Demand and potential subsidy level for forest insurance market in Italy

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Summary

The projections for climate change in the coming decades highlight that European and Mediterranean forests will have to deal with negative biotic and abiotic impacts. Extreme meteorological events seem to be one of the main source of risk. Financial strategies can be a form of risk management. In this framework the work analyse the Willingness to Stipulate forest insurance schemes at national level by owners and managers of stands, based on owners characteristics, forest typology and localization as well as Willingness To Pay. Results are also defined at spatial level (macroregions for Italy: northern, central and southern regions) in order to be compared with premium.

Preliminary results confirm how WTP is related with both statistical and perceived risk of damage. Moreover, forest owners appear more available to pay for insurance in case of high forest (in particular coniferous) in respect to coppices. Among motivations for not stipulating insurance, the main reason seems to be the preference for alternative form of risk management (e.g. post-event public compensation or silvicultural interventions).

The paper stresses the difference between premium and WTP depicting the area where public subsidy could have a greater impact for insurance diffusion. Finally, discussion for future improvements and integration of the research are performed.

Keywords: forest damage, risk perception, insurance, willingness to pay, premium
JEL Classification codes: Q11, Q23, Q54

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1. INTRODUCTION

In Italy, forest stands cover about 35% of the total national surface (10,467,533 ha - INFC, 2005). The ISTAT (2011a) estimates approximately 4,700 production companies working in the silvicultural sector and involving 8,200 employees (without satellite activities). According to the official national statistics, total used wood (both from forests and arboriculture) amounts to 13,112,514 m^3 (ISTAT, 2015). Forest provide wood for about 5,320,500 m^3 and represent 40% of total production (ISTAT, 2015).The value of the production is nearby 1,489 million euros, while the added value sums to 333,575 thousand euros (ISTAT, 2015). In economic terms, the total import / export value at national level for wooded assortments amounts to 8,602,933,000 euros (FAO, 2016). It includes both timber and other assortments (mainly fire wood).

The assessment and management of forest must related the economic significance of their production with the length of the crop cycle. During rotation period, wooded areas are exposed to several potential natural or anthropogenic damages (Brunette et al., 2015; Qin et al., 2016;). Such phenomena seem destined to increase in the future due – for example – to the effects of climate change (IPCC, 2014; Liberato et al., 2011). This exposes owners to economic losses (Gardiner et al., 2010; Riguelle et al., 2016; Schelhaas et al., 2003).

In Europe, forest damage caused by natural factors is estimated at 35 million m^3y^{-1}, in the period 1850-2000. Storms account for 53% of the losses, fires by 16% (Schelhaas et al., 2003).

In Italy, extreme events have already caused damage to stands in recent decades, both in economic and ecological terms (Gardiner et al., 2010). In the future, these phenomena may intensify both for frequency and intensity (EASAC, 2017; EEA, 2016; Linder et al., 2010), proving crucial factors for the health and productivity of forests (Romano and Di Pietro, 2011).

Traditional tools to cope with these damages and to support forest owners, provide compensation of economic losses due to extreme events (Gardiner et al., 2010). European Union also promotes the use of insurance instrument as an effective means of prevention and mitigation of risks. In 2013, through the "Green Paper on insurance against natural and anthropogenic disasters" the EU has put forward a number of issues relating to the appropriateness and availability of insurance against disasters. The forest insurance is an adaptation tool that can be implemented – both at public and private level – to cope with losses caused, among others, by fires and extreme events (Brunette et al., 2017). This strategy represents a risk management form (EU, 2013; Zhang and Stenger, 2014), which allows owners to face uncertainty related to environmental investments (Mechler et al., 2006). The insurance, in fact, redistributes and reduces the financial risk associated with the claims by distributing the costs between the individual contracting parties or over time (EU, 2013).

In Europe, a forest insurance market exists, but it is present only in some countries, like France, Germany, Spain, some Eastern European countries and the Scandinavian area (Brunette et al., 2017; Gardiner et al., 2010; Zhang and Stenger, 2014). In these nations, with few exceptions represented by the Scandinavian countries, this market is still at an early stage and the percentage of insured wooded area is

quite low (Brunette et al., 2015; Gardiner et al., 2010). In Italy, a forest insurance market is practically inexistent.

Scientific literature highlights how the main obstacles to the diffusion of this instrument are identified in: i) the price of the insurance premium, considered too high by the owners, when compared to the value of forest (Brunette et al., 2015), ii) the presence of public compensation (Brunette et al, 2015) and iii) the difficulty of insurance companies to quantify the risk for each species and geographic site (Pinheiro and Ribeiro, 2013). The uncertainty and the low probability associated with the occurrence of natural disasters are additional elements that disincentive forest owners to take out an insurance policy. In this way an high risk of economic losses is evident due to the potential high extent of the damage (Deng et al., 2015; Zhang and Stenger, 2014).

This work is developed to investigate the potential for the activation of a national insurance market against damage caused by extreme events on forest production.

The presence of a critical mass of potential buyers is essential for the development of an insurance market in the forest sector, because it allows insurance companies to limit the price of the insurance premium (Brunette et al., 2010; EU, 2013; Zhang and Stenger, 2014). Therefore, two different lines of research can be identified in insurance forest market: the assessment of potential insurance premium (supply) and the willingness to stipulate an insurance coverage and to accept the relative premium (demand).

From supply point of view different authors have worked on implementing econometric models, to develop insurance schemes based on the risk of catastrophic events, the presence of public subsidies, the characteristics of the stands and the localization of forest (Barreal et al., 2014; Brunette and Couture, 2008; Holecy and Hanewinkel, 2006; Sacchelli et al., 2018). On the demand side, empirical studies were developed to provide an estimate of the availability to stipulate insurance policies and quantify the willingness to pay for a given premium. Applied methodologies are mainly based on stated preference theory (Brunette et al., 2015; Deng et al., 2015; Sauter et al., 2016).

The work integrates a previous research (Sacchelli et al., 2018), whose purpose has been the evaluation of the level of forest insurance premium at regional and national level in Italy. The work involved the development of an open-source GIS-based tool, capable to define effective insurance schemes for individual study contexts.

The present paper reports the results of an exploratory survey, conducted on a sample of public and private forest owners, in order to analyze whether or not they could be willing to stipulate (WTS) a multi-risk insurance to protect forest against fires and storms. An analysis for the quantification of Willingness To Pay (WTP) is also developed. Differentiation of WTS and WTP according to sample and forest characteristics are investigated. Premium and potential demand are eventually analysed to depict preliminary (and potential) level and localization of public subsidy to promote insurance market in Italian forests.

2. MATERIAL AND METHODS

2.1. Premium quantification

The present analysis follows a previous research (Sacchelli et al., 2018) focused on depiction of premium level for forest insurance schemes at national level. The former model pays attention on risk of fire and storms. The work develops an open-source Geographic Information System (GIS) tool able to define suitable insurance schemes for each single context of study. The applied approach is multiscale, for the possible aggregation of data from the minimum unit (pixel) up to the national level. The model is subdivided

into three modules: the first - based on GIS applications already used in the national and international forest context - is focused on quantifying the financial value of the forests; in the second, the probabilities of fires and storms are quantified through the aggregation of national statistics, satellite data and data from the Joint Research Center. An actuarial scheme based on the combination of the financial value of the woods, the probability of extreme events, the cost of restoration and insurance companies' financial data is implemented. A full/partial insurance coverage and a temporary/permanent damage can be considered in the model. Results here considered refer to full insurance and temporary damages more frequent in international evidences. Output are reported for different scenarios and aggregated at regional level. Results reveal the high variability of forests in the case study area from the standpoint of both the value of woodlands and the probability of extreme meteorological events. In general, premiums seem to be consistent in the southern regions, in high forest and in Mediterranean forest typologies (Sacchelli et al., 2018).

2.2. Demand analysis

Survey design

The analysis here conducted was administered through a self-structured questionnaire compiled via web (cloud-based Survey Monkey software) (Appendix A). The CAWI (Computer Assisted Web Interviewing) technique has the advantage – compared to other detection techniques – to allow greater flexibility and the ability to strongly contain the timing and costs of data collection (Couper, 2001, Couper et al., 2001). Among limitations, lower response rate and potential sample bias can be mentioned (Frippart and Marquis, 2010; Sax et al., 2003; Wright, 2005).

In order to increase the response rate and the quality of the data, the survey design has been developed taking into account the guidelines presented in literature (Angeliki et al., 2016).

Between January and March 2018, 4,225 forest owners, selected through a reasoned sampling were invited to participate in the survey. The sample includes both private owners and public managers. The first category was selected among forest operators registered in the regional registers of forest companies and the Chamber of Commerce and Agro-forestry Cooperatives. Public forest managers have been identified from Regional Agencies, Basin Authorities, Consortia, Associations and Unions of Municipalities.

A response of 76 valid surveys, which represent approximately 2% of the initial sample, was reached. The web response rate is in line with literature (MacElroy, 2000).

Questionnaire design

Demand and indicators inserted in the questionnaire were depicted thanks to literature and technical manuals regarding web-based surveys (Couper et al., 2013; Sánchez-Fernández et al., 2012; Peytchev et al., 2006), Contingent Assessment (Carson et al., 2001; Hoyos and Mariel, 2010; Venkatachalam, 2004) and forest insurance (Brunette and Couture, 2008; Deng et al., 2015; Sauter et al., 2016).

The questionnaire was divided into 4 areas for a total of 22 items (Appendix A):

1) Characteristics of the forest property (9 items)
2) Risk perception (4 item)
3) Availability to pay for a multi-risk insurance against fire and storms (3 items)
4) Socio-demographic characteristics of the owner / forest manager (6 items).

The socio - demographic characteristics of the forest owners / managers are based on the classifications of National Institute of Statistics (ISTAT, 2011b; ISTAT, 2017).

The first area is dedicated to information of the forest property (surface area and location, species composition, management, main forest function). The surface of property and the geographical location usually influence owners' willingness to pay for the stipulation of an insurance policy (Deng et al., 2015). Species composition and management influence type of assortments and their value acting on WTP as well as premium level (Benneter et al., 2018; Hevia et al., 2016; Ramage et al., 2017). The main function of the forest (productive, protective, supporting, cultural – TEEB 2010) is a variable that has been included in the questionnaire because there is a trade - off between timber production and other ecosystem services (Eggers et al., 2017; Langner et al., 2017). In this section, one item is dedicated to check whether the respondents have suffered damage due to extreme events in the past. It is noted that having experienced previous economic losses is a factor that affects the WTP for forest insurance (Deng et al., 2015).

The second area includes questions regarding the perception of the risk related to the occurrence of calamity due to fires and storms. The section includes demands aimed at detecting the risk attitude of the owners. From a theoretical point of view, the behaviour of individuals in conditions of risk has been addressed both through the framework of the expected utility theory, and through the psychometric approach (Penning and Garcia, 2001; Shaik et al., 2008). In the scientific literature (Shaik, 2008; Sauter et al, 2016) it is evident that the perception of risk and the risk attitude affect the willingness or not to stipulate insurance. In particular, risk perception influences the ability of forest owners and managers to implement adaptation actions to cope with climate change (Brunette et al., 2014). Although individuals generally tend to refuse insurance against low probable events (Laury et al., 2009), Sauter et al. (2016) highlight how risk-adverse individuals tend to choose insurance in case of low-probability events with high risk of economic losses. Perception and risk attitude were detected using a 5-position Likert scale (Deng et al., 2015).

The third area is dedicated to the detection of the WTP for a "full insurance" policy, with the characteristics proposed by Sacchelli et al. (2018) (recovering of the full market value of timber minus the salvage value). WTP was detected with a payment card approach. In order to avoid errors caused by range bias or centering bias, a scale has been elaborated with exponential values (Rowe et al 1996). It was defined from the range of results obtained by Sacchelli et al. (2018) for a total of 17 bids. "Protest responses" were selected from "true zero", by means of filter questions. Among respondent not willing to stipulate an insurance tool, "true zero" were associated to owner that consider efficient other risk management strategies (e.g. silvicultural interventions). Protest bid were related to people not interested in stipulating insurance because "They can take advantages from post-event public compensation" (Jorgensen et al., 1999).

In the fourth section the personal characteristics of forest owners / managers are defined (age, gender, family status, educational degree and income) (Deng et al., 2015). These variables can influence the risk perception and attitude of forest owners (Andersson, 2012; Dohmen et al., 2011; Pennings and Garcia, 2001).

2.3. Descriptive statistics, cluster analysis and supply-demand comparison

The questionnaires are analyzed through a descriptive statistics of representative items. A cluster analysis was also applied to variables by means of Hierarchical Cluster Analysis (HCA) through the Gower dissimilarity matrix; the resolution technique uses the Ward method for mixed variables (coefficient of agglomeration 0.83) (Gower and Legendre, 1986; Podani, 1999).

The comparison between supply (potential premium) and demand (potential WTP) is defined at spatial level for Italian macroareas (northern, central and southern regions) and forest management. Gap analysis for the above parameters finally shows the potentiality for insurance schemes implementation as well as public subsidy level to favour the market.

3. RESULTS

The socio-demographic characteristics of the sample are described in Tab.1.

Table 1. Interviewed characteristics

Variable	Private		Public		Total	
Age	*Number*	*Percentage*	*Number*	*Percentage*	*Number*	*Percentage*
<39 anni	9	26.5%	7	16.7%	16	21%
40 - 65 years	23	67.6%	35	83.3%	58	76%
>65 years	2	5.9%	0	0.0%	2	3%
Total	34	100.0%	42	100.0%	76	100%
Child	*Number*	*Percentage*	*Number*	*Percentage*	*Number*	*Percentage*
No	10	29.4%	6	14.3%	16	21%
Yes	24	70.6%	36	85.7%	60	79%
Total	34	100.0%	42	100.0%	76	100%
Qualification	*Number*	*Percentage*	*Number*	*Percentage*	*Number*	*Percentage*
Bachelor/master degree or post graduate degree	11	32%	28	67%	39	51%
High school diploma	16	47%	13	31%	29	38%
Elementary school diploma and secondary educational	7	21%	1	2%	8	11%
Total	34	100%	42	100%	76	100%
Yearly income	*Number*	*Percentage*	*Number*	*Percentage*	*Number*	*Percentage*
<36.000 €	20	59%	19	45%	39	51%
36.000 € - 70.000 €	13	38%	17	40%	30	39%
70.000 € - 100.000 €	0	0%	3	7%	3	4%
> 100.000 €	1	3%	3	7%	4	5%
Total	34	100%	42	100%	76	100%

The sample is mainly composed of men (89%), ages 45-65 (76%), with child/s (79%). More than half of the sample (51%) presents a high study degree (bachelor/master degree or post-graduate degrees); 38% have an high school diploma, while only 11% have low school qualifications. The work sector is mainly linked to agriculture (67%) and the income is in the range 36,000-70,000 € and <36,000 € for 39% and 51% of cases, respectively.

Some differences emerge between private owners (44% of the sample) and public managers (55% of the sample). The private owners are constituted for more than 25% by young people (under 39 years old), for 67% by adults (aged between 40 and 65) and a percentage (5.9%) of people aged over 65 years old, absent in public managers. The sub-sample of public managers consists of more than 83% of people aged between 40 and 65 and only 16% of young people. The degree of education is high in 98% of public managers.

The average forest property area is 11,566 ha (Tab. 2). The average surface with a prevalence of deciduous trees (coppice or high forest) is clearly greater than properties with conifers. Private households own on average 268 ha of forest, while the average forest area managed by public bodies is about 20,713 ha.

The average surface of the stands with a predominant productive function is about 1,399 ha, with strong differences between private individuals (about 115 ha) and public managers (3,069 hectares). This difference is also confirmed on a geographical scale. The average size of the private forest property is 104 ha, 632 ha and 200 ha respectively in Northern, Central and Southern Italy + Islands. Public ownership, on the other hand, has an average size of 2,416 ha in northern Italy, 2,500 ha in the Centre, 72,229 ha in Southern Italy + Islands.

Table 2. Interviewed characteristics

Variable	Private owner	Public operator	Total
Area of forest typology	*Mean (ha)*	*Mean (ha)*	*Mean (ha)*
Broad-lived coppice	330	40,115	13,118
Coniferoushigh forest	329	2,038	1,611
Broad-livedhigh forest	23	25,507	20,046
Mixed high forest	181	20,385	11,405
Total	267	20,712	11,566
Area of forest function (ecosystem service category)	*Mean (ha)*	*Mean (ha)*	*Mean (ha)*
Timber production (production)	114	3,068	1,399
Biodiversity conservation (supporting)	320	26,531	16,702
Protective function (protection)	3,749	54,323	49,725
Aesthetic function (cultural)	450	5	227
Total	267	20,712	11,566
Area of forest localisation	*Mean (ha)*	*Mean (ha)*	*Mean (ha)*
Northern Italy	104	2,416	1,360
Central Italy	632	2,500	1,332
Southern Italy + Islands	200	72,229	56,794
Total	267	20,712	11,566

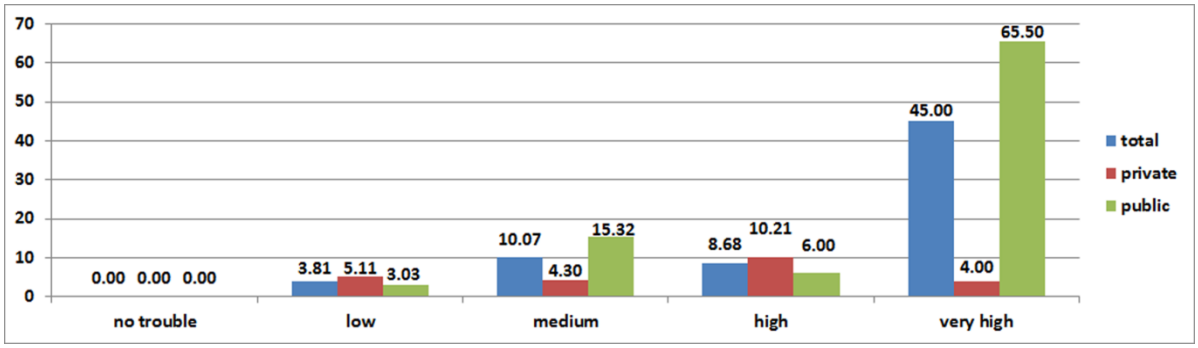
The 65% of the sample declares that has not suffered economic losses due to fire or storm in the past three years (Tab. 3). Public managers appear to have experienced economic losses in 42% of cases, private owners in 22% of cases. The willingness to stipulate an insurance (WTS) increases in case of suffered losses: an average value of +32% is highlighted in results. Not only a WTS grow this stressed but also a WTP increase from an average value of 9.69 €/ha y^{-1} to 18.65 €/ha y^{-1} (protest bids excluded for the quantification of WTP).

Table 3. Relation of WTS and WTP with suffered damages

			WTS		WTP
			Not	Yes	
Damage in last 3 years	Not	Total	65%	35%	9.69
		Private	64%	36%	
		Public	65%	35%	
	Yes	Total	36%	64%	18.65
		Private	22%	78%	
		Public	39%	61%	

Trouble level concerning perceived damage risk from extreme events reveals a 51% of interviewed that are not worried about this and around 20% with an high level of concern. A strong positive correlation between expressed trouble and WTP is evident (Fig. 1; R^2: 0.69, $p<0.05$). Some interesting evidences are the confirmation of null WTP for people that are not worried about risk and the highest level of WTP for the maximum degree of perceived trouble.

Figure1. Correlation between WTP (€/ha y^{-1}) and degree of perceived risk



The relation among WTP and forest management emphasizes the greater values for high forest, in particular due to WTP of public owners/managers (Fig. 2). The property and the typology of ecosystem service (ES) in forest population seem to influence the WTP (Fig. 3): private owners are more willing to pay in respect to public ones for insurance of productive stands. The WTP for private owners decreases moving from productive function to protective, supporting and cultural ones. The opposite trend is evident in case of public properties.

Figure2. Relation between WTP (€/ha y^{-1}) and forest management

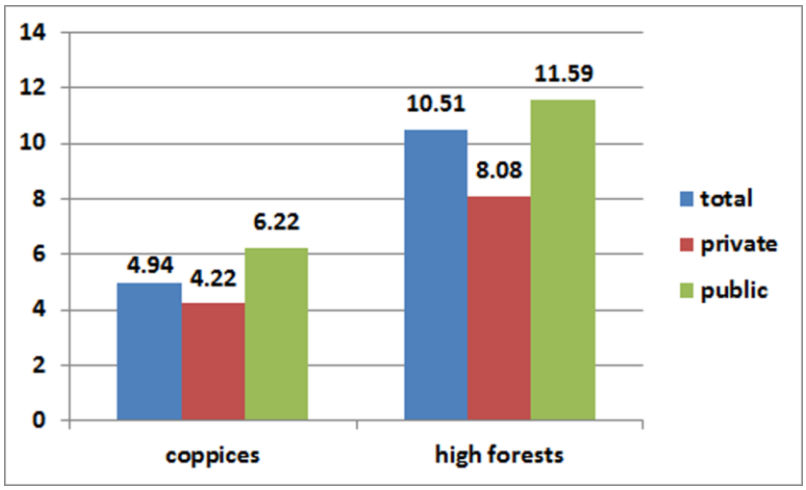
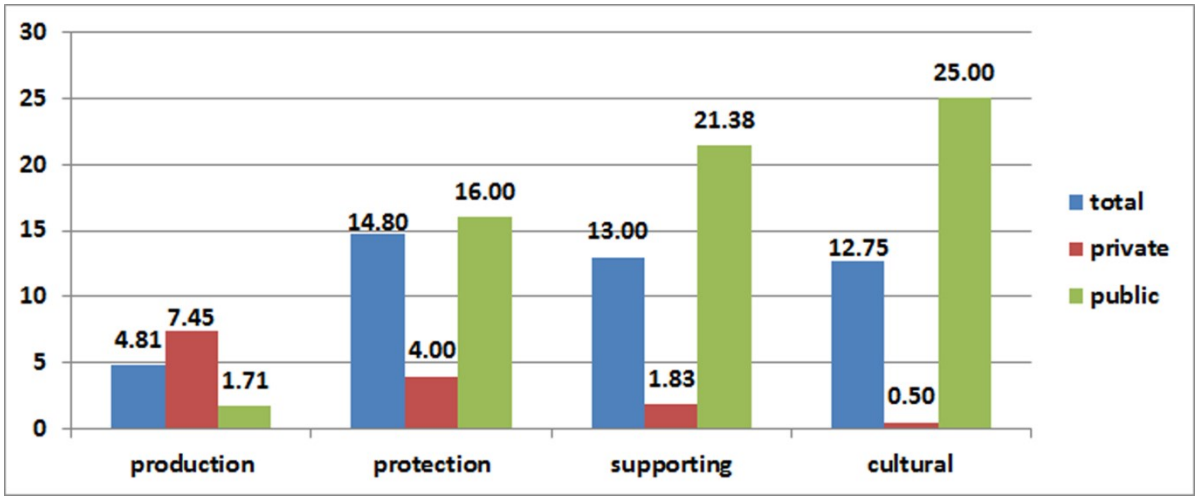


Figure3. Relation between WTP (€/ha y^{-1}) and forest function



Among motivations to refuse insurance policy other risk management tools are considered effective in 63% of respondents; advantage of public compensation after damage is another option for 17% of the sub-sample. The 20% of respondent do not know the item or prefers not to provide explanations.

The comparison between potential premium and WTP had the goal to depict their differences at macroregion and forest management level (Tab. 4). Potential premium is computed by means of zonal statistics developed in Sacchelli et al. (2018). As mentioned, the scenario are the same for both premium and WTP quantification (full insurance schemes to cover temporary damage due to fires and storms). Results are confirmed by scientific literature that reports how owners usually are willing to pay a quota to insure the forest lower than proposed premium (Deng et al., 2015). At macroregional level this gap is significant for Centre of Italy and Southern regions + Islands. In general, owners show low WTP for coppices in respect to high forest (average value 7.58 €/ha y^{-1} and 22.61 €/ha y^{-1}, respectively). Reduced differences with premium are reported for high forest in North and South of Italy + Islands. The absolute value of difference gives an order of magnitude for potential public subsidy needed to match supply and demand in forest insurance market.

Despite WTP is always lower than premium, an interesting insight is the fair correlation between the above variable. In other term the performance of WTP seems to follow the trend of premium (R^2: 0.5, $p<0.05$).

Table 4. Comparison between insurance premium (from Sacchelli et al., 2018) and WTP

Macroregion	Average premium (€/ha y^{-1})	Average WTP (€/ha y^{-1}) (for WTP>0)	Difference (€/ha y^{-1})	Difference (%)
North (N)	21.44	14.72	6.72	-31%
Centre (C)	19.91	7.83	12.08	-61%
South + Islands (S+I)	46.51	24.75	21.76	-47%
Forest management and macroregion				
Coppice (N)	20.98	7.83	13.15	-63%
Coppice (C)	19.91	8.42	11.49	-58%
Coppice (S+I)	41.74	6.50	35.24	-84%
High forest (N)	21.82	18.16	3.66	-17%
High forest (C)	19.93	6.66	13.27	-67%
High forest (S+I)	50.33	43.00	7.33	-15%

The HCA analysis allows to extract six homogeneous clusters (Tab. 5).

The first cluster (11 units) is composed by both private owners (4 units) and public managers (7 units), who have all declared disposal to stipulate insurance (11 units). All owners have suffered economic damage due to fires and storms; nine units declare to be very worried about the risk related to extreme meteorological events. The majority of them (8 units) declare availability to implement new forms of risk management. Finally, the units of this cluster belong to low and medium-low income classes.

The second cluster (16 units) is characterized by a clear prevalence of private owners (13 units). All units refuse to stipulate the proposed forest insurance, although fifteen units declared they had previously suffered damages. With regard to the perception of risk, statistical units are equally distributed among classes. Six units are willing to implement new forms of risk management. Finally, income class is low (10 units) or medium-low (6 units).

The third cluster solely consists of public managers (19 units), who refused to stipulate insurance. Eleven units have not suffered damages to property; thirteen units are not worried or slightly worried about the possibility of weather injuries. Eight units are willing to implement new forms of risk management. Class of income is predominantly low and medium-low. However, the medium-high (2 units) and high (2 units) categories here appear.

The fourth cluster (13 units) is represented by a major component of private owners (10 units). A total of nine units agree to take out the insurance policy. None of the units have previously suffered damage from fires and storms. Eight units are slightly worried about the possibility of damage to forest, one unit expresses concern, while there are very worried (3) and extremely worried (1) units. Eleven units declare they are willing to implement new forms of risk management.

Cluster 5 is formed by private (7 units) and public (4 units) owners or managers. Eight units are willing to stipulate the proposed insurance policy. Eight units have previously suffered damage due to fires and storms: six of them have agreed to take out the policy. The stands of cluster have exclusively a productive function. The trouble perception ranges at intermediate levels. Six units declare themselves not inclined to implement new risk management tools. Ten units belong to the low and medium-low income classes. Only one unit belongs to the medium-high class.

The last cluster (6 units) consists only of public managers who are potentially willing to stipulate insurance. None of the managers has previously suffered damage. Regarding the perception of the risk, three units declared to be slightly worried, two units worried and one unit very worried. The income is low or medium-low for five units; one unit belongs to the highest income category.

Table 5. Results from cluster analysis

	Cluster 1 (n=11)	Cluster 2 (n=16)	Cluster 3 (n=19)	Cluster 4 (n=13)	Cluster 5 (n=11)	Cluster 6 (n=6)
Public property	7	3	19	3.00	4	6
Private property	4	13	0	10.00	7	0
Average surface (ha)	32,913	165	25,210	358	2,710	152
Coppice (ha)	51,575	135	0	663	4,578	178
Conifers high forest (ha)	325	259	3,953	118	109	0
Broadleaved high forest (ha)	0	5	38,103	10	206	90
Mixed high forest (ha)	40	195	37,710	104	7,518	200
Average surface per function (ha)						
Production	190	93	3,206	82	2,710	0
Supporting	249	279	66,180	1	0	136
Protection	120,008	500	45,552	3,749	0	250

Cultural	450	0	0	0	-	5
Damages in last three years						
Yes	11	1	8	0	8	0
Not	0	15	11	13	3	6
Trouble level						
No trouble	0	5	3	0	0	0
Low	2	3	10	8	5	3
Medium	4	5	4	1	6	2
High	3	2	2	3	0	1
Very high	2	1	0	1	0	0
Not willing to use risk management strategies						
Totally disagree	3	4	4	7	0	0
Partially disagree	5	1	4	4	0	0
Indifferent	1	6	6	2	5	5
Partially agree	2	3	3	0	6	1
Totally agree	0	2	2	0	0	0
Willingness to stipulate a forest insurance						
Yes	11	0	1	9	8	6
Not	0	16	18	4	3	0
Class of income						
<36,000	4	10	9	7	5	4
36,000 – 70,000	7	6	6	5	5	1
70,000 - 100,000	0	0	2	0	1	0
>100,000	0	0	2	1	0	1

4. DISCUSSION AND CONCLUSIONS

The analysis investigated the Willingness To Stipulate (WTS) a forest insurance according to owners and forest characteristics as well as a preliminary evaluation of their Willingness To Pay (WTP). Despite the number of respondent is in line with previous web-based surveys, the study can be considered as exploratory due to sample dimension. WTS and WTP are consistent with the past experience of owners /managers (presence of damages suffered in last three years) and perceived risk. Both output increase if previous losses due to fires and storms occurred as well as if trouble for this events intensify. WTP seems to be greater for high forest in respect to coppices. This statement can be justified by the economic value of high forest and their probability of damages due to fires and storms (generally higher) as confirmed in Sacchelli et al. (2018) for premium evaluation. Obviously, local differences and variation can emerge at national and regional level but the similar trend between WTP and premium – here stressed – could be considered as preliminary confirmation of the above issue. An interesting output arises from disaggregated data: the low level of WTP for insurance in mixed forest is also confirmed from premium point of view (Sacchelli et al., 2018). Mix in species and structure can be considered as a risk management strategy per se.

Private and public owners declare a different WTP according to prevalent function of their forests. Tangibility of delivered ecosystem service (ES) seems to be a key element in this case: as well established in literature the ability to quantify both biophysical and economic value of ES generally decreases moving from provisioning function (e.g. timber production), to protective, supporting and cultural ones. This trend is directly and indirectly related with WTP for private and public owners, respectively. Insurance for market

value is a priority for private forest owners, whereas public managers pay particular attention to cultural (recreation and tourism) as well as supporting (maintenance of habitat) services.

Among motivations for not stipulating insurance, the main reason seems to be the preference for alternative form of risk management. First of all, silvicultural interventions seem to be perceived as a financially efficient form to cope with hazards. In addition, the availability of post-damage compensations is a significant incentive to refuse insurance (Brunette et al., 2014).

The differences between premium and WTP reveal potential forest management and area where the implementation of insurance schemes could be easier. Lower gap is highlighted for high forest located in northern and southern Italy. These categories – in general – represent forest with higher economic value and higher risk of extreme events, respectively.

The low level of forest insurance coverage in Italy is – in part– due to the lack of marketing activity. The summary of the Confederation of European Forest Owners – CEPF – Insurance day (CEPF, 2010), stressed how forest owners have not an accurate understanding of insurance mechanisms and availability. In this sense one option to promote the market could be the development of marketing strategies directed to specific owner categories. Implemented cluster analysis indicated six classes of potential insured that are differentiated according to some items. Cluster 1 indicates an high propensity to forest insurance due to previous suffered damages and high level of trouble for fires and storms. Particular attention should be paid to people of Cluster 2 that, even though occurred losses in their property, decline stipulation of insurance. These proprietaries are private with low or medium-low level of income; in their decision a strong influence of premium could be hypothesised. Public managers represent Cluster 3; they refuse activation of insurance and seem not to be troubled about the risk. In this case a motivation can be depicted in the absence of previous damages to forest properties. Scenario presentation and projection of number as well as intensity of future extreme events could be considered as an information strategy for the Cluster. Risk-adverse owners are categorised in Cluster 4 composed by private owners who agreed to take out the insurance policy. Taking into account that they have not suffered damages, their WTS should be guided by expert toward specific form of insurance schemes. Units of Cluster 5 are identified at intermediate level for risk-perception and show an equal distribution of items. Majority of them are willing to implement an insurance; the main characteristics of Cluster units is the forest function (productive in all cases). Differentiated marketing strategies should be considered in this Cluster; however insurance schemes should be calibrated considering the production of timber and other wooded assortments. Innovative form of insurance could involve Cluster 6 composed by public owners that have not previously suffered damages from fires and storms. They are willing to stipulate forest insurance, probably to include the protection of less tangible ES (e.g. cultural and supporting ones).

Future analysis should focus on sample integration and evaluation of potential insurance premium including the value of forest non-market goods and services. Thus, the concept of Total Economic Value (Pearce 1990) could be investigated also for insurance market and mechanism of Payments for Ecosystem Services should be introduced in the analysis.

Decline of insurance due to the presence of public ex-post damage compensation is considered as "protest bid"; additional investigation for this item should be developed in future studies.

With the above recommended integrations, the study can be considered a preliminary step to suggest guidelines for policies as well as marketing activities to improve insurance schemes in national forest sector.

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APPENDIX A

Section	N.	Item	Question typology	Answer options
1) Property characteristics	1	Property typology	Dichotomic	1: private 0: public
	2	Main forest typology	Multiple choice	1: conifers high forest; 2: coppice; 3:broadleaves high forest; 4: mixed high forest
	3	Main forest function	Multiple choice	1: timber production; 2: non-wood forest product production; 3; touristic-recreational; 4: water and soil protection; 5: habitat and biodiversity conservation
	4	Surface (ha)	Open	-
	5	Damages suffered in the last three years from fires and/or storms	Dichotomic	1-yes 0-not
	6	Property localisation	Multiple choice	Northern Italy – Central Italy – Southern Italy + Islands
	7	Property localisation (if Northern Italy)	Multiple choice	Piedmont, Aosta Valley, Lombardy, Trentino-South Tyrol, Veneto, Friuli Venezia Giulia, Liguria, Emilia Romagna
	8	Property localisation (if Central Italy)	Multiple choice	Tuscany, Umbria, Marche, Lazio
	9	Property localisation (if southern Italy + Islands)	Multiple choice	Abruzzo, Molise, Campania, Apulia, Basilicata, Calabria, Sicily, Sardinia
2) Risk perception	10	Trouble for risk (fires and storms) on forest property	5 steps Likert scale	5: very high - 1: no trouble
	11	Willing to accept risk (fires and storms)	5 steps Likert scale	1: totally disagree - 5: totally agree
	12	Not willing to use risk management strategies unless they are applied from others	5 steps Likert scale	1: totally disagree - 5: totally agree
	13	Risk aversion (self-assessment)	5 steps Likert scale	1: Not willing to risk - 5: Willing to risk
	14	Willingness to stipulate a forest insurance	Dichotomic	1-yes 0-not
	15	If the answer to question 14 is "yes": please, define the maximum WTP for an insurance premium (€/ha y^{-1})	Multiple choice	0; 0,5; 1; 1,5; 2; 3; 4; 6; 8; 12; 16; 25; 30; 45; 65; 90; 130
	16	If the answer to question 14 is "not" or if the answer to question 15 is "0": why?	Multiple choice	1: presence of post-event public compensation; 2: in my opinion are more efficient other forms of risk management; 3: I don't know
4) Owner / manager characteristics	17	Age	Multiple choice	< =39; 40-65; >65
	18	Gender	Dichotomic	1- male 0 –female
	19	Child/s	Dichotomic	1: yes; 0: not
	20	Study degree	Multiple choice	1: Elementary school diploma or secondary education; 2: high school diploma; 3:

				bachelor/master degree or post graduate degree
	21	Sector of work	Multiple choice	1: agriculture; 2: industry; 3: commerce and tourism; 4: transport; 5: finance; 6: other
	22	Yearly income (€)	Multiple choice	1: <36,000; 2: 36,000 -70,000; 3:70,001-100,000; 4:>100,000