, or 75% of 5,000-6,000 € (75% of US$ 6,900-9,600) ha^{-1} for storm damage with a premium of 0.32 - 0.65%. To qualify, the damage must exceed 20% of the loss of insured timber.

Brunette and Couture (2008) pointed out that governments should not provide direct compensation for forest damage as this would reduce incentives for risk management. It is more appropriate for governments to offer aid to landowners who protect their assets through insurance. More controversial is whether governments might make insurance mandatory for private forest owners, thus reducing risk for insurers and lowering premium prices. So far, no country has adopted this approach.

Forest insurance premium rates are quite variable: 0.2% (fire only) to 3% (all disaster damage) in Sweden; 1.5 - 2.6% (fire only) in South Africa; 1% for all damage up to full reforestation cost in China. In a few countries, such as Chile and New Zealand, forest insurance covers planted forests only. This means that insurers have to estimate the probability and effect of natural disasters on a few tree species only.

Summary and recommendations

This research has shown that globally timber insurance offered does not meet the demand because transaction costs for timber insurance are high. These findings agree with a statement made in 2000 by the Policy Director of Australian Forest Growers: "...it can be difficult for an individual grower to obtain forestry insurance cover. Forestry insurance is very specialised, and cover is probably provided by only a small number of underwriters. Even if an individual grower succeeded in taking out insurance, the premium rate could be very high" (Cummine, 2000).

Some form of intervention or market stimulation is required if the timber insurance market is to be expanded. The current authors consider that "doing nothing" may not be the best option, because insurance of forests against disasters could encourage investment in planted forests and other forestry production and conservation activities. Experience from Scandinavia shows that forest insurance is feasible if it is promoted by strong forest-landowner associations. The existence of a mutual fire insurance company in Norway for more than a century shows that a cooperative approach is not only possible but beneficial. Governments can help as well. Rather than offering direct compensation for forest damage, governments can assist investors in forestry by asking private landowners to purchase appropriate insurance as a condition for the granting of additional government aid.

In countries that do not have forest insurance, it may be advisable to begin with coverage of one type of risk (e.g. fire) before expanding to other possible disasters. Also, planted forests are easier to insure than natural forests because their well-defined location and species composition reduce transaction costs for the insurer. They also have a higher unit timber value, which increases potential

demand for insurance. Timber insurance can be seen as a tool for enhancing investment in planted forests.

Differing natural and socio-economic conditions may influence the insurance market for standing timber. Thus, future research could be directed towards the willingness of landowners to purchase forest insurance and finding ways to meet these different levels of demand. Other research topics could include investigation of the influence of insurance on forest management behaviour (Blennow and Sallnäs, 2002) and the design of contracts allowing more flexibility in the selection of timber stands to be insured based on dominant species, value of the tree stand, threshold for compensation following damage, and type of damage covered.

Competing interests
The authors declare that they have no competing interests.

Authors' contributions
DZ and AS studied timber insurance practices in the US and France; DZ conducted a survey of timber insurance in other countries. They shared data and drafted the manuscript together. Both read and approved the final manuscript.

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References
Blennow K, Sallnäs O: **Risk perception among non-industrial private forest owners.** *Scandinavian Journal of Forest Research* 2002, **17(5)**:472-479.
Brunette M, Couture S: **Public compensation for windstorm damage reduces incentives for risk management investments.** *Forest Policy and Economics* 2008, **10(7-8)**:491-499.
Butler BJ: **Family forest owners of the United States, 2006.** Newtown Square, PA, USA: U.S. Department of Agriculture, Forest Service, Northern Research Station; 2008 [http://nrs.fs.fed.us/pubs/gtr/gtr_nrs27.pdf], [General Technical Report NRS-27].
CEPF: **Summary of CEPF insurance day, 16 des 2010.** Luxemburg: The Confederation of European Forest Owners; 2010 [http://www.cepf-eu.org/vedl/CEPF%20Insurance%20Day%20Summary.pdf].
Cummine A: **Plantation Insurance: An introduction.** Dickson, ACT, Australia: Australian Forest Growers; 2000 [http://www.afg.asn.au/images/stories/PDF/Publications/Conference_Papers/Earlier_Conferences/Plantation_insurance_an_introduction.pdf], May, [Vic DNRE Seminar Series, Financing Farm Forestry].
De Saint-Vincent RE: **Assurances de biens forestiers et gestion financière des risques aux forêts.** In *Expertise Collective sur les Tempêtes, la sensibilité des forests et sur leur Reconstitution Dossier de l'environnement de l'INRA No 20.* Paris: INRA-ME&S; S. Droiineau, O. Laroussinie, Y. Birot, D. Terrasson, T. Formery, & B. Roman-Amat (Eds.) 2000:229-237.
Deng Y, Munn I: **Willingness to pay for potential standing timber insurance.** *Presented in Southern Forest Economics Workshop* Little Rock, AK. March 19-21; 2011.
European Forest Institute: **Destructive Storms in European Forests, Past and Forthcoming Impacts.** 2010 [http://www.sifi.se/wp-content/uploads/2011/01/Destructive-storms-in-European-Forests.pdf 21.02.2012].
Holecy J, Hanewinkel M: **A forest management risk insurance model and its application to coniferous stands in Southwest Germany.** *Forest Policy and Economics* 2006, **8**:161-174.
Manley B, Watt R: **Forestry insurance, risk pooling and risk mitigation options.** Wellington, New Zealand: Ministry of Agriculture and Forestry; 2009.
Munthe-Kaas OS: **Markedsanalyse av skogforsikring i Sverige og Finland.** Uppsala, Sweden: SLU, Department of Forest Products; 2012, (in Norwegian). [Second cycle, A1E].
Munger TT, Shepard HB: **Forest insurance number.** Portland, OR, USA: U.S. Forest Service Pacific Northwest Forest Experiment Station; 1934, 1-5, [PNW Old Series Research Notes No. 14].
Nygaard J: **Forest fire insurance in Norway.** *Journal of Forestry* 1951, **49**:337-338.
Pomélie P: **Un Contrat d'assurance Incendie-tempête-Sylvassur: Un bouleversement de l'économie forestière.** *Forêts de France* 2013, **564**:25-29.
Schelhaas MJ: **Impacts of natural disturbances on the development of European forest resources: Application of model approaches from tree and stand levels to large-scale Scenarios.** In *Alterra Scientific Contributions. Volume 23.* The Netherlands: Wageningen UR; 2008, [http://content.alterra.wur.nl/Webdocs/PDFFiles/Alterrarapporten/SciContrib23.pdf], (Dissertationes Forestales 56).
Shepard HB: **Forest fire insurance in the Pacific Coast States.** *Journal of Forestry* 1935, **33(2)**:111-116.
Smith WD, Miles PD, Perry CH, Pugh SA: **Forest Resources of the United States, 2007.** Washington D.C.: U.S. Department of Agriculture, Forest Service, Washington Office; 2009, [General Technical Report WO-78].
Williams ET: **Forest Insurance.** Newtown Square, PA, USA: U.S. Forest Service Northeastern Forest Experiment Station; 1949, [Paper 26].

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