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CICLO XXV

TITOLO TESI:

PAYMENT FOR ENVIRONMENTAL SERVICES AS ECONOMIC TOOL TO ENHANCE THE ENVIRONMENTAL SERVICE MARKET: THE CASE OF NON-WOOD FOREST PRODUCTS AND SERVICES IN THE VENETO'S MOUNTAIN FORESTS.

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...a tutti coloro che ho incontrato nella mia vita

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List of acronyms

ES	Environmental Service
GNP	Gross National Production
PES	Payment for Environmental Services
MCA	Mountain Communities Authority
MES	Market for Ecosystem Services
NWFP	Non Wood Forest Product
RWMP	Recreational Wild Mushroom Picking
WM	Wild Mushroom
WTP	Willingness t pay

Summary

The thesis explores the evolution of environmental service (ES) commercialization in the Veneto's mountain areas, thought the implementation of payment for environmental service (PES) schemes. Starting with the description of general theory beyond PES based on the principal statement of the contract theory, we introduce the ES commercialization through the analysis of an alternative forest business, based on recreational wild mushroom picking (RWMP) that became recently an important income source for forest managers in mountain areas. Across a multiple case study, the role of governance of WM resources have been highlight arguing the need to have a direct link between WM resources and stakeholder coordination. The case of RWMP has been used to introduce the concepts of ES user's direct utility and ES commercialization by bottom up initiatives; scarcely addressed in water sector, where a top-down approach by the central government prevails. Finally, an estimation of Veneto dwellers' willingness to pay (WTP) has been assessed through a choice experiment application, to highlight key factors determining their preferences to spend for ES provision improvement. The results confirm the attitude of people to have higher WTP for the ES directly used, even if a key role is played by people knowledge to create ES demand.

Riassunto

La tesi esplora l'evoluzione della commercializzazione dei servizi ambientali nelle foreste montane del Veneto, attraverso l'adozione di schemi di pagamento per servizi ambientali (PES). Iniziando con la descrizione della teoria dei PES basata nei principi cardine della teoria dei contratti, si introduce lo sviluppo della commercializzazione dei sevizi ambientali attraverso lo sviluppo di attività forestali alternative basate sulla raccolta di funghi selvatici ai fini ricreativi (RWMP), diventata oggi una importante fonte di reddito per i gestori della foresta. Attraverso un caso studio multiplo si evidenzia il ruolo della gestione delle risorse fungine sostenendo la necessita, in politiche di commercializzazione degli ES, di creare un legame diretto tra gestione delle risorse fungine e l'azione di coordinamento degli attori coinvolti. Il caso dei RWMP è stato utilizzato per introdurre i concetti di commercializzazione dei servizi ambientali e utilità diretta degli utilizzatori dei servizi ambientali; questi concetti sono stati scarsamente utilizzati in altri casi di commercializzazione degli ES, come per esempio nel settore idrico, dove prevale l'approccio di imposizione di vincoli dal governo centrale. Infine, la disponibilità a pagare da parte dei residenti del Veneto è stata stimata attraverso l'applicazione di un esperimento di scelta, per evidenziare i fattori determinanti che spingono le persone a esprimere una volontà di spendere per migliorare la produzione di servizi ambientali. I risultati confermano l'attitudine delle persone ad avere una maggiore WTP per i servizi ambientali utilizzati, anche se il ruolo della conoscenza delle persone gioca un ruolo chiave nella creazione della domanda di servizi ambientali.

1. ES in the real economy: from concept to ES market. A historical approach

The concept of environmental or ecosystem service (ES) has become very popular in the last few decades. The increasing attention to the environment has become well known issue by the majority of the global society, mainly due to the rapid effect of the human behaviour affected the "earth ecosystem". At the root side of the present situation the huge demographic increment has been the main threaten of the earth ecosystems. A global review of the concept of ES was delivered by Gómez-Baggethun et al. (2010) that spent a lot of effort to summarize the scientific and social patterns (see Figure 1) that allowed world society to incorporate part of the natural capita in the real economy through the market for ecosystem services (MES) (Bayon 2004).

Hardin (1968) and his famous paper "*The Tragedy of Commons*" have been the embryo the concept of MES. The self-interest was the main cause of environment depletion. In fact, the huge demographic boom after the Second World War triggered the demand of natural resources exceeding in several places the ecosystem carry capacity. Together with welfare growth and the social demand change, people have stated to ask new commodities at cheap price, using the environment as an inexhaustible source of goods. The expanding need of energy for the society took Georgescu-Roegen (1971) to consider the second law of thermodynamics in the economic process, because any human activity require energy to work. The same principle was adopted in the same year by Odum (1971), father of the ecosystem ecology. Basically, both the authors, one in economy and the other in ecology, understood that energy was at the basic mechanism beyond every action. Just one year later, in the 1972, the United the Nations along the proclaims of Stockholm conference, the seventh point was entirely incorporating the concept that humans act within the environment, on in other words, the beginning of ES internalization in the real economy. Moreover, the concept opened immediately another debate about the world carry capacity. The use of finite resource within a close ecosystem as the earth, let Meadows et al. (1972) to develop the concept of growth limits, basically the contrary perspective of the neoclassical economy.

Few years later, the first oil crisis was a first advise of these global changes, confirming the scholar's theoretical perspectives. In fact, the first Arabic oil embargo in the seventies was the historical break point that introduce the consciousness of earth limit and the need to seek a new type of world development (Sachs 1974). The demand of a new "*global governance*" saw the creation of two different theoretical thoughts over sustainability: one side Daly (1974, 1977) with the eco-centric or strong sustainability concept and on the other Hartwick (1977) with the a strong opinion that economy as such generated of intergenerational equity. Nevertheless, the world economy continued with this last assumption, based on neoclassical economic theory, while sustainability concept rise up only some year later in the real economy. The second oil crisis was a consequence of the political instability of Iranian government, rather then a market consequence of oil shortage. However, it helps to strengthen the concept of interdepended relationships between world economy and energy (Costanza 1980), few years later (1982) embedded as core concept by the World Resource Institute (WRI). Founded as independent non-governmental organization, WRI has focused in four main issues: *i)* energy and climatic change, *ii)* institution governance to raise environmental friendly policies; *iii)* market and environmental responsible enterprises; and lastly *iv)* environmental resource conservation.

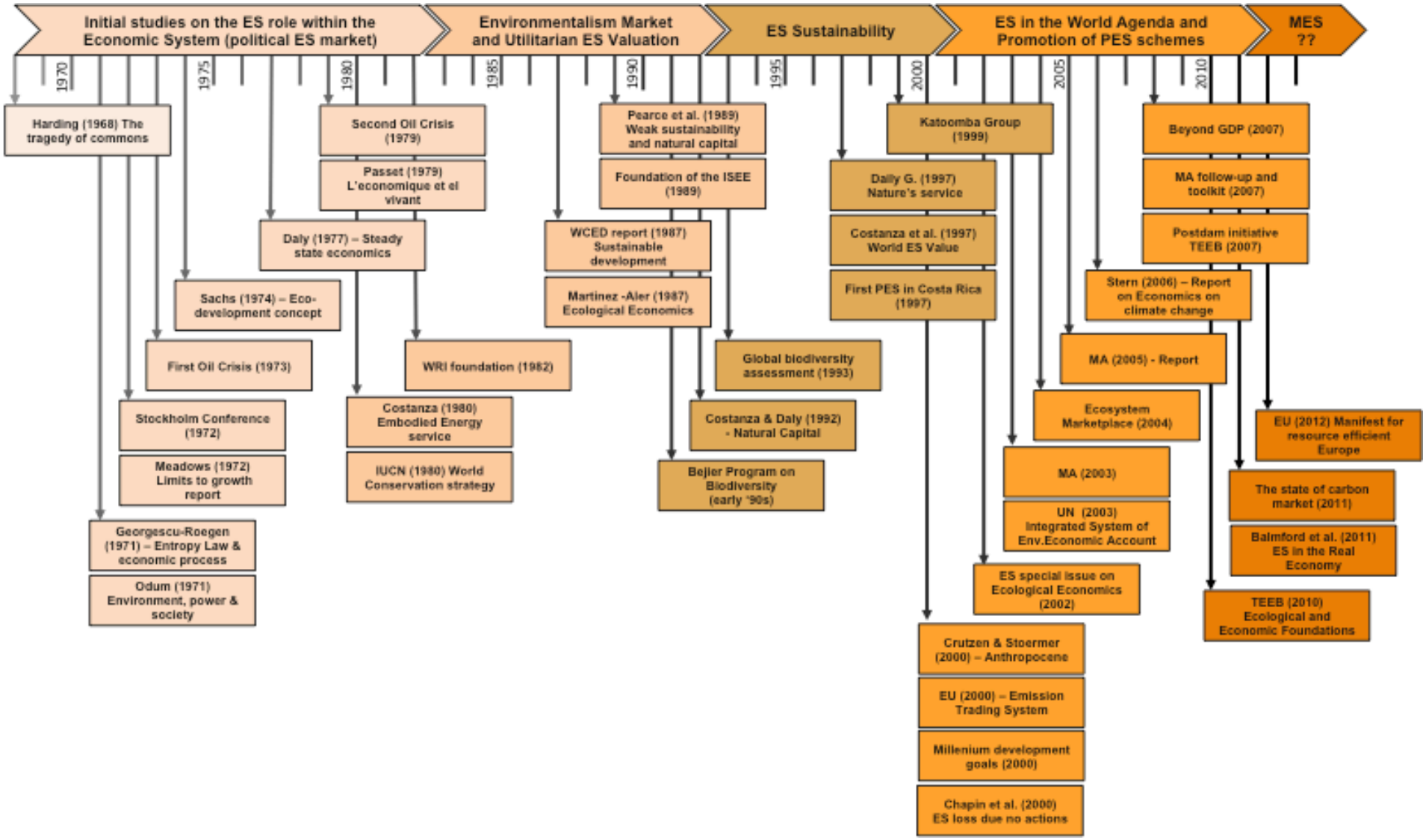
The lack of countries' environmental information and the scattered ES valuations led UN to promote the world commission on environment and development (WCED). The final report of the commission recognized the role of welfare in environmental conservation as well the

acknowledgement of the economic limits that the adoption of any eco-centric policy can have on the industrialized countries, by mean of an ES cost. Moreover, the need to redistribute the resources at global scale was the an identification of the world economy interdependency as a huge global ecosystem, concept returned by Martinez-Alier and Schlupmann (1987). The maintenance of natural capital was considered an insurance for the whole world economy, both achieving welfare and sustainable growth (Costanza and Daly 1992) through a taxation of the traditional economy in favour to the environment, demonstrated the most feasible solution to dam the environment depletion.

The first general assessment of the value of the world environmental services (Costanza et al. 1997, Daly 1997) has been the wider econometric effort to prove the cost of human passivity toward the protection of the environment, being the environment the source of a seventeen services that worth in total 1.8 folds the global annual GNP. However, the impressive results have to be seen as a political advise to the global scale of the environmental problem (Farber 1998). In the same year (1997), the first payment for environmental services (PES) has been created in Costa Rica for watershed market at national scale. PES, despite legal constrain on the use or on the non-use of some ES, it binds the ES user and ES supplier with a contract, so the how to use the ES is defined by the parts, instead by the government. Driven by the effort of the World Bank to begin the ES commercialization, the PES schemes implemented allowed to enhance large watershed protection, while minimal effect have been achieved on biodiversity and carbon sequestration. Thanks to the rapid follow up of PES schemes, the ES have been inserted in the seventh principle of the millennium development goals (MDG) (UN 2000), today representing the world driving principles. Being the loss of ES a cost for the society (Chapin et al. 2000), the global accounting (UN et al. 2003) and reporting (MA 2005) have been the tools the suggested to promote the market for environmental service (MES), as direct consequence of PES diffusion. In this sense, the Postdam initiatives of the G8 summit in 2007 launched the economic of ecosystem and biodiversity (TEEB) that was an operative tool of the society to monitor the global ES market. Other initiatives followed this first, like Ecosystem Marketplace (de Groot et al. 2010). Here after, PES and in general MES, has start to be a wide spread practice in Europe (Natura 2000 program, Life, Common Agriculture Policy funds for Agro-Forestry Service) as well in other countries as practice to preserve the environment without an economic loss for the local society. Anyhow, ES market needs further effort for the civil society to scale up, due to the evidence of the ongoing global threat (Alexander 1997) that start to affect also to the world economy (Noy 2009, von Peter et al. 2012) due mainly to the incapability to organize people and resources in the space and time. The complexity of the ecological, political, economic and social framework have played a major role on MES implementation (Balmford et al. 2010), but where PES have been applied through the creation of a real demand and supply, in which both the parties gain a better utility with regards their previous status, the success has been a guarantee.

The brief introduction on ES shows clearly how much effort the scholars, institutions and civil society spent before the implementation of the first national PES scheme. After the case of Costa Rica, several other cases have been recorded globally, while some decades have still to pass before a full recognition of the ES value in the market. Among the key ES traded biodiversity (especially in wetlands), soil protection, water quality, carbon sequestration and recreation have been the most frequent traded ES since now. In Italy, the MES did not succeed as in other countries. Despite PES is a new useful tool to enhance the provision of ES, it still remains linked to few case studies associated to legal acts of the central or regional government. Due to the complexity of the issue, we report a specific chapter that explains in details the main legislative changes occurred in the last centuries on ES provision.

Figure 1: From ES concept to ES market: milestone timeline



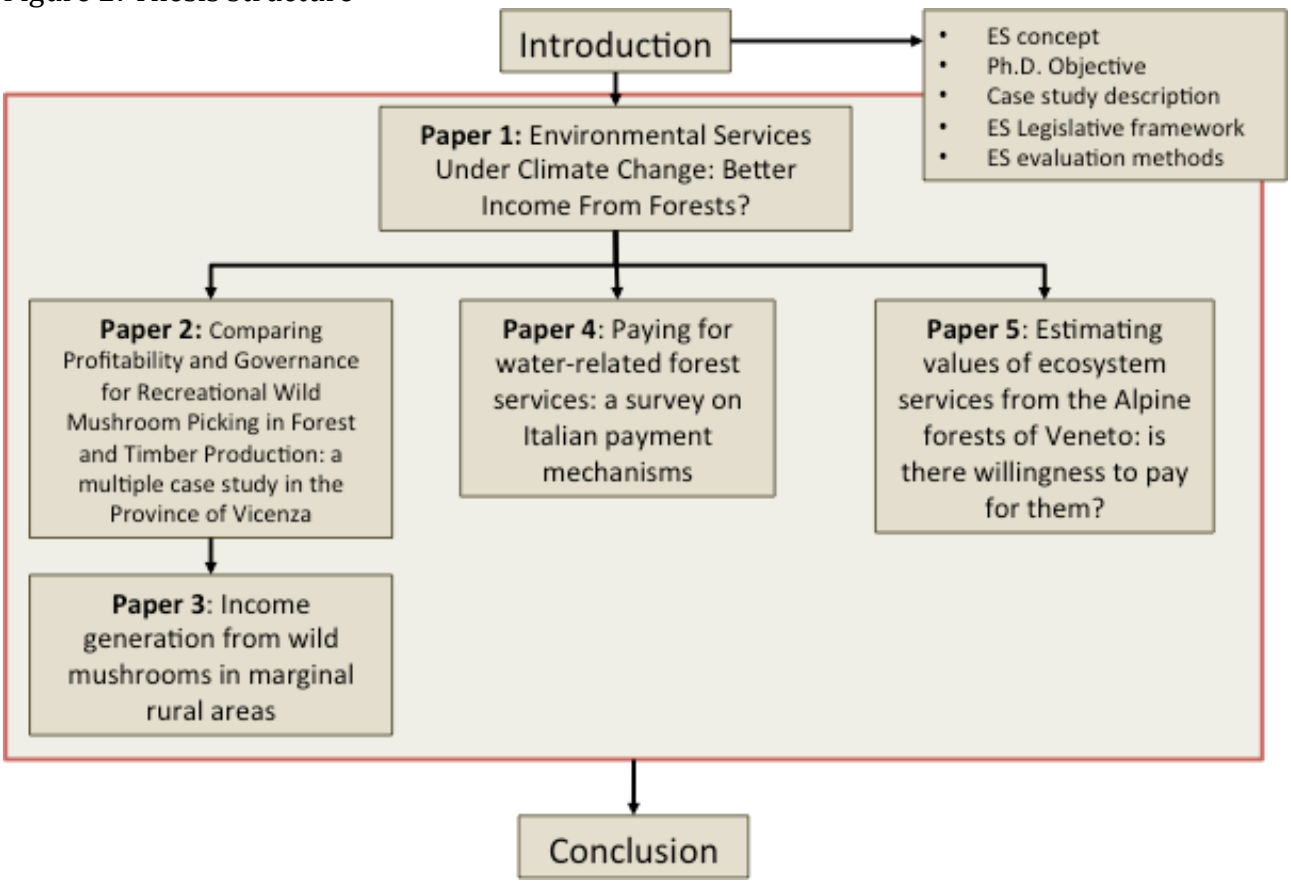
Source: (Gómez-Baggethun et al. 2010) modified.

2. Thesis objectives and structure

Italian Government has set up a multitude of legal forest constrains to preserve the environment, nevertheless the overall effect of the command and control approach has triggered forest and land abandon. Also other concauses helped to diminish the land productivity for example the heavy bureaucratic procedures, the land fragmentation or the welfare enhancement, but above all, the lack equality distribution once legal constrains was implemented have to consider a key problem. If on one side the population benefits of the ES increment thanks the legal constrains, on the other, land owner has suffered without any compensation: core principle PES scheme implementation try to solve.
The present work explores the feasibility of PES scheme implementation in Veneto Region for the main ES generated in mountains areas and not yet commercialized, like forest recreation, water quality, biodiversity conservation, carbon sequestration and aesthetic component of the landscape that are today public goods. The lack of financial means from central or regional government together with the increasing perception of a diminishing patters of ES availability has highlighted the possible creation of a monetary flow between ES user and ES suppliers, mainly located in mountain areas. Since now, subsidies to enhance forest ES has been calculated through the cost of provision, or in other words the cost the ES supplier (land owner or manager) has to spend to increase a given ES provision. Nevertheless, since the "*power of scarcity*" is hold by the ES consumer (the demand), economic actor supposed to pay in a potential PES scheme implementation, we address our attention on the demand side to understand whether or not there is a willingness to pay (WTP) on the forest services that are today free of charge.
After a brief introduction to describe the case study area, the legal framework that regulate the use of the ES in the region and the methodologies that might be applied to assess ES value, we present the theory beyond the PES schemes by mean the *paper 1* entitled "*Environmental Service Under Climatic Change: Better Income From Forest?*". The paper explores the possibility to implement PES schemes as a new market tool to enhance the forestland income. Here, four case studies are presented and they introduce the issues described in the papers 2, 4 and 5 (see Figure 2). ES funding represent today the major dams to implement an efficient PES scheme. The volume of the economic transaction to provide ES may be calculated through the estimation of the "*ES demand*" or across the calculation of the "*cost of provision*". While we think the demand is a driving force for the market and it makes easer the implementation of any PES scheme, the creation of a fund to subsidized the ES provision paid by everyone, hence also people that do not have a direct utility on a given ES, might have a smaller dimension and generally it remain limited to a local cases. These concepts are shown in the cases respectively reported in *paper 2* and *3* for demand effect and in *paper 4* for the supply.
The *paper 2* analyse the historical pattern that pushed the policy makers to consider wild mushroom (WM) as new commodity to be sold from forest sector. Wild mushrooms (WM) have been an important forest externality collected by a large portion of Italian citizen since the late '90s. The congestion over WM resources and the demand to increase the availability of WM resources in the forest allow the creation of a new type of forest income for the forest manager. The assignment of specific property rights has been the first step to allow the commercialization of recreational WM picking permits. Nevertheless, if in one side a new forest output was created, on the other the WM enterprises transfer their attention abroad with the effect of a general decrement of the local WM added value. The *paper 3* describes a case study from Eastern Finland and the effect of WM export to Italy. Despite WM are considered a public good in Finland, the creation of a collecting mechanism allowed to generate a new income source for rural population, unknown before.

Water quality is an important ES, especially in the Mediterranean basin. *Paper 4* analysed the historical process that allow to create a monetary fund to subsidies mountain forest owner in order to compensate the cost of provision of cleaner water through the adoption of alternative forest management practices. The fund has been generated by an additional tax on water bill. Despite WM, the diffusion of water economic mechanism remained limited due to the political sensitivity at political level, because consider an additional cost for the household, not expressly want by the population; in fact the PES scheme has been implemented only in three out of twenty-one Italian regions.
Lastly *paper 5* report an application of WTP assessment for mountain forest ES in Veneto region. The estimation has been done applying a choice experiment analysis, a common approach to estimate the demand of non-markets goods. Basically, the main aim of the paper was to understand whether it exists a WTP for biodiversity maintenance, carbon sequestration and general recreation as pick nick areas, forest aesthetic view and landscape beauty. Moreover a test between mountain user and non-mountain users has been done to check the differences in terms of utility.
Finally, the conclusions wrap up the main findings of the research, reporting some evidences come up in these three years of work.

Figure 2: Thesis structure



3. The case study area description[1]

3.1. The geographical context

The Alpine region spans across eight countries: France, Monaco, Switzerland, Lichtenstein,[2] Italy, Austria, Germany and Slovenia. It forms a unique mosaic of natural, agricultural and forest spaces and landscapes, characterised by high ecosystem values, whose conservation is at the root of the signature in 1989 of the Alpine Convention. In this context Veneto Region, located in the North East Italy, represents a only small part of the Alpine system, in which anthropic modification had a huge pressure on the original ecosystem. Veneto Region, represents quite a diversified area, in fact within the two hundreds kilometres of regional surface, there are much diversified landscapes, from Mediterranean environments to arctic or semi-arctic ecosystems on the dolomite glaciers (see Figure 3) that did not limit the development of industrial district model based on small-medium-size enterprises (SMEs). Since the 70s, this model allowed a fast economic development of the Region modifying the land use in the whole plain and hilly areas especially along the axis Verona-Padua-Treviso, where the continuum built-up space has become the actual land matrix (urbanized country). Basically this urban framework ended-up in the so well known "urban sprawl"; 84% of Veneto population is living in this area, the main user basin of the local mountain resources. In the plain and other flat areas at intermediate altitude the forest has been almost completely removed, firstly for the conversion of land into agricultural uses, more recently (in the last decades) as a consequence of the urbanization and industrialization processes. On the contrary, mountain area with low population density – 108 inhabitants/km^2 (ISTAT 2007) has maintain the typical alpine forest landscape. The economic situation is rather heterogeneous and changes even from one valley to the contiguous one. In some areas, mostly in the Dolomites' valleys, a well-established touristic industry both in summer and in winter has developed; this has meant employment and revenues for local people but also environmental conflicts on the use of natural resources. On the other hand, the more remote Alpine valleys are affected by problems of depopulation; unemployment and land abandonment connected with serious environmental degradation problems. In this scenario, mountain system was chosen to focus on the portion of the Veneto Region which is considered 'mountainous' and will refer to it as 'case-study ar-

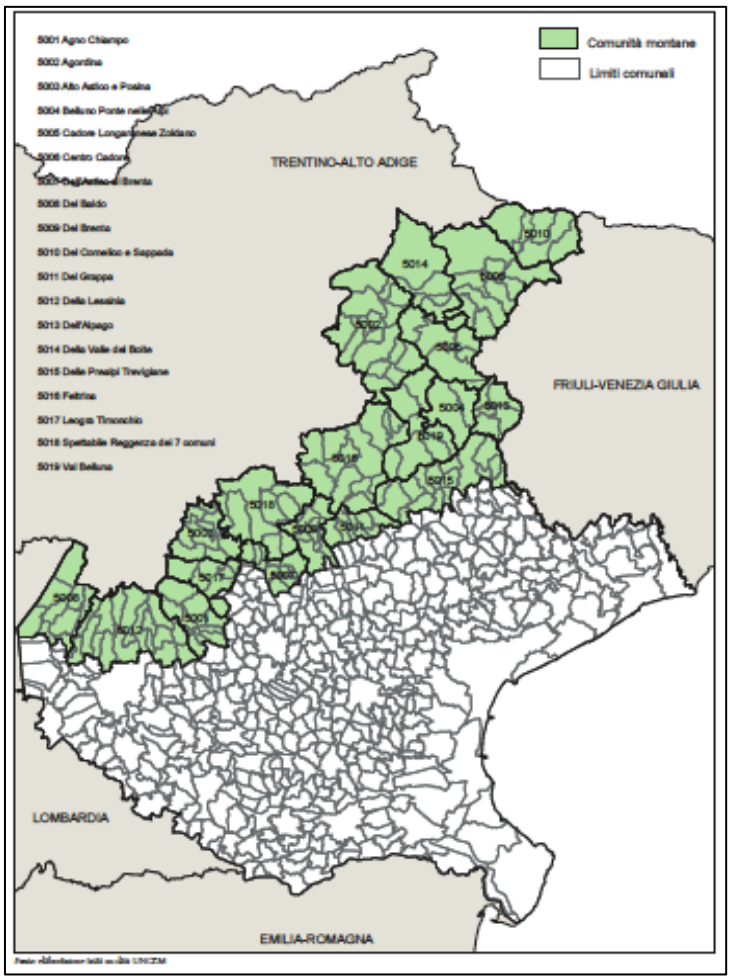


Figure 3. The case study area

[1] This part has been written as introductory part of the NEWFOREX project by the thesis author and revised by the other co-authors (Deliverable 2.1).
[2] http://www.alpconv.org

ea' throughout in this work. It allows us to work in a scenario homogenous in terms of administrative organisation, institutions and stakeholders, policies (forest policies, sometimes focused especially on mountain areas), socio-economic and cultural background. The chosen area is relevant in terms of production of key externalities linked to forest and to forest management, it allows us to define rather precisely options in forest management scenarios and is large enough to include a sufficient number of forest holdings on which to carry out the survey on the costs of provision of forest externalities Already regional government has tried to preserve the mountainous area, implementing several environmental laws. Since the early 80s, the regional act 40/84 has introduced in Veneto the possibility to preserve ecological amenities by the institution of Regional parks. Nevertheless, due to the several complain generated by local dwellers, they had only spot-like impact on ecological conservation. Later on, in the 90s the implementation of the habitat (92/43/CEE) and Bird directives (79/409/CEE) within the national legislative system stimulated a different approach on the ecosystem conservation. In fact it was drafted to allow forest owners to maintain their activities, and compensating through the rural development plan those companies (mainly farm) that have high ecological impacts: first step toward green economy and environmental service market, core issue on the present work.

3.2. The case study area

The case-study area has a total area of 668,130 hectares and, according to the last Census (2000) a population of 729,541 inhabitants (ISTAT 2007).. The largest part (84%) of this of this population lives in urban settlements (small towns and villages), located in valley bottoms, the remaining in hamlets of a few houses or in isolated farms. The population dynamics in the area are those common to the Italian mountain areas, indicating population ageing: the age-index (ratio between population aged 65 and more and that aged less than 14 years) is 138.6 (whole Veneto Region: 135.7, Italy: 131.4); the rate of natural population decrease is -0.6 per thousand inhabitants (compared to +0.7 for the whole Veneto region). This decrease is partially compensated by immigration, so that the total rate of population growth is 3.6 ‰. Always according to ISTAT (2007)., the unemployment rate of the area is rather low (3.5%), and lower than that of the whole Veneto Region (4.1%): this labour is mostly employed in some rather important industrial activities (42.8% of total employment) – mostly electrical appliances and spectacles in the Province of Belluno – and in services (mostly tourism). However, there are rather relevant differences amongst the unemployment rates of the areas nearer to the plain (2.8%) and those of the inner valleys (twice as much). The Veneto Region is the leading Italian Region for number of tourists (about 60 million each year) and the mountain areas of the region benefit of this flow. The result is an accommodation potential of 129 units (hotels, B&B and other forms of accommodation) per square km in the mountain areas, which is low if compared with that of the whole Region (218), but high if compared to the average Italian situation (38). The recent inclusion of the famous Dolomites mountains (80% located in Belluno province) in the list of sites of the UNESCO World Heritage will probably contribute to increase the touristic flow in future.

The mountain areas of Veneto are mostly characterised by agricultural and forest activities. The two are intimately connected (most of the private forests are within farms) and are both important in shaping the characteristic mountain landscape and creating positive externalities. According to the last Agricultural Census (ISTAT 2007)., the total UAA of the case-study area is 101,800 hectares, distributed amongst crops, orchards, grazing and meadows as shown in Figure 6. The Statistic Atlas of mountain areas in Italy reports that, in the case-study area, there are about 5.6 farms per km2, (the indicator for the whole Region is 10.4), and that

the average area per farm is 10.3 hectares including the forest area and 4.0 hectares considering only the UAA.

According to the Veneto Region, the forest land of the whole Region was 414,893 hectares at the turn of the century; the data of the more recent National Forest Inventory of 2009 show that this area has increased now up to 446,698 hectares (including both FAO categories of 'forests' and 'other wooded land')3. Veneto contributes with 4.2% to the total Italian forest area and 79.5% of this forest land is located in the mountain, therefore in our case-study area. In terms of composition the forest area of the Veneto Region is very rich of species (Figure 5). Of the total 446 thousand hectares, 88% is forestland, 0.6% plantations and 11.7% other wooded land. It is difficult to produce a coherent picture of the forest situation in the case-study area, especially as regards forest ownership structure, because we need to rely on different sources based on different definitions and perspectives (for example, most of the data do not allow to distinguish the forests located in mountain areas from those located in the plain). The data in Figure 4 show that the Province of Belluno alone (which is totally mountainous) accounts for more than half of the whole forest area of the Region. In addition, forest in mountain areas are also located in the Provinces of Verona and Vicenza.

Table 1 reports the distribution of the forest area (excluding the 'other wooded land') referred to the whole Veneto Region (not only mountain) according to type of land ownership. It shows that 67% of the forest land is private, the remaining 33% is public. The private forestland belongs mainly to individuals, but also to the collective properties (labelled as 'other private bodies'), which are the most important landowner in some

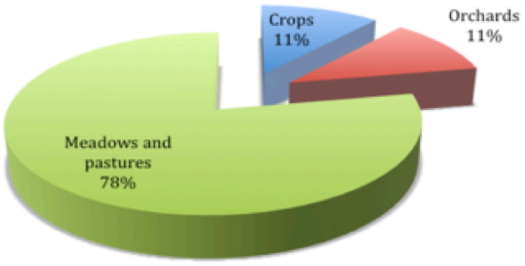


Figure 6: Distribution of UAA (101,800 hectares) in the case-study area

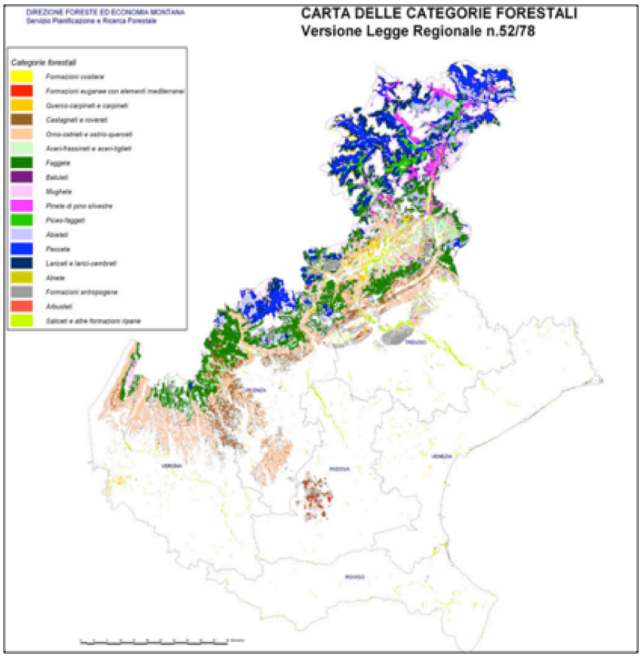


Figure 5: Forests in the Veneto Region

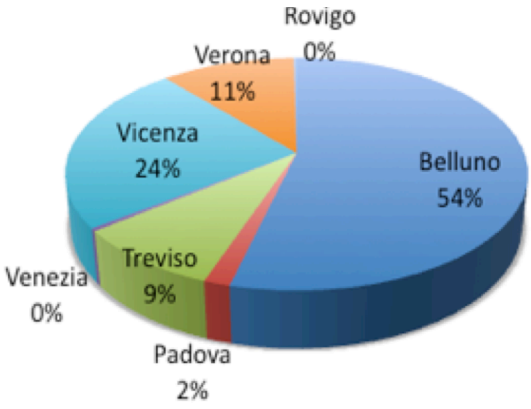


Figure 4: Distribution of forestland amongst Veneto's provinces

3 In Italy, historical data on forest and forest ownership structure are available at least from three different sources: a. the National and Regional forest Statistics produced by ISTAT since the beginning of the XX century; b. the Agricultural Census (always published by ISTAT every 10 years starting from the years '50ies; the last one is of the year 2000) c. the last National Forest Inventory (published in 2009, with data from 2005). Although the system of providing forest data has recently (i.e. with the last National Forest Inventory) gone through a reform process in order to produce coherent data amongst the different sources (especially harmonising the definition of forest area), there are still discrepancies in the data referred to time periods before the reform, so the figures are not always comparable. In any case, the increase in the forest area noted for the Veneto Region is meaningful of the generalised natural expansion of forests in mountain areas due to depopulation and land abandonment linked to decrease of active agriculture.

Alpine valleys. The public forestland belongs mostly to Municipalities, while the State has a much smaller share of public forestland, generally the Nature Reserves and other protected areas.

Table 1: Distribution of Veneto Region forest by ownership type

Private Ownership	**267.590**
Individual forest owners	223.095
Companies	4.078
Other private bodies	31.856
Not determined	8.560
Private Ownership	**129.960**
State	28.577
Municipalities	97.648
Other public bodies	3.735
Not determined	0

Source: National Forest Inventory, 2009

The data reported in Table 2 come from a different source of data, i.e. the Agricultural Census of 2000, the only source where we can find data specific on the forests of the mountain area (ref. footnote 4). These data can be interpreted as the representation of the forest area still managed by the owner and not abandoned. Not considering the area with plantations, that is negligible and not significantly contributing to the production of positive externalities, we can see that, in the case-study area, nearly 14,000 forest holdings have been counted, managing a little less than 158,000 hectares of forestland. However, if we look only at the area with high forests, the number of forest holding decreases sharply to 2,857 on a forest area of a little more than 90,000 hectares. The data do not allow us to say anything about private or public landownership of these forest estates.

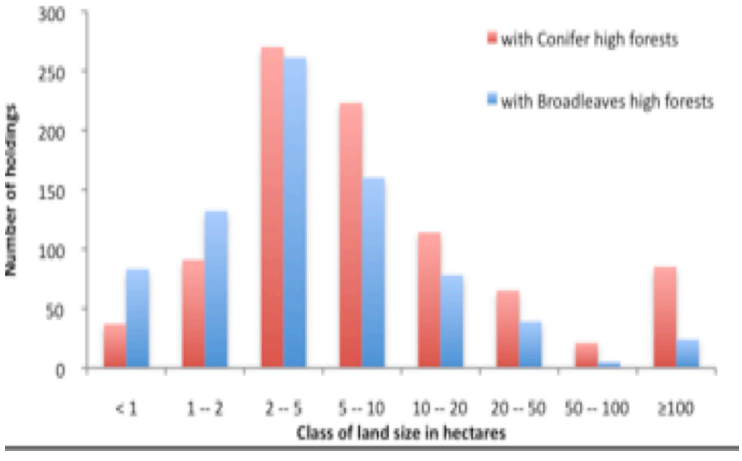
Table 2: Number of forest holdings and their forest area in the case-study area

	Number of forest holdings	**Forest area of forest holdings**
WITH FOREST AREA	13,992	157,756
with high forest	2,857	91,925
with Conifer high forests	906	69,586
with Broadleaves high forests	782	5,325
with mixed high forests	1,453	17,015
with coppices	11,983	65,787
with Mediterranean maquis	12	4.413
WITH PLANTATIONS	141	2.556
for production of Chistmas trees	12	549
for 17nergy production	126	1.737
for industrial destination	3	270

Source: ISTAT, 2012

Finally, Figure 7 shows clearly that the structure of forestland ownership in the case-study area is based on very small-holdings, being most of them in the two class sizes from 2 to 10 hectares. Only 109 holdings own a forest area larger than 100 hectares, respectively 85 with Conifer high forests and 24 with Broadleaves. In the case study area, as elsewhere in Italy, there is a relatively high number of diverse stakeholders dealing with the forest

Figure 7: Distribution of forest holdings in the case-study area by class of land size



sector. Their number and diversification reflect a complex socio-economic and institutional-political context, mainly due to a strong but incomplete decentralisation process occurred since the '60-70ies. On one hand, while in theory several competencies, included forest management, have been transferred from the State to the 21 Administrative Regions and Autonomous Provinces, a real power-devolution is still lacking, while in addition there is a strong attitude of the regional forest authorities to keep under their direct control any forest-related decision-making process (neo-centralism). On the other hand, the political and social willingness to maintain cultural identities al local level seems to be strong too (with for example the so-called Regole, i.e. community-based ancient institutions for forests and pastures management in mountain areas). As a result of the incomplete and complex decentralisation process, competencies on forestry and related sectors – like environment protection, game management, land planning, etc. – have been split and distributed among various public authorities acting at different geographical and political levels (State, Regions, Provinces, Mountain Communities, Municipalities, National Parks, Regional Agencies, etc.), with unavoidable overlapping of competencies and roles and significant risks of potential, latent or real conflicts.

In the case study area, the main role for policymaking, forest law enforcement, forest planning, tree felling authorisation, management of EU funds under Rural Development Programme belongs to the Veneto Region, which is organised in a central technical structure – i.e. the "*Dipartimento Foreste ed Economia Montana*" (Department for Forestry and Mountain Economy) – directly under the Regional Ministry for Agriculture and Forestry and located in the town of Mestre-Venezia – and seven peripherical structures, the Servizi Forestali Regionali (Regional Forest Services), one for each Province. In mountain areas, at a more detailed scale, special associations of mountain Municipalities called Comunità Montane (Mountain Communities Authority - MCA) are instituted by law, providing aggregated technical and extension services in agricultural and forests to public and private forest owners. In the case-study area they are 19, at the moment.

Veneto Agricoltura is the Agency of the Veneto Region dealing with R&D in forest and agriculture and managing directly (with its own personnel) the portion of the public forest estate belonging to the Veneto Region (about 16,000 hectares).

Professional organisations like *Coldiretti*, *CIA* and *Confagricoltura* provide mainly extension services to farmers and forest landowners (however, given the low liveliness of the forest sector, they are more active in agriculture than in forestry).

The most important landowners in the case study area are the community-based institutions called *Regole* and *Comunioni familari* (51 in Veneto, of which 50 in Belluno and 1 in Vicenza province. Forests, pastures and agricultural lands are commonly owned by the ancient residents of the mountain areas; on one hand, they have the private right to use their lands and related resources (e.g. timber, firewood, pasture, etc.), but they share the common duty to maintain or improve their resources for future generations by re-investing in forest management and implementing proper management practices. While few of them are characterised by a long history and strong traditions, being continuously active since centuries (*Regole d'Ampezzo*), most of them have been quite recently restored by law (Veneto Region Law N. 26/1996), having their forestland tenure rights been assumed by local Municipalities in the past. These recently restored Regole might be quite weak in terms of human and economic resources, thus often lacking legal, technical and administrative competencies on forest management (and thus having limited or no capacity of innovation, long-term planning, re-investments, etc.).

A part from the above mentioned community-based ownership, there is a number of private forest owners, who are sometimes associated into consortia or similar organised structures (local associations). Even if only few forest owners associations are active in the case-study area, some of them might be relevant because they are involving more than 100 small or very

small forestland owners and/or both forest owners and forest enterprises specialised in logging or other forest management operations. The most relevant ones are located in Belluno province (*Associazione Monte Grappa and COGEFOR*). All the remaining single private forest owners are high fragmented (3.2 ha/forest as an average), dispersed and often no longer interested in their forestlands (e.g. because the young generations moved to urban areas for employment in sectors other than agriculture and forest and therefore lands have been abandoned).

Chartered Professional Forests are grouped under specific registered associations called *Ordini dei Dottori Agronomi e Forestali*, organised on a provincial base. Those dealing with our case-study area are based in Belluno, Verona and Vicenza.

Issues of sustainable forest management is dealt with by the two main Forest Certification Schemes active in the Region: PEFC and FSC (the latter has its main headquarters in Legnaro, at the Faculty of Agriculture). About 35,000 hectares of forests are PEFC certified at the moment in the case-study area, while none is under the FSC scheme (even if pre-feasibility studies have been carried out to assess the possibility to obtain also the FSC certification in some special forests like *Cansiglio*). The PEFC certified forests are mainly belonging to PEFC Veneto, the regional forest management certification initiative firstly launched and financed by the regional public authority; a number of the community-based institutions called *Regole* are participating into the regional scheme. Finally, the Faculty of Agriculture and its Departments are the main points of reference at regional level for research and teaching in the different forest disciplines.

4. The Legal framework on environmental resources[4]

The legal environmental framework is the principal non-economic tool that the policy makers have set up to answer at the high demand of clean environment: in other words to fulfil the demand of forest and environmental externalities. The national legislative decree 152/2006 has been a national effort to clarify rights and duties of the forest and environmental service users; however several other laws has set up use rights within several other laws, sometimes overlapping or stating opposite definition. Starting with the concept contained in the constitution we will introduce and describe the intricate legislative framework in which the potential roots of the environmental service market.

4.1. Environmental rules and property rights

The legal framework for the four considered externalities, recreation, carbon sequestration, water quality and biodiversity maintenance, is mainly based on three national laws: the Constitution, the first National Forest Act (issued in 1923) and the Nature Conservation Act (issued in 1997).

- The Constitution (Const.), in article 42, regulates in general terms the property right issue. Public or private, the land must ensure "public utilities" allowing everyone access, hence the right to walk or to do other activities linked to public goods. Moreover, article 41 Const. and the third section of the Civil Code (C.C.) limit the effects of the private ownership and other initiatives (profit-oriented or not) in order to ensure the public functions of land resources.
- The National Forest Act (Royal Decree 3267/1923) was approved to enhance the supply of what use to be considered at the beginning of the last century as the most important forest externality: land stability in mountain areas. The Act defines a special regime of protection (without compensation) for 98% of the Italian forest resources, based on strict forest management rules and constraints to the forest owners. Other externalities were not considered in details, however the Act establishes that forest management plans (that are compulsory for public land and voluntary in the private forests), must take into account all the forest products and services (hence also the externalities) for a wide set of stakeholders. Moreover, the forest law sets some measures (rarely implemented) for compensating forest owners in case the prescribed limitations affect their income. More recently the Act has been integrated and improved with the aims to promote biodiversity preservation and market-based mechanisms in forest management (Legislative Decree 227/2001, art. 10-12). Nevertheless, the concrete outcomes of this new regulation have been so far limited.
- Finally the Nature Conservation Act (D.P.R. 357/1997) declared the need to preserve and enhance the biodiversity through specific actions aiming to the conservation of the habitats. Moreover, some measures of the recent Rural Development Programs provide compensations to the landowner for maintaining or improving the supply of ecosystem services.

Altogether these regulations represent the pillars of the legal framework for the forest externalities where the main target is to maintain and preserve the supply of some public goods without or with very limited compensations to the forest managers.

Theoretically, the property rights of land use based externalities belong to the forest owner (art. 820 and 832 C.C.) as outputs associated to farm and forest productions. In general, it

[4] This part has been written as introductory part of the NEWFOREX project by the thesis author and revised by the other co-authors (Deliverable 4.1).

does not matter if the landowner is willing or not to produce externalities, because the property rights extend over the so called "hanging fruits". The externalities may also be sold by the owner (art. 1148 C.C.) or exploited by any stakeholders having the use right (art. 1021 C.C.). Actually, the present property right legislation has been developed with more attention to the agricultural sector, while there are few specific indications about forest externalities, mainly linked to recreational and water regulation services. About the first issue, the Civil Code and specific laws define the property rights of wild fauna and non-timber forest products (NTFPs) use.

Both wild fauna (mammals and birds) and NTFPs are managed by public authorities that set the annual limits to users and the maximum quantity allowed (number of game or kilogram of NTFPs). More specifically, the entire bird and mammal populations are defined as "unavailable State property", while other living organisms are not considered as such (art. 826 C.C.). This decision is linked to the massive presence of hunters in Italy[5], a strong lobby that has been successful in defending their rights to free access to game resources. On the other hand, the problems of competition and congestion of some non-timber forest product harvesting activities, like truffles and wild mushroom picking, lead an unsustainable exploitation in the late 1980s and 1990s. This problem was partially solved with the implementation of new property right regulations (Act 752/1985 and Act 352/1993), where a given picker may purchase the right to collect NTFPs. Nevertheless, in the last decades the efficiency of these systems of property right regulation has decreased due to the high costs of the control system implementation. In the meanwhile, new market-based initiatives have been put into practice (Pettenella and Kloehn 2007), having a great impact on rural areas in terms of revenue generation for forest owners and employment opportunities creation along the local supply chain.

A special case is the water property right regulation system that was set up in the early 30s of last century and then reconsidered in 1994 by the Galli's law[6] (Act 36/1994). According to the law, the water belongs to the State except in one case, when the rain is gathered by the private owner in its estate (art. 909 C.C. and following articles). Anyway, the Galli's law set up an import issue: the indirect compensation to the forest owners through an extra payment by the drinkable water users included in the water bill. Actually, this payment is regulated by regional public authorities that are responsible of transferring the payments to the local mountain authorities. These authorities finance specific forest management activities in order to maintain and enhance the role of mountain forests located in the catchment area in water cycle regulation and land erosion control. Here, indirectly the main beneficiaries are often the forest owners, because the forest investments are normally new infrastructures to reduce the forest management costs. Moreover, Galli's law promotes the water management system driven by public companies (now also private ones after Act 135/2009), within a single or a group of catchment basins. In the Veneto case study, the mechanism has been implemented just at the end of December 2010 through the Regional Act 3483/2010. The first effect is the direct financing (around 1 M€/year) of mountain areas operations to enhance land stability and reduce soil erosion.

Out of these cases, linked with land protection, recreational activities and water supply, all other externalities are not regulated by the law but they could be in theory traded through formal contracts between the forest owner and some economic agent. Examples are the contracts signed within the CARBONMARK project[7] in the Veneto case study area, where the suppliers, mainly municipal forest owners, sell carbon credits to small-medium enterprises.

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[5] In the 1970s the hunters represented 3% of the Italians (i.e. almost 2 million people), while today their number has decreased to 1%.

[6] From the name of the main member of the Parliament who made the initial regulation proposal.

[7] See www.carbonmark.org

As far as the biodiversity protection services are concerned, the high level of standards imposed by the ongoing forest legislation, based on close-to-nature silvicultural criteria, affects indirectly the maintenance of different habitats. Only quite recently, specific regulations have been implemented to define policies to protect some threatened species (DPR 357/1997). Nevertheless, according to the present laws, the biodiversity service holder is again the forest owner, apart from the two already mentioned exceptions (mammals and birds) reported in the Civil Code.

4.2. Institutional Framework

The Parliament or the Government may promote any law, while act proposals might be delivered to the Parliament through a draft law signed by at least fifty thousand people (art 70-71 Const.). However, in the field of environment legislation, the Ministry of Environment and the Regional Governments have been the main promoters since now. In general, the approval of environmental and forest-related laws at national level must be agreed by a State-Regions Coordination Committee. The Committee's main tasks are the examination and/or the modification of the drafts into a final proposal that may become law (art. 72 Const.).
At national level, the environmental laws are generally promoted by the Ministry of the Environment [8] or by the members of the National Environmental Council[9]. Here, technical aspects or new environmental laws are drafted and then delivered by the Minister of Environment to special Commissions (Environmental investment commission-COVIS, Commission for environmental impact evaluation or water commission), according to the competences, that give opinions about how to improve or modify the law. Once the law has been approved by the Parliament, the Regions have to incorporate it into the regional law. At this level, the Regional environmental commission (art. 12 regional Act 33/1985[10]) is assigned by the Regional Government to examine the national law, suggesting specific articles suitable for the local context implementation. Finally, the monitoring is driven by two different entities: Environment Protection Agency (ISPRA) and National Forest Corps (CFS). ISPRA is delegated by the Ministry of Environment to collect information, develop guidelines and report the overall environmental law effects on the natural resources. CFS is on the contrary an effective forest police corps in charge of the law compliance in the field.
The overall forest sector disorganization is affecting its output performance; a good indicator of this problem is the lack private forest owner associations both at national and regional levels[11]; this let the policy makers move freely on norms related to externality property rights. For instance, the implementation of harvesting mushroom law (Act 352/1993) obliges a given picker to purchase the harvesting right (harvesting license) paying a government tax on the use of a private good such as wild mushrooms (WM). The revenue goes directly to the regional bank account without giving part of the income to the forest owners whether not expressively requested. Other cases are referred to water use. As already mentioned upwards, water belong to the State, even though the Regions have the right to manage any water resources. Nevertheless, the private forest owner is only partially compensated in case the spring is used for drinkable water. The regional government gives him/her a certain amount of money ac-

[8] http://www.minambiente.it - main web page of the Ministry of the Environment.
[9] The National Environmental Council is renewed every three years directly by the Environment Minister, and it gathers national environmental authorities, 10 regional, provincial and municipal delegates, 15 environmental NGOs, 1 national R&D delegate (CNR), 1 delegate of renewable energy agency (ENEA) and 1 delegate of the national energy company (ENEL) (http://www.minambiente.it).
[10] http://www.consiglioveneto.it/crvportal/leggi/1985/85lr0033.html .
[11] Italy is the only country in the EU without a representative of private forest owners within the Confederation of European Forest Owners (CEPF).

cording the surface covered by infrastructures (pump, water pipe, etc.), but in any case the compensation does not cover the loss of the potential water use. Moreover, the high cost of monitoring and the general lack of competences of local administrations increase the fraudulent behaviour of the stakeholders, leading sometimes right-right fights between the holder of local customary rights and the Regional administration.
Finally, the issue of the effects of customary rights on forest externality provision can be briefly considered. Customary rights, i.e. the free or partially free use rights to common goods by local dwellers, regard mainly the exploitation of some forest products like forage (grazing in the forests), fuelwood, NTFPs. Basically, these customary rights are in contrast with the implementation of MBI due to the fact the right holders reduce the quantity and in some cases also the quality of a given forest externality. An example is the free harvest of NTFPs by the local mountain inhabitants, which affects the quantity of products available for the recreationalists that are willing to pay for NTFPs picking permits. Similarly the use of large amounts of water for irrigating mountain field affects the downstream water availability and also quality (for the high concentration of phosphate and nitrogen).

4.3. Main actors involved in the ES market: forest owners and beneficiaries.

The suppliers. The mountain case study involves a wide group of forest owners. Nearly half of the 414,894 hectares of forest in Veneto region (22.5% of the total surface) are privately owned (single property, collective property, church property, NGOs, etc.) while the remaining parts is public (municipal, regional, State owned and other public and semi-public institutions), as already reported in the previous chapter.
Most of the private forests are fragmented and under a process of abandonment due to their low profitability, especially in the southern mountain part of the region. Only in collective properties, so called "Regole" (with management units ranging from some hundreds to few thousands hectares), the forest owners have been able to maintain an active use of forest resources, however forestland controlled by the Regole's is quite limited.
Public properties, covering the 64% of the total regional forest surface (Dissegna and Carraro 2007), have been more supported by public subsidies and, with some exceptions, are more active in forest management, infrastructure development, and industrial wood harvesting.
Only a couple of publications have examined in details the forest ownership issue in the case study area (Preto 1985; Canton and Pettenella 2010), and still the main information source remain the national statistical institute (ISTAT 2007). Preto's study investigated the change on forest owner work status from agriculture (once the 48% of the forest owners) to non-agricultural (51,6%). Recently, Canton and Pettenella (2010) describe for the first time in Veneto region the private forest owners' managerial motivations through a case study in the municipality of Recoaro Terme, in the southern part of the Veneto's Alps. The paper shows that the forests are more important for their intangible values and firewood self-consumption than for timber selling or other financial benefits. The forest owners have been grouped in three owner types having different motivations: 1) Intangible Values, 2) Multi-objective owners, 3) Un-interested owners (see Table 3).

Table 3. Forest owner characteristics.

Variable	Sub-variable	Indicator	1-Intangible	2-Multi-objective	3-Un-interest
Demography	Distance house-forest	mean	18.5	2.7	6.9
	Age	mean	57.4	50.5	64.5
	Sons & daughters	mean	2.1	1.1	1.9

	Employed	%	47.1	71.4	20
	Forest summer cottage	%	50	26.7	0
Land use	Wood production	%	72.2	100	60
	Forest road maintenance	%	61.1	93.3	30
	Reforestation	%	11.1	40	0
	Investments	%	22.2	60	0
Main aims	Forest road improvement	%	52.9	80	22.2
	Income	%	16.7	53.3	10
Neighbour collaboration	Good neighbour collaboration	%	88.9	80	44.4
Information	Regional forest service	%	38.9	80	20
	Mountain community authority	%	33.3	73.3	10
	Knowledge about forest bureaucracy	%	94.4	100	66.7

(Source: Canton and Pettenella 2010). Note: All percentages are calculated within the forest owner group.

The incentives to the forest owner are mainly driven by the forest measures of the Rural Development Program (RDP) of the Region (Pettenella and Maso 2009) even though the national and regional forest acts prescribed a large set of specific actions (like those to promote forest associations that are as a matter of fact not supported by any public incentive nowadays). The main sources of incentives aimed to externalities provision are the first and second RDP axis where a set of specific measures have been implemented, such as incentives for:

- specific maintenance operations like grass keeping in the abandoned meadows (in order to contrast the process of forest expansion on abandoned grassland)
- forest selective cuttings;
- non-productive operations for promoting MBM for carbon sequestration and biodiversity conservation.

Nonetheless, the lack of awareness and the fragmentation of the small private forest surface do not allow the access to the funds. Since now, less than 10M€ of the RDP funds have been spent on forest measures shared among 300 beneficiaries (~30,000€ per demand on average).

The beneficiaries. Three out of four externalities have the national public as potential beneficiary, and only water has a lower scale dimension (maximum at the level of hydrographical basin). CO_2 sink and biodiversity protection services can even be considered services with an international scale dimension, while recreation has manly a regional scale with a wide range of groups and local associations; these consumers however can be the most accessible target to improve the awareness on other forest externalities. At the present situation the paying beneficiaries are the only ones mentioned in the analysis of the national or regional regulations previously reported.

4.4. Towards the market based mechanisms: the historical pattern at national level

The Mountain region, more than other rural areas, has been affected by a massive contraction of employment ratio as well as a general decrement of annual dwellers. Consequently, the exodus raised a huge debate due to the land abandonment, main cause of hydraulic instability and forest disfunctionalities. Hence, local and regional public managers pushed the national government to legislate over particular issue like drinkable water supply, property right enforcement on NTFP use, and biodiversity maintenance, or roughly speaking, how manage the main forest externalities. Following the time order, the first market-based mechanism implemented was linked with the wild mushroom (WM) and truffle harvest. The welfare condition of the late 1980s led people to spend a part of their free time on forest recreational activities (mostly in mountain areas) that rapidly moved to a generic congestion over specific common goods becoming scarce. Here, "right-right" conflicts between producer and consumer[12] was solved implementing a specific law setting in both sides rights and duties linking one each other with a payment mechanism. The forest owner was allowed to sell the right to collect WM as compensation of the property right loss. On the other hand, the "given picker" had to respect a certain behaviour reported firstly in the National Act 752/1985. After almost three decades, the overall MBM output shows different performances, positive and negative, and in any case highlighting the general problem of the people fraudulent behaviour that difficultly reach the law compliance if no control exists. However, the top-down approach imposes local administration to spend time and resources, while WM were not the target issue for their forests. Lack of interest led consequently lower investments on WM issue, hence a general fraudulent behaviour of WM picker, like illegal harvest, that result on a lower income for the forest owners. Here, the difference between good and bad performance was linked singularly to human capital or in other words, to the effort the local forest owners and managers put on WM picking organization. While the WM law implementation had a jeopardized good performance, the local adoption of the WM law framework allows to build a more efficient MBM based on "actual people behaviour".

Another MBM enforced in the Mountain region was promoted by the Galli's Act 13/1994 and its implementation at regional level. Basically a top-down approach promoted by the central government, it was thought following the idea that the Mountain areas are "somehow" the source of water for the lower zones in plain area, hence worth to be protected. Due to the high operational costs of the companies operating within the mountain agro-silvo-pastoral system, principal mountain stability providers, a certain percentage of the user water tax[13] must be paid to the supplier identified on the Mountain Community Authority (MCA). Thereafter, the fund has been used to target specific agro-silvo-operations carried out by local entrepreneurs, considered the only one being able to enhance the stability and the maintenance of slope areas. Nevertheless, limitations of the MBM do exist and they are mainly related at least to two issue: first the lack scientific evidence of cause-effect of the agro-silvo-operations and stability increment, second the incapability of the MCA to decrease the land abandonment. Anyhow, the law implementation since now is limited to the Piedmont Region, while the law ratification has not occurred on the other regions yet. Thus, the lack of available data, the presence of a singular regional case on this issue and the long term orientation of the agro-silvo-operations do not allow to understand in practice the overall output of the mechanism, hence gather general achievable rules. In Italy, as well in the case study area, several soft ES market based mechanism has been introduced in the last three decades, briefly summarized in the follow paragraph.

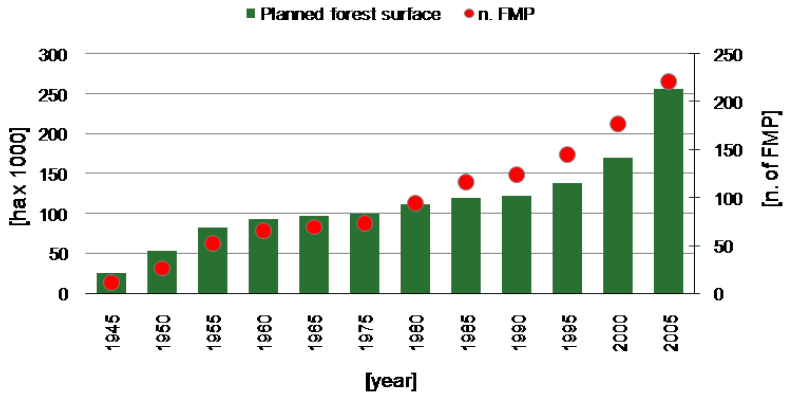
[12] Producer and consumer are considered the forest owners and NTFP pickers especially WM ones.

[13] Piedmont Regional Law 13/97 set a percentage of 5% of the water tax.

- **Taxes, charges, performance bonds.** The general taxation on forest outcomes is based on the actual VAT law, which does not prescribe any particular form of compensation for operation impacts. Nonetheless, specific taxes for the resource use impact are set in different national and regional acts. For instance, the 3% of the water tariff are used to compensate directly or indirectly the forest owners. Moreover, the Regional Water Protection Plan[14] shows a possible tariff increment within the next five years due to the enhancement of water environmental standards in addition to the infrastructure and financial investments (Regione Veneto 2009a, see p. 186). In practice, the actual cost per cubic meter, waving from 0.92 to 2.67 €/m^3, will be increased up to the range 1.63-4.16 €/m^3 (lower and upper tariff of drinkable water, 0.49€/m^3 for industrial purposes) in the 2016. Here, the policy-maker targets clearly to the general reduction of the water use, an extremely valuable resource that at the present account for 443M€. In addition, to the drinkable water, agricultural use is surely the sector that demands the higher quantity of water, around the 50% of the total supply. Altogether, the marketed water economical value in Veneto region is estimated to 1567M€, when just a 1.1M€ are used to compensate indirectly the forest owner in mountains area. Another taxation implemented at regional scale in Veneto, is the duty paid by the wild mushroom and truffle pickers in order to purchase the license[15] to harvest from the regional government. Nevertheless, in some cases the revenue from this taxation exceeds the income of the forest owner generated by the wild mushroom harvest permits[16].
- **Subsidies and grants**
    - **Subsides for Sustainable Forest Management.** The Veneto region forest law (art. 23, L.R. 52/1978) prescribes the SFM in all the forest areas, even though it allows a certain degree of freedom to the private forest owners. In general, the 75% of the forest management plan (FMP) costs are paid by the region while the remaining parts by the local municipality, even if the forests are private. Today, the forest surface under a FMP has reached the 61,8% (Dissegna and Carraro 2007) of the total forested areas (see Figure 8).

[14] The Water Protection Plan in Veneto region has been implemented in 2009 according to the art. 121 of the environmental act 152/2006.
link:http://www.regione.veneto.it/Ambiente+e+Territorio/Ambiente/Acqua+e+difesa+del+suolo/Acqua/Ciclo-Acqua/Pianificazione+Regionale/Piano+di+Tutele+delle+Acque.htm
[15] The Wild Mushroom harvesting license costs 29.24€ every five years.
[16] Local permits have variable costs according to the harvesting area and length of the permit itself. The daily harvesting permit cost between 6.50 and 10€, while the annual one wave between 32 and 77€.

Figure 8. Forest under management plan.



Source: Dissegna and Carraro (2007). Note: green bars represents the forest surface under forest management plan; grey dots the number of forest management plans.

- **Subsidies for regional parks and reserves.** The regional government promotes the regional parks and natural reserve in order to protect and enhance the environment and cultural patrimony. Being on the interest of all the regional citizens, Veneto region provides subsides to cover the administrative cost as well as the promotion of nature conservation (L.R. 40/1984). Moreover, wherever it is possible, the park authority should stimulate market mechanisms to increase the financial sustainability.
- **Subsidies for Natura 2000 areas.** The regional government through the art. 38 Reg. CE 1698/05 and art. 38, 46 Reg CE 74/09 of has built specific measures (mainly Veneto PSR-2007-2013 measure 213) to compensate farmers operating within the Natura 2000 areas. Nevertheless, direct effect on the potential 132,500 ha affected by the measure 213, only a small part have been affected (7% of Natura 2000 farming area), while the forest measures (216, 221, 225, 226, 227) had a direct impact on the 44% (Regione Veneto 2009b).
- **Subsidies for forest consortiums.** The regional law 52/1978 points out the need to rebuild the structure of private forest management, stepping from the self-management to a more coordinated plan that help the cutting organization among the multitude of private forest owner. The target issue of this law was the increment of forest output performance, in terms of wood production as well as enhancement of forest externalities.

- **Tradable permits.** According to the national inventory report (ISPRA 2010, p. 258) all the land surfaces (grazing land, forest) are under a certain management system, hence also the carbon stocked in the abandon areas can be accounted in the national carbon inventory. This definition allows the Italian government to consider 10.2 Mt CO_2, corresponding to the 17.6% of the actual national target (the reduction of the 6.5% from the 1990 CO_2 level equal to 485.7 Mt CO_2). Nevertheless, the law 120/2002 does not consider any direct compensation to the forest owner that could be estimated to 51M€ considering a low price of 5€/t CO_2 (Pettenella and Ciccalese 2010).
- **Offset schemes.** The national law 157/92 sets the State property right over wild mammals and birds moving on the Italian surface. According to the civil code (art. 2043 and 2052) and the art. 8, paragraph "f" of the law 157/92, the owner, in this case the State, is also the responsible and guarantor of the animal's actions and the effect the animals have on other things. Even more specific, it is the decision of the Cassation

Court (n. 8953, 2008/April/7th) that impose the national government, through the regions, the direct compensation of all the wild animal damages, regardless the species.

- **Mitigation banking**. No implementation of such measures at the moment. The Lombardy Region is planning to introduce this measure for compensating some new large infrastructure development works.
- **Market creation and contractual arrangements**. Private-Public contracts have been signed recently within the CARBONMARK project. The aim of the contract was the direct compensation to the public forest owner because supplier of a certain amount of CO_2. The forest owner allows to store more carbon increasing the forest stock. At this level, it may sell or self-use the carbon credits. Now the total number of formal contracts is 20, with the prospect of increasing the number in the next years. Out of this issue, the example of another market creation is surely the adventure parks. Still quite limited in terms of site number (6 recorded sites) and managed surface, they are located mainly next to the urban infrastructure in mountain areas. Much more complex, it is the Wild Mushroom harvest market scheme (L 352/1993 and LR 23/1996). Basically, it is divided by land tenure right (public or private) and type of picker (forest owner or real-right holder, pickers living in mountain areas and living in plain). Except for the local dwellers and private forest owners, all the others have to purchase the right to pick (picking badge-license purchase) and then compensate the mountain forest owner through a direct payment of a picking permit to the local forest management authority, which generally are represented by the Mountain Community or the Municipality Authorities (see paper "*Comparing Profitability and Governance for Recreational Wild Mushroom (WM) Picking in Forest and Timber Production*" below**).** Though the policy maker built formally a PES scheme, which prescribe the revenue reinvestment of 70% of WM permit selling, in reality it was not fully implemented; only a small part of the revenues have been reinvest while a consistent part used for other purposes also out of the forest sector. In this context, the present scheme assume much more a market form due to the lack of target investment on WM resources that should occur in a PES scheme.
- **Auctions.** At the moment, there are no experiences related to auctions or conservation tenders. There is evidence that the payment for the so-called agro-environmental measures of the RDP should be improved through more effective systems of financial support to privates operators, like auctions.
- **Eco-labelling, certification**. The main two certification schemes in the case study area are FSC and PEFC. Nevertheless, due to a regional agreement with the Veneto region only the second certification scheme have been promoted and implemented at forest level. In concrete, the forest certification scheme has not improved the previous forest management method. Even so, the actual forest under PEFC certification scheme in Veneto region amount to the 60,000 hectares (1.67% of the total forest surface). Another certification scheme has also been promoted in the Asiago plateau within a territorial marketing scheme. Among the certified products, wild mushrooms are considered main culinary forest product outputs, so a tangible rural development tool for the area. However, none of the process has been put in practice.
- **Payments for environmental services – schemes.** Water management is only payment for environmental services fully implemented in Veneto region. Water management is a simple circle where the water supplier, formed by the members of the local public authorities and province delegates, sell the water to the households and the revenue is then split in different part according to the investment need (LR 5/1998). Just recently, the 3% of the water tariff income is used for compensate the mountain

forest owners through public investment led by the Mountain Community Authority (DGR 3483/2010).

- **Eco-sponsoring, donations.** The national act 113/1992 prescribes the compulsory tree planting per each new Italian child. The municipalities must organize the tree feast day every year for promoting among the new generation a higher environmental awareness.

5. Forest externalities evaluation: a step toward the environmental service market

The attention on the Alps has generated a good amount of literature, both grey literature, reports and communication magazine, in which Alpine values has been targeted several time, especially biodiversity and landscapes. In parallel, scientific literature in the field of environmental economics has developed too, with papers assessing the role of the main externalities in Alpine mountains and forests. Given the wide variety of alpine ecosystem, these studies are mostly focused on assessing the Total Economic Value of Alpine ecosystems rather then the value of single externalities. When this is the case and one sole externality is the target of the study, this is usually landscape or recreation, while the number of works focused solely on carbon sequestration, biodiversity or watershed protection is rather limited.
The choice to assess a bundle of values rather than single externalities implies also that a multiplicity of different economic methods can be used together, and this makes sometimes the distinction between 'stated' and 'revealed' preferences methods rather difficult and not always completely coherent. In the rest of this chapter we will present first those papers using stated preferences, then those ascribable revealed preferences and, finally, those using a combination of different methods, benefit transfer or meta-studies, aimed mainly at determining Total Economic Values rather then single values.
The scale of the studies changes from local to regional, but none of the studies found takes into consideration the Alpine region in its entirety. In terms of methodology, the approaches are rather homogeneous, but, seen the case-specificity of the studies, cross comparisons of values is most of the time very difficult.

5.1. Stated preference method.

An interesting outcome of the ALPSCAPE project is a paper produced by (Grêt-Regamey et al. 2008), which presents a list of case-studies of environmental valuation of landscape, biodiversity, recreation and avalanche protection values in the Alps using stated preferences (see Table 4).

Table 4: Stated preference case-studies in the Alps

Study	Ecosystem service (ES)	Method	Location
(Baumgart 2005)	Scenic beauty	Discrete Choice Experiment	Bernese Oberland (Switzerland)
(Grêt-Regamey et al. 2007)	Scenic beauty	Contingent valuation	Davos (Switzerland)
(Jäggin 1999)	Biodiversity	Contingent valuation	Jura (Switzerland)
(Getzner 2000)	Biodiversity	Contingent valuation	Hohe Tauern National Park (AU)
(Hackl and Pruckner 1997)	Recreation	Contingent valuation	Kalkalpen National Park (Austria)
(Gios et al. 2006)	Recreation	Contingent valuation	Campogrosso (Italy)
(Tempesta and Thiene 2004)	Landscape	Discreto Choice Experiment	Corina's Alps (Italy)
(Thiene and Scarpa 2008)	Recreation	Discreto Choice Experiment	Veneto's Alps (Italy)
(Löwenstein 1995)	Avalanche protection	Contingent valuation	Hinterstein/Allgäu (Germany)

Source: (Grêt-Regamey et al. 2008) modif.

The authors stress the fact that there is a considerable variability among the values derived from the different studies, even when they deal with similar environmental services and ob-

serve that, with the existing knowledge, it is very difficult to determine whether 'these differences could be explained by different preferences among people or whether they are due to the methods and the data underlying these methods'.
They also discuss the feasibility of an overall estimation of all the externalities produced by the mountain system and stress the need for an interdisciplinary approach, underlining that stakeholder's preferences are unpredictable in the long run.
Using Contingent Valuation, Tempesta and Marangon (2005) have assessed the Total Economic value of Italian forest landscapes by asking to respondent whether they were willing to abrogate a law for forest fires prevention thus reducing the tax load. The results estimated a TEV of 722.6 €/ha, with a non-use value component of 665 €/ha. The authors compared their result with that of other papers showing differences with values obtained in neighbouring regions, e.g. Goio et al. (2008) for Trentino Alto Adige and Marangon and Gottardo (2001) for Friuli Venezia Giulia, who both estimated in 3-400 €/ha the fraction of Non-use value for Italian forests.

5.2. Revealed preference method

Specific works using revealed preference methods are quite scarce in the last decades. Tangerini and Soguel (2004)estimated the whole landscape value in the Swiss Alps (Valais) using the hedonic pricing method adjusted with the MACBETH approach Bana et al. (1998). They found that the landscape variable affects considerably the final price of real estate properties. The results of the study highlight that positive changes in landscape are appreciated both by locals as well as tourists, while the presence of tourist infrastructures decreases the house value for the dwellers.

5.3. Studies based on a combination of methods

Croitoru (2007) assessed the value of all Mediterranean forests including the southern part of the Alpine region. The authors took into consideration the four classical externalities – recreation, biodiversity, water and carbon – and related them to TEV components: recreation to 'direct use values', carbon sequestration and watershed protection to 'indirect use values' and biodiversity to 'non-use values'. These works have provided the estimates of the different components of Italian forests TEV reported in Table 3 below.

Table 5: Average estimates of Italian forest values (annual flows)

Average value	Watershed protection	Wood	Net Increment	NWFPs	Hunting, recreation	Grazing	Carbon sequestration	Negative externalities	TEV
€/ha	154	50	37	23	28	7	7	-59	249

Source: (Croitoru 2007)

Recreation was estimated at large scale deriving consumer surplus from application of both Contingent Valuation and Travel Cost. Where no estimates were available, 'actual payments' (permit prices, costs of travel) were used. The author stresses the lack of a common methodology as a significant limitation for comparing the different results available in literature. Goio et al. (2008) also assessed recreational values focusing mainly in the activities linked to extractive opportunities in forests, like the game values (trophies), game experiences (price paid for hunting trips) and mushroom picking activities (value of the harvest of amateur mushroom pickers). The underpinning idea was the evaluation of the potential revenues accruing to forest owners, excluding non-use and option values.

The 'avoided damage costs' approach was used in many countries to evaluate the watershed protection value. Croitoru (2007) showed that different paths could be followed from the operational side, like the avoided loss of productivity in nearby agricultural areas, the avoided costs of building and operating hydraulic works, the water storage capacity. Nevertheless, the author emphasises that estimating the value of watershed protection is quite problematic due to the difficulty of establishing clear cause-and-effect relationships between forests and downstream water services. The potential restoration cost approach is used in limited cases like high soil erosion, floods and landslides. The lack of data availability in many cases reduces the implementation of any approach so that sometimes the costs of purifying contaminated water or of dredging accumulated silt is used instead. Notaro (2001) used a mixed approach for assessing watershed protection, assuming that the value of water in rivers is linked with the level of fishable water fauna and the value of fishermen's surplus. A similar methodology was used by Battazzi and Viaggi (2001)for assessing the recreational value of game hunting. Carbon sequestration is the forest externality whose physical quantification is probably the most straightforward. The total forest increment net of forest felling gives the quantity of carbon dioxide stocked in the forest. The price is established with reference to the international market price of CO_2 credits. Nowadays the availability of many scientific data on carbon sequestration in soil and roots has increased the reliability of the assessment of carbon sequestration, even if this has so far still limited implementation in the present carbon accountability (Pilli and Anfodillo 2008). The value of biodiversity has been investigated by Jäggin (1999) in the Swiss Jura and by Getzner (2000) in the "*Hohe Tauern National Park*" in Austria.
A detailed analytical work for the southern part of the Alps was led by Goio et al. (2008) who have assessed the Total Economic Value of the forests in the Province of Trento, i.e. 345 thousands hectares of mountain areas. The paper is a meta-study conveying, for specific externalities, the results of other studies, thus facing the challenge of comparing values estimated using different methods. This is, to a certain extent a shortcoming, therefore the study provides an order of magnitude of the economic importance of forest ecosystem in mountain regions rather than the exact quantification of the total economic value of the study area. The methodologies utilised, mostly based on market approaches or revealed preference methods, are reported in Table 6, where the assessment methodologies used by Goio et al. (2008) for three types of externalities are reported. The authors consider two type of recreational use of the forest: the extractive use relates to the consumptive activities like non-timber forest product harvest and game hunting, while the non-extractive use concerns non-consumptive uses like scenic view, existence value and option values.

Table 6: Externalities assessment: methodologies and indicators

Externality	**Assessment methodology**
Carbon sequestration	Value of increment stock left in the forest (La Notte and Paletto 2002)
Watershed protection	Planting and maintaining costs of meadows in efficient condition (Marangon and Gottardo 2001)
Recreation	
Extractive	Price based method (license payment for recreational mushroom picking and game)
Non-extractive	Added value experience to be in the forest within an extractive recreation

Source: Goio et al. (2008)

Recently, a new approach to recreational assessment has been developed combining travel cost method and choice modelling (Scarpa and Thiene 2005, Scarpa et al. 2007, Thiene and

Scarpa 2008). This combined method, based on stakeholders' stratification in homogeneous groups, allows the understanding of the factors influencing personal choices, therefore providing support to policy decisions. A further progress was the direct estimation of WTP, avoiding the estimation of the distribution of the utility coefficients and then deriving the WTP distribution (Scarpa et al. 2008, Thiene and Scarpa 2008, Scarpa et al. 2010).

5.4. Lessons learned from valuation studies

Lange (2004) has provided a good synthesis of the methodologies applied (see Table 7), which is valid also in the Alpine Region.

Table 7: Externalities and assessing approach/methodologies

Forest product	Valuation approach/methodology
Non-wood forest goods	Local market prices of same product
	Price of close substitute product
	Production cost
Forest services	
Recreation and tourism	Travel cost
	Hedonic price of land
	Contingent valuation method, 33nergy33nt analysis
Forest environmental protection services	
Carbon storage	Carbon tax
	Carbon emission permit trading price
	Global damage from climate change averted
Biodiversity and habitat preservation	Contingent valuation method, 33nergy33nt analysis
Protective services for water, soil, etc.	Damage cost (e.g. reduced productivity in non-forestry sectors)
	Damage prevention costs
	Contingent valuation method, 33nergy33nt analysis

Source: (Lange 2004)

As already underlined, a sharp distinction between stated and revealed preference methodologies is not possible throughout the literature. Regional or national studies have applied both approaches at the same time for two decades, while only recently a combination of methodologies has occurred, when the focus of the researchers has moved towards understanding stakeholders' behaviour as one root-component of environmental services demand. The externalities have been estimated through comparing a set of alternatives where people choose the best alternative solution. Choice Experiment methodologies have been developed in order to find a tool able to overcome the limits of Contingent Evaluation.

The literature review has also highlighted that there is a high variability in the focus of the studies, i.e. in the type of the externality estimated (some studies estimate TEVs, the most part estimate recreation and landscape, very few estimate water), in the scale of the site under study, and in the values obtained.

6. Paper 1: Environmental Services under Climate Change: Better Income from Forests?

Chapter IX

ENVIRONMENTAL SERVICES UNDER CLIMATE CHANGE: BETTER INCOME FROM FORESTS?

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Abstract

Climate change is affecting the forest sector as whole. While forests are increasingly looked to their climate mitigation capacity, forest managers are seeking financial means to stimulate the adaptation of forests to climate change. Among the market-based instruments, payment for environmental services (PES) is likely to play a major role in sustaining new business opportunities in the forest sector. The chapter describes the principle of PES and provides its historical background, addressing the question "how is a PES developed?". To provide a comprehensible answer, there will be a focus on PES scheme implementation, looking at beneficiaries, providers and transaction models with particular attention to the PES reference scale considering some successful cases in the Mediterranean basin.

1. Introduction

The economy of environmental services is a relatively new issue in the forest sector. In this chapter, we will focus on the rising economic role of services generated in the Mediterranean forestland, paying specific attention to the market based mechanism as instrument to reduce the gap between environmental service (ES) supplier and direct or indirect users. Due to the high specificity of environmental service we will consider only a few successful case studies, in which payment for environmental services (PES) has been promoted as a market tool to enhance ES provision.

Mediterranean forests have recently undergone a slow process of environmental and social changes. The lack of revenues in rural areas has played a major role in the forest sector up to

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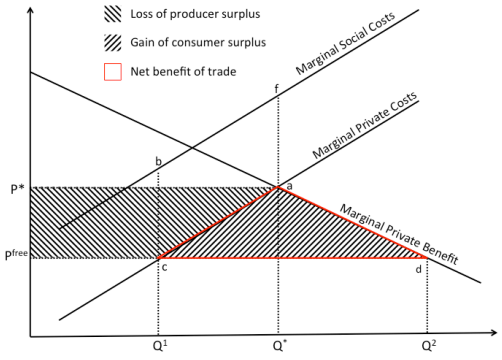
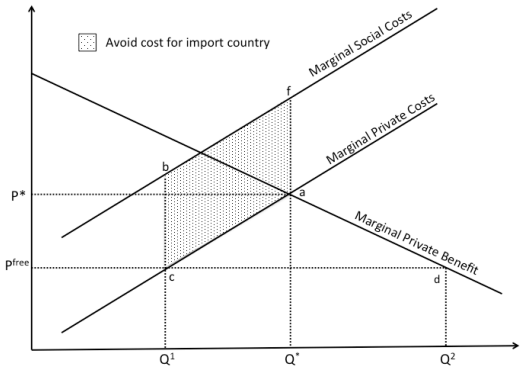
now [3]; moreover, in the last few decades the high variability of meteorological events in terms of distribution and intensity has been a new challenge for the forest managers [4-6]. Soil erosion, loss of soil fertility, pest outbreaks, increased frequency of flash-floods and long summer dry periods have provided evidence of direct or indirect effects of climate change in the Mediterranean basin [7-9]. These effects are better known as negative environmental externalities as they represent an additional cost for society. However, the forest sector may also offer several positive externalities, often the targets of new forest management practices, which enhance the benefits for a multitude of stakeholders. Some examples are carbon sequestration, biodiversity conservation, water quality enhancement and the promotion of recreation in forests; all well known ES that might be stimulated by specific forest management changes. In general an externality is an economic loss or gain by a party, generated by the activity of another party that supports all the cost, and in this situation the loser is not compensated, leading to a market failure. Some intensive forest management practices, such as large clear-cuts, can produce negative effects such as soil erosion that influence, directly or indirectly, several forest users who are not compensated for the damage they suffer, or on the other hand the massive use of fossil fuel by society has increased the frequency of forest damage generally borne by the forest owner. Therefore the most common solution adopted has been the implementation of legal constraints on the use of natural resources or more recently the introduction of environmental taxation on different scales to cover the costs of damage, protection and lack of provision of some ES in order to rebalance the relationship between the economic system and the environment.

Box 1: Theoretical effect of international trade.

Graph A



Graph B



Free trade plays an important role in environmental services provision. Considering the theory of comparative advantage, both parties involved in trade improve their condition by specializing in goods and services. However, the externalities are usually left aside in free trade. A timber producer in a closed market has a marginal private cost that is equal to the customer's marginal private benefit (see graph A); hence Q^* will be supplied on the market at price P^*.

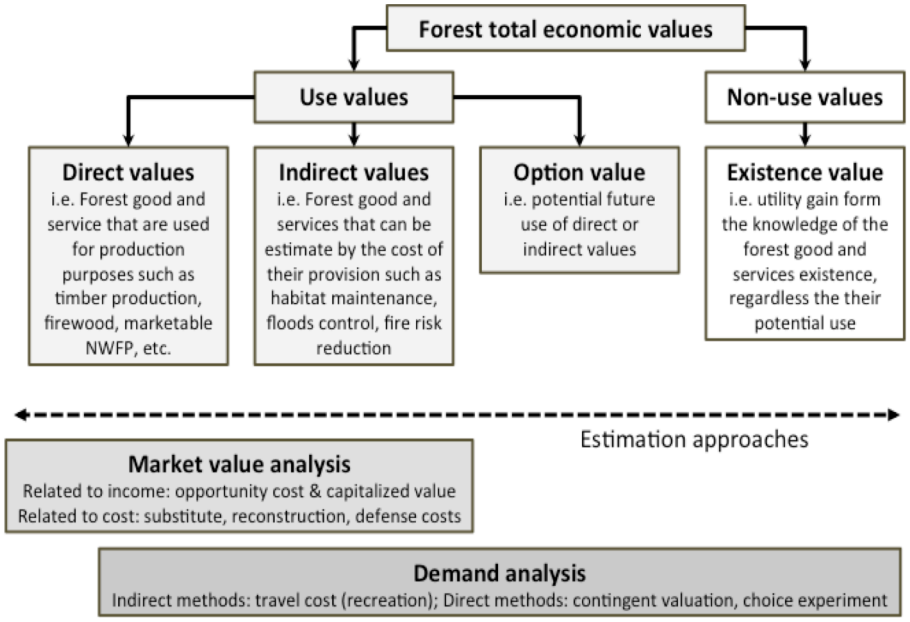
The effect of a free market lets the price decrease to P^{free}, hence the local producer can supply only Q1 while the consumer will push traders to import the remaining quantity (Q^2-Q^1). In the new market condition, the supplier will lose part of his surplus, equal to the area $P*acP^{free}$, while consumers will gain a surplus equal to $P*adP^{free}$. The overall net benefit of the market is given by the difference between supplier and consumer surplus within the new conditions (*adc*). However, considering the externalities involved in the trade (see graph B), scenarios may differ. In fact, the marginal social cost includes private and externality costs of timber production; so when timber production generates negative externalities, a given importing country will gain the area *afbc* as avoided costs for society. Examples are avoiding soil erosion, biodiversity maintenance or water quality enhancement. Basically, all these costs are transferred to the exporter's timber costs. Nevertheless the theoretical background might deeply differ from the reality; for instance the exporter rarely considers the externality cost in the timber price due to unclear property rights or high level of information asymmetry.

In a hypothetical market, where the ES property rights are ensured and there are monetary transactions between ES beneficiaries and suppliers, and there is no free-riding behavior, the optimum level of forest goods and services, or more generally ES, might be achieved. Through taxation, governments and public institutions have tried to move towards the internalization of ES, especially on negative externalities, in order to mitigate the effects on society. International trade also affects ES provision, almost like a specific forest policy (see box1). In the forest sector, some authors [10] have suggested the institution of an environmental taxation to cover the cost of ES provision, but it has rarely been put into force due to its constraint on timber production. Another example of taxation-based mechanism in northern Mediterranean countries is the common agriculture policy (CAP) paid for by the general taxation on European citizens. CAP has slowly introduced the compensation principle of habitat and biodiversity protection as well as water quality enhancement, based usually on the cost of land management change or cost provision. Several benefits have been provided but the cost of organizing the fund has been relatively high, losing efficiency in terms of social expenditure. While policy makers look at the ES supply side, scholars have started to collect information on the demand side [11-15]. Due to the general welfare increment and high economic growth people have abandoned many rural areas since the 1970s, especially in the northern part of the Mediterranean region. Hence, the demand for alternative forest products has been stimulated, with several problems linked to organization of the forest externality provision, compensation for the ES supplier (small or nil) and the lack or absence of date reporting. The description of these new behaviors based on people's utility has underlined the increasing perceived scarcity of forest externalities such as recreation ~~in forest~~, carbon sequestration, soil protection and water quality maintenance: potential new markets for the forest sector that need to be evaluated on both sides.

2. ES estimation: basic concepts to organize ES provision.

ES prices are usually left out of the official statistics, except for some cases related to recreational activities in the forest (i.e. entrance fee for nature reserves, recreational wild mushroom picking permit, etc.), water related services or CAP measures within the local rural development plans (RDP) (i.e. subsidies per hectare, performance based payment, etc.). According to

Figure 1: Forest value types and estimation approaches



the type of forest good or service and its use, different valuation methods are applied (see figure 1), both related to the market and supply side as well as to the demand. Based on prices available on the market, ES values have been estimated through simple evaluation approaches. In practical cases, such as the case studies presented in this chapter, the most common approach used by policy makers to set up economic instruments for ES is the estimation of the minimum costs the landowner has to bear to supply ES, or in other words the sum of the physical work, management and transaction costs. Sometimes, the approach is integrated with or compared to the present and future opportunity cost the landowner has on his land, capitalized with a low interest rate. Instead of the traditional market analysis, the expansion of environmental monetary evaluation techniques allowed scholars to develop methodologies to assess the ES value on the demand side [16] and these are grouped in two categories: indirect and direct methods. The former include the hedonic price [17] or travel cost method [18] to assess the value of the environment based respectively on the cost of surrounding houses and

the value of a given area according to the frequency of tourist visits. Where no information is available, direct methods have been applied, such as contingent valuation [18] or choice experiment [19] methods. Here the value of a given ES is related to the consumer behavior in a simulated hypothetical market through a survey, in which the willingness to pay for a given ES is asked. However, these methods have been used more on transport policy or policy advice on program acceptability than on ES valuation as such. Several of these estimation approaches have been used to assess total forest economic values globally [20] or in a specific environment such as the Mediterranean area [12]. In one of the first broad assessments, Mediterranean ES values have been evaluated by Croitoru [21] and an inter country estimate has been provided considering both positive and negative forest externalities (see table 1).

Table 1: ES values of the total forest production in the Mediterranean region.

Value type	Forest good & services	ES	Min value	Max Value	Approach
Direct use value	WFP removals	No	5 €/ha	130 €/ha	Market price
	Net growth of standing timber	No	20 €/ha	75 €/ha	Market price
	Losses of WFPs due to forest fires	No	-8 €/ha	-41 €/ha	Market price
	Grazing	No	33 €/ha	74 €/ha	Market price
	Collection of NWFPs	Partially	1 €/ha	143 €/ha	Market price
	Losses of NWFPs due to forest fires	Partially	n.a.	n.a.	Market price & shadow price
	Recreation	Yes	5 €/ha	163 €/ha	CVM and TCM
	Hunting	Yes	-4 €/ha	89 €/ha	Permit price and CVM
Indirect use value	Watershed protection	Yes	25 €/ha	150 €/ha	Avoid costs and defence expenditure
	Negative externalities linked to water-related issues	Yes	n.a.	51 €/ha	Restoration costs
	Carbon sequestration	Yes	2 €/ha	50 €/ha	Fankhouser's and UN-ECE/FAO approach
Non-use values	Biodiversity conservation	Yes	1 €/ha	60 €/ha	CVM
	Pharmaceutical value	Yes	n.a.	5 €/ha	Rent capture technique

Source: Croitoru [21] Modified. Note: the gap between upper and lower ES value is linked to the specificity of a given country; hence they are not applicable throughout the Mediterranean region.

Surely, prices of and demand for forest goods and services have a quite static evaluation, but the frequency and implementation of new economic approaches may improve the estimate. Moreover, the application of new technological techniques on monitoring may enhance and speed up the estimation process.

3. Policy Tools for Environmental Services

While the economic evaluation of ES may be achieved by the adoption of a suitable approach, how this value is transferred to the real world requires several steps in order to draft a specific policy strategy. In addition to the neoclassical economic concept of market efficiency, the concept of equity on ES benefits and costs has been an important step to recognize that humanity lives in a closed system, hence the need to consider the ES as part of the economy [22]. The Kyoto Protocol and ongoing debate on climate change is a clear example of how equity has been considered at global scale. Today policy makers may stimulate ES using different tools, which aim to motivate the supply or encourage the ES consumption in a given group of stakeholders. The overall effect aims to rebalance the provision costs of and user benefits from environmental externalities.

The most common tools that have been implemented can be collocated in three main categories [23]: 1) information and education instruments, 2) command and control (CAC) regulation and 3) economic instruments, better known as market based instruments (MBI).

1. Investments in ES information and education are fundamental to increase the awareness and fill information gaps among all ES stakeholders. Researchers, policy makers and technicians are the main target subjects of the education tool, while the promotion of information may target a wider pool of stakeholders from ES supplier to the whole of civil society. The main aim is to reduce the information asymmetry during the "bargaining" process of ES use rights implementation, or more generally to enhance the role of civil society on ES rights promotion and enforcement. Education and information instruments also help in the implementation of other policy instruments, as they are the first step of a participation process.
2. Command and control instruments are based on legal acts, enforced by the government. Basically, the implementation of specific ES laws set the main goals of the policy, the method to achieve the aims, the monitoring set-up and control system, and finally the fees and legal action against the non-compliant stakeholders. Among the most common CAC tools, the ES license, qualitative standards and access limitation are frequently used throughout the Mediterranean region. Moreover, they are often related to the ES property rights on which the CAC system regulations are built. Some examples are allowances (i.e. carbon emissions), prescriptions on best practices (i.e. soil protection during felling), limitations on polluting substance, qualitative standards (i.e. water quality standards), ES access rights and protection for different ES.
3. Finally, market based instruments are economic tools that aim to stimulate consumer and supplier behavior though market allocation of ES. The government may have either a

passive or active role similar to CAC, according to the ES demand, complexity and dimensional scale. Well-defined ES, with a clear dimension, are easier to achieve, while the opposite situations may require a more active effort in order to reduce some constraints such as transaction costs for grouping the demand or supply, measurement protocols and general information access; however government has a fundamental responsibility to set up and secure ES property rights. Relatively new in southern Mediterranean countries, MBI appear to be a promising approach, when the inefficiency of the control and monitoring limits the ES provision.

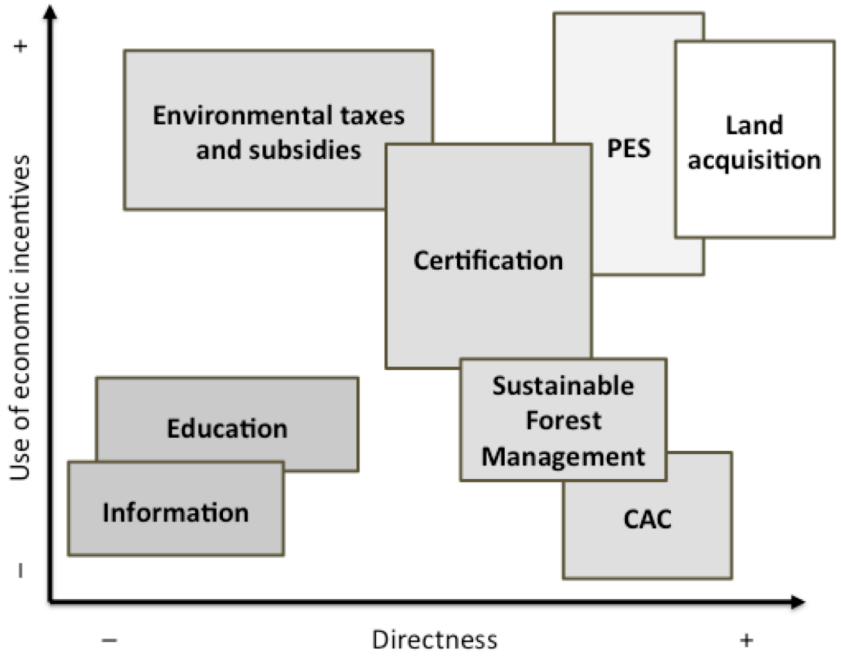
MBI have had a rapid development since the early 1990s, when "*principle 16*" of the Rio Declaration promoted the internalization of environmental costs and the use of economic instruments, based on the "polluter-pays" principle [24]. Next to the traditional regulatory approach, economic measures have been introduced as a complementary part of a country's environmental management system; however, the different situations and the complexity of the ES also introduced the concept of the "user-pays" principle in ES consumption (i.e. drinkable tap water), according to the ability to pay (annual user income). Nevertheless the overall financial effect should be same. On the contrary, where there are no economic transactions for a given ES, marketing tools may help to develop or enhance an ES market. According to some authors [25-27] the MBI may be grouped in three categories: 1) price-based, 2) quantity-based, which might be the evolution of a CAC regulation, and 3) market friction instruments.

1. Price-based instruments generally stimulate the provision of ES through target taxation or incentives. They may be either positive (grants, subsidies, soft-loans, concessions, auctions, etc.) or negative, charging a specific tax on a given economic activity or product. In both cases, they have a direct effect on ES supply, though they act in different ways, either directly enhancing the supply (positive) or limiting the demand (negative).
2. Quantity-based instruments limit the negative externalities by setting up a maximum production on a given economic activity. Each economic agent may produce a certain quantity according to the purchased permits and in any case the total amount of permits is limited according to a general agreement among the multitude of economic agents. Among the most common quantity-based instruments, cap-and-trade (i.e. ES market where a maximum limit is calculated according a reference time), off-set (or no-net-impact) and mitigation banking have been implemented as economic tools for climate change mitigation (the first two) and wetland conservation (last one), in which a third party usually certifies the compliance with a set of standards.
3. Lastly, market friction instruments are tools to promote or even create a new ES market. These tools vary from simple marketing strategies such as product differentiation and eco-labeling for less impacting products to more complex financial tools based on the

environmental risk assessment of a given activity. Conservation insurance and leveraging eco-investments are two examples. Some of these tools are similar to the financial derivatives (i.e. debt-for-conservation), where the reduction of a natural area in one area is compensated for by the expected creation of another one. However, in the recent years, thanks to demand analysis, more pressure has been put on contract-payment and ES market creation where payment for environmental services (PES) is just the initial step towards the ES market.

According to Wunder [2], conservation approaches may be ranked on two parameters: 1) the directness of the approach to conserve or enhance the ES and 2) the dependency on economic incentives (see figure 2). ES information and education rely on incentives and public finance,

Figure 2: Conservation approaches rank



Source: Wunder [2] modified. Note: In practice, several approaches may be combined.

but their cost is relatively lower than other approaches. Moreover they are not strictly linked to a given ES, even though they stimulate behavior changes: an indispensable step to promote PES. More directness is given by the implementation of CAC. The legislative system sets rules and a control system where the user has some constraints on ES use. It has been used to solve congestion problems or weak provision of ES, however the high cost of control and the incapacity to have constant monitoring reduce the efficiency of the system since this political tool is usually paid for through general taxation. In some cases it might evolve into a PES scheme where an equity principle between users and suppliers is considered. Environmental taxation is surely the most common MBI used up to now. However, due to the lack of linkage

with the ES target, the high cost of organizing the funds and the social unwillingness to pay taxes, this instrument is starting to be quite inefficient and less supported by policy makers. Sustainable forest management (SFM) has become the pillar of the forest sector worldwide. In the Mediterranean basin some problems of unsustainability exist. Examples come from Albania, Montenegro and Macedonia in which parts of the forest have been overexploited triggering soil erosion and forest resource depletion [28]. Generally SFM has been introduced in practice throughout the Mediterranean area, but without the support of public funds it could be difficult to achieve. The introduction of forest certification has stimulated the adoption of good forest management practices by encouraging the forest owner with the possibility of obtaining a higher price on the market, because people generally link the certification brand with the provided ES when compared to other non-certified goods. The main difference between timber certification and PES is the directness of the payment, which in the case of certification is related to the extra-cost on the purchased goods. On the contrary, PES schemes are definitely linked to the ES provision. In general it is a bit more costly but ES provision is stimulated by the direct transaction between user and supplier, which does not occur in the certification schemes. PES may last for one year, a decade or even in perpetuity, but its duration is strictly related to the ES. Finally, land or in real right acquisition could be used to avoid ES depletion by negative stakeholders or to reduce the transaction costs. This is widely used by bottled water companies (i.e. Vittel case study – box 2) and in general in the water sector to protect the water catchment basin from soil erosion or pollution. To some extent, public land has also been forced to maintain high quality natural resources, managing their access and uses.

4. The economic theory behind Payment for Environmental Services

Forest externalities are rarely considered in the real economy, although they provide several goods and services to different stakeholders. Payment for Environmental Services (PES) has been developed to correct the market failure, setting up prices for given goods or services. Although different environmental services (ES) have been traded for a long time, even with-

Figure 3: Direct PES

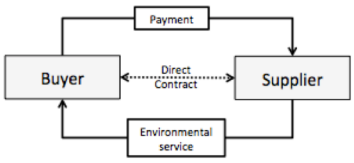
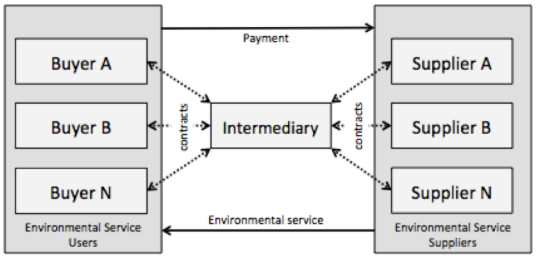
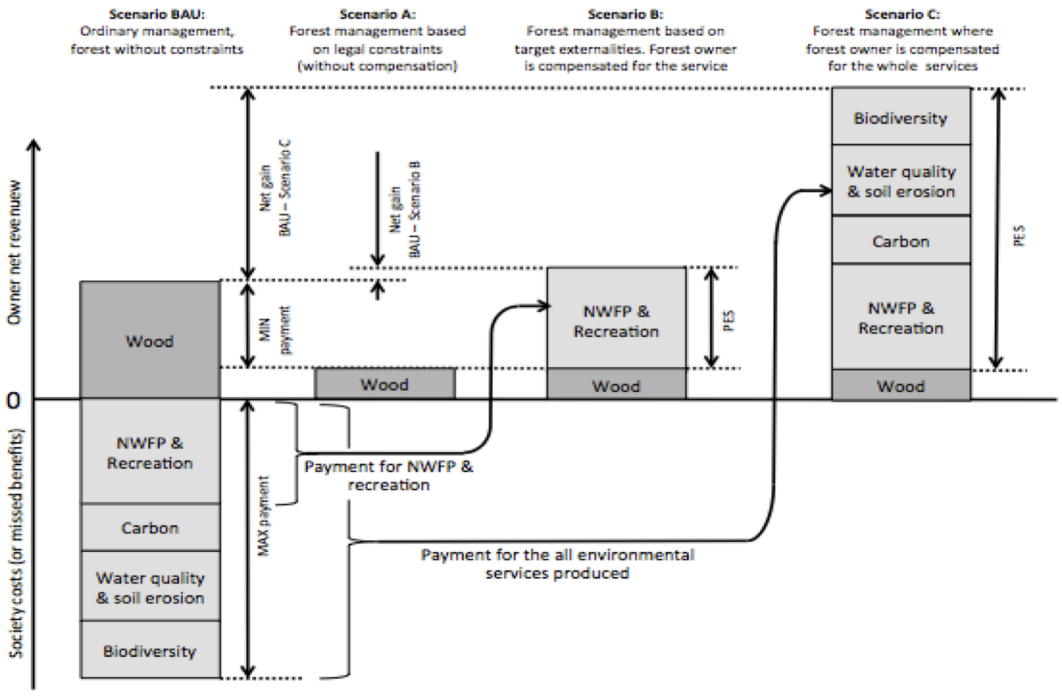


Figure 4: Mediate PES



out considering it as such, historically they have been contemplated whenever there has been strong human pressure on nature. Already Goméz-Baggethun [16] have described the evolution concept of the environmental service economy as a slow pattern of change based on perceived environmental scarcity. Since the late 1990s, there has been an effort to assess the global value of ES [20] and transfer the concept into policy. PES has thus become a practical instrument to finance ES in the real economy [29-31] through a commodification process [32]. PES are defined as a voluntary economic transaction (1) based on a contract between at least two parties, one supplier (2) and one buyer(3), that trade a certain ES (4) and its provision (5) is ensured by the provider [29] (see figure 3). While simple bilateral contracts between private individuals are rarely implemented, PES developed by intermediaries due to high number of buyers and suppliers are more frequent (see figure 4). Where one of the five parameters is not fulfilled, the PES may be called a PES-like scheme [33]; for instance, if buyer and supplier are interdependent public institutions or there is no voluntariness and the scheme is compulsorily enforced on one of the two parties, the scheme name is substituted by PES-like. However, a clear ES definition and additionality must be respected in both cases. On the contrary to the command-and-control approach; PES is an economic tool that aims to increase benefit equity through efficiency and efficacy for a given ES. The financial mechanism might be explained in a simple graph (see figure 5). In the first scenario, business as usual – BAU, a forest owner gains revenue from selling wood, while the other forest stakeholders do not receive any benefits: the normal situation for a large cut in coppice forest management or a clear-cut. The missed benefit for society can be considered a cost partially spent on land defense against floods, soil erosion and forest fires as well as a general loss of recreational activity and non-wood forest product (NWFP) collection. A change of forest management based on the implementation of legal constraints, such as avoidance of clear-cuts or to set limits on forest road construction, may reduce the social costs (scenario “A”), where the forest owner has to reduce his/her revenue on wood production, while all the other stakeholders enjoy the benefits of the new forest externalities produced in different areas. The policy maker should consider at least the unbalanced equity that limits the forest owner’s rights; in fact, without providing any compensation (win-lose system), the efficacy of the law may be limited. Subsidies have surely to be charged to the general fiscal system because the benefits are available for each forest stakeholder.

Figure 5: PES schemes for target and multi environmental service provision



Source: Pagiola [1] mod.

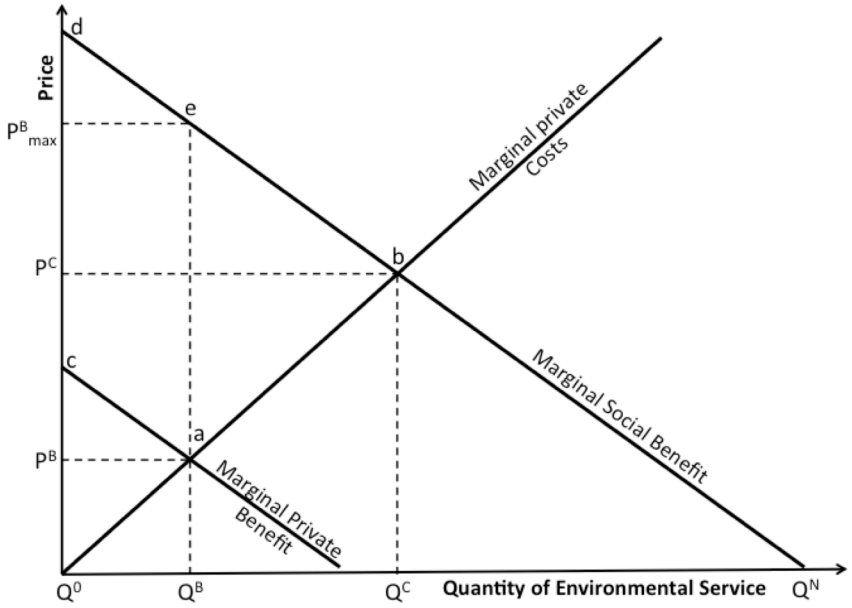
Moving towards a market-based-mechanism (MBM), providers and consumers trade their utility to have a certain level of goods and services from forest management in exchange for a monetary transaction to cover the forest owner's opportunity cost. In scenarios "B" and "C", both parties have a positive net gain compared to the BAU, in terms of both environmental service provision and equity for the ES supplier and beneficiaries. For instance, PES might be implemented for target externalities (scenario "B"), where the beneficiaries pay for a specific forest management that provides NWFP and recreation. Even considering the most costly forest management system that generates the highest level of all externalities, there is a clear improvement on equity distribution. In this case, NWFP and recreational users will not be the only beneficiaries. Indeed the best theoretical scenario is "C", where the producer is compensated for all the externalities by a wider set of stakeholders; nevertheless PES schemes are commonly related to scenario "B". A case study that has been a sort of reference point in the PES sector is surely the Vittel case study, briefly described in box 2. PES may be described though traditional economic curves. In figure 6, we describe a theoretical PES scheme implemented in the forest sector (large scale), in which the landowner has the right to clear-cut the forest (like in the previous figure). The situation without direct payment or economic revenue to the landowner (business as usual - BAU) does not provide any traded externality, hence the ES is equal to Q^0. This is due to ~~the~~ market failure, so the landowner is not stimulated to enhance ES. However, the state can implement a new policy (command-and-control) to limit the property rights of the landowner.

Box 2 - The water PES in France: the Vittel case study. Since a decade ago, an example of PES that has been considered a reference case in Europe is the case of the Vittel Company (Nestlé group) in France. This brand of bottled water had a high risk of spring contamination due to the high levels of nitrogen distribution in the fields above the water catchment area [34]. Scientific study has highlighted the cause-effect relationship between agricultural practices and water quality. Based on this scientific evidence, the company began a negotiation process mediated by a specific agency, with the farmers (26 in total) and forest owners. After approximately 10 years of bargaining, the parties signed the agreements setting up a PES scheme; in total there were four types of contract according to farm size and production. Each farmer received a premium of 200 €/ha/year, linked to the income loss and a set of benefits, such as free technical assistance for the change of their agricultural practices and a payment of 150,000 €/ farm for infrastructure modernization; Moreover, all debts and loans related to land acquisition have been cancelled, while 30 years of concession was ensured to those farmers willing to sell their land. The overall process stimulated a cropping change from corn to other more environmentally friendly crops or meadows on 17,000 ha, with the positive consequence of nitrogen reduction in the springs. Several farmers also decided to move towards organic agriculture. In the first seven years of PES enforcement, Vittel has spent nearly 24.25 M€ (980 €/ha/year) out of 5.2 billion € business turnover (2005): 9.14 M€ for land acquisition, 3.81 M€ for modernization and 11.3 M€ to directly compensate the farmers.

If the policy targets the whole environment, the quantity of ES generated may increase to Q^N but without any income for the landowner; this could be the extreme case of an integral nature reserve, where even the landowner cannot enter, but generally it increases the ES provision.

The introduction of a market-based mechanism, such as PES schemes, stimulates the land-

Figure 6: ES market: optimal provision



owner to change forest management practices in favor of a specific ES, delivered at quantity Q^B. To achieve this, the payment has to be set equal to the marginal costs, so the price for the ES is equal to P^B and has to be higher than the landowner's opportunity cost. The marginal costs of service provision include the landowner's production cost, the opportunity cost for

alternative land use and all the transaction costs to support the scheme. Moreover, cost effectiveness is maximized at P^B; in fact if we set a price equal to the marginal social benefit at P^B_{max}, the budget required to implement the PES scheme is equal to the area $Q^B e P^B_{max} Q^0$, while it is only $Q^B a P^B Q^0$ if we consider the landowner's marginal cost. As mentioned before, if all the ES are traded on the market, the optimum ES level for society is reached at Q^C, the point where the marginal cost of ES provision is equal to the marginal social benefits at price P^C. The improvement of ES provision from Q^B to Q^C also enhances the net benefit. It can be calculated as the difference of total welfare between the two market levels, equal to $Q^0 bd$ minus $Q^0 ac$. Price and quantity of ES provision are just the final objective of PES scheme implementation. PES is affected by several preconditions that have to be considered before being put into practice [33]. First the dimensions and characteristics of the ES are the starting point to draft the PES scheme. PES is generally affected by ES scale dimension. Small forest owners usually have one or few forest management targets. Wood production has remained the main aim for the landowner so far, though recreation in the forest, NWFP provision or carbon sequestration represent new options that might be achieved at small scale. On the contrary other complex ES like water quality and biodiversity are very difficult to realize within the average size of private forestland. To generate more complex ES, a wider scale is needed. Directly related to the scale dimension, ES measurability is a challenging issue especially for a complex service. An example is biodiversity where just a few shared indicators exist at different scales [35, 36]; this is basic information to evaluate the ES in economic terms [37, 38]. It is worth mentioning that the monitoring and data collection for a biodiversity payment scheme might be very costly, increasing the transaction costs between the parties or even limiting the PES start-up process.

Apart from the ES physical characteristics; other important factors to bear in mind in the PES design are competitiveness, cultural context and institutional framework. Since the Kyoto Protocol, carbon sequestration is the most homogeneous ES at global scale. The common units and the global recognition from the international community were at the base of the carbon credit trade. More often the scale dimension is linked to buyer utilities. Tap water quality may be improved introducing alternative forest management practices at watershed level, but people living outside the area are not interested in paying extra money to improve the quality of water they will not use directly. The ES demand is part of the PES competiveness precondition. A large number of buyers and suppliers or demand fragmentation complicates the negotiation process. To simplify the bargaining procedure, the demand organization is surely needed. Positive examples are often reported in a mono or oligopsony market typical of the water-related ES where the presence of one or few buyers reduces the negotiation and reaches the best agreement. Other aspects like efficiency, information symmetry, independence of

irrelevant alternatives, scalar invariance, ES provision monotonicity, buyer and supplier utility maximization and other aspects relying on contract theory may affect the negotiation process and might be difficult to assess, but are important to consider in the contract.

Cultural context is important for PES acceptability. People may accept the concept of ES monetization but in other cases they see PES as a trap on their land. The commercialization of right of access for recreational purposes is an example. In fact, small forest owner are generally unwilling to sell part of their property rights, scared by the fact that the new user will damage the forest or create new privileges, while large property owners do not demonstrate adverse positions. Property rights are fundamental and a clear excludability is the existence of "*condictio*" for PES scheme implementation. Despite common law, civil law systems lack efficiency due to their slow evolution patterns. This is typical of the majority of Mediterranean countries; in fact, according to [39], the accumulation of norms, customary rights and formal institutions have limited the effectiveness and coordination of policy and rule implementation. PES become more acceptable where command and control systems fail. An investment in a new market-based mechanism may be more economical than a law-based system, especially due to the latter's high cost of control. Moreover, the political driving forces are in many cases reluctant to legislate on highly sensitive issues such as the environment and water, where civil society is wholly against any privatization process. Besides, two huge constraints to any PES implementation are the absence of forest owners' associations and the highly fragmented landownership that increase the transaction costs, hence limiting the capabilities of an ES investor or supplier to take action. In such conditions, the role of national or local governments is fundamental, due to the fact that the economic agents trade firstly in rights [40, 41].

Unlike the command and control approach, PES schemes usually increase the price to the ES end users. Local users may at first glance see a form of environmental taxation, but in the long run the active forest management and the capacity to create employment in rural areas makes PES strategic. In the next few sections we will describe some PES case studies established in the Mediterranean basin.

5. Form theory to practice: PES and PES-like case studies in the Mediterranean basin.

In the Mediterranean basin the PES and PES-like scheme has been promoted in the last two decades. Recent publications [42, 43] have tried to map and describe PES schemes implemented in different nations, but the rapid evolution of the topic and wider recognition of the equity concept has enhanced the implementation of PES schemes making it very difficult to

be detected and reported in scientific publications or white papers. In this brief section we will report some good examples of PES on three main issues: water quality, carbon sequestration and biodiversity.

Case study 1: Tap-water provision in the northern Mediterranean basin: some cases from North Italy

Tap-water quality has been an important topic in the Mediterranean region. Several governments have strictly regulated setting up land use constraints, being considered among the most strategic ES. However, some new changes have been introduced since the early 1990s in the northern Mediterranean countries, coordinated only in the year 2000 by the introduction of the Water Directive Framework, in which water for human consumption has been formally declared a priority with regard to other uses[2]. Though it has been not specified, this assumption poses a sort of hierarchy on water uses, where the maintenance of the whole water catchment basin has been addressed (Kunk 2004) through a partial compensation for the ES generated. In Italy, the concept was introduced by Galli's act (Law 36/94) that suggests the adoption of an extra-payment on the water bill (3-8% of the water costs) to compensate for the maintenance of the upstream area (mainly forestland). The law highlights the role of local public authorities because of the high fragmentation of private land, which has been considered a major obstacle. In fact, the correct management could be very difficult without a representative surface around the catchment areas in which the forest owners are usually not represented by an association, increasing the transaction costs.

Despite the law's suggestion water-related ES payments have only been introduced in some local contexts based on an extra-charge on tap water bills ('user-pay-principle'): Piedmont and Veneto. Piedmont Region built up a structural fund[3] with 3-8% of extra-charge on water bills to compensate mountain areas in terms of projects or infrastructure aimed to improve the local forest management practices. In the same way, the Decree of Veneto Regional Council no. 3483 of the 10th December 2010 set up a financial tool for mountain areas (3% of the water bill) partially covering the costs of new hydraulic infrastructure and forest operations close to areas of slope instability in order to protect the downstream population. The recent introduction and the weak data reporting have not allowed a full understanding of the mechanism, due also to the large number of intermediaries and public agencies involved. Basically, the repartition of the fund is based on a ranking of the amelioration projects that are selected annually.

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[2] Water Directive Framework - Reg. 2000/60/EC

[3] Regional Act 13/1997, art. 14

Apart from these large-scale regional schemes, there is an additional example. It is worth mentioning the case of "Romagna Acque S.p.a.", a public company owning and managing the entire drinkable water resources of Romagna[4] sub-regional area. Started as a consortium of municipalities to reduce the cost of drinkable water supply in 1966, it was able to cover the distribution of water to the whole Romagna area in 1989 and only a few years later, in 1994, "Romagna Acque S.p.a." was founded, becoming owner of the water resources in 2004. The most important company water source is a dam-basin, located in the central Apennines (Ridracoli area - municipality of Bagno di Romagna), which covers 50% of the whole Romagna tap water demand (108 M m3/year) especially during the summer season. Since its construction, the biggest problems have been dam sedimentation and maintenance of high water quality. In 1993, the company invested in research to understand the link between different forest managements and soil erosion as well as water quality stabilization. After four years of research, the clear impact has been demonstrated of forest operations such as clear-cut or forest conversion from coppice to high stands on soil erosion while minimal silvicultural treatments or natural evolution of stands markedly reduce the soil erosion [44]. Moreover, these last two practices have also been demonstrated to have a positive influence on nitrogen reduction and pH stability. Acknowledging these problems, part of the revenues deriving from the water tariff payments (1-3%) has been used to compensate landowners in the catchment areas, helping them to cover the cost of changes in management practices and opportunity cost. The average payment to forest owners has been around 200 €/ha for the first years (2006 was the first), decreasing to 100€/ha after 2010. The positive impact of the PES scheme was accounted as a general decrease of 25% in soil erosion[5], and a consistent reduction in nitrogen as well as pH stabilization. In terms of performance both Romagna Acque S.p.A. and the landowners have increased their benefits: on the one hand the company has reduced its water purification costs prolonging the dam life, while on the other the landowners have maintained or even increased their annual forest revenue. Anyway, due to the complex bureaucratic process the company decided to acquire the land wherever this was possible. Moreover, part of the compensation has been invested in programs to inform the public on the use of tap water and the effects of the positive management practices adopted in the catchment area. The positive example of Romagna Acque S.p.A. represents a PES-like scheme built on legislative gaps[6]; it cannot be categorized as pure PES due to the overlapping between the ES supplier and consumer (in some ways, they are both represented by Romagna Acque S.p.a.).

[4] Provinces of Ravenna, Forlì-Cesena and Rimini, in North-East Italy.
[5] The initial soil erosion was 40,000 m^3/year while today total amount has decreased to 30,000 m^3/year in the water catchment basin.
[6] art. 18 and 24 Act 36/1994

Case study 2: Watershed protection in Tunisia

Over-grazing and intensive land use in southern Mediterranean countries have been the most problematic constraints on the water quality provision [7]. Traditionally, the public land tenure right lets several users freely exploit the forest and grassland, without taking the real carrying capacity into account. Especially in the fragile mountain ecosystem the human pressure may result in a general depletion of the natural resources, in particular water [45]. However, where law prescriptions and limitations fail, the implementation of a market-based mechanism such as PES may inspire the stakeholders linked to a given ES.

A positive case comes from north-west Tunisia, in the Barbara watershed (surface 200 km^2) as reported by Croitoru [46]. Forest covers 25% of the watershed, with the remainder[7] divided between cropland (53%), grassland (3%), human settlements and unproductive surface that contain a population of 124 inhabitants/km^2. Due to the higher concentration of people in the lower part of the watershed the demand for clean water and irrigation has increased while the high land pressure has resulted in soil erosion, causing landslides, river bank and bed erosion; corresponding to additional costs for society. In fact river and dam cleaning has been very expensive. Among the possible solutions to stem the erosion effects, afforestation in the gullies was assessed as the best economic option. Local government decided to finance the program through an extra-payment on water bills, as the main financial channel to maintain the subsidies fund. The program was based on the direct payment to convert farmland to forestland with afforestation. The cost was initially drafted to cover the plantation costs, but the high tree mortality has undermined the effectiveness of the program due to farmers' carelessness after receiving the payment. Hence, the payment was linked to the number of trees planted and survived in a year. The simple cost of provision, without considering the opportunity costs has had a weak rate of applicants. According to Croitoru [46] the payment should fluctuate between the minimum cost related to the farmer's income loss (approximately 49 €/ha) and the net benefit of society (approximately 99 €/ha) as avoided cost of water cleaning and watershed maintenance.

Case study 3: Forest reserve for biodiversity in Girona Province (Spain)

Natural forests have become quite rare in Mediterranean countries, especially near very densely populated areas, where they are frequently used for recreation. Among the proposals for forest areas used for biodiversity the common approach undertaken by the majority of

[7] Potential water capacity of 59 Mm^3

governments is the implementation of a specific rule to protect a certain piece of land. However, the equity between civil society and forest owner is simply ignored. A different approach has been promoted in the Girona area, where the provincial council aimed to maintain at least 1% of province forestland with over-mature trees through a program named "*Programa Selvana*". The general idea was to preserve some pieces of land, where old forest will be set aside from the regular forest management and left to evolve naturally for the next 25 years with no silvicultural treatment. The involved actors have been mainly forest owners, both private and public, and their associations; while the agent responsible for the scheme has been the provincial council. Since the beginning the main problems have been related to finding a sufficient number of people who would like to enter ~~to~~ the scheme. Based on the principle of "supplier compensation", the level of payments has been differentiated according to the landowner's opportunity cost of the more remunerative forest income alternative. Attracted by higher income opportunities, forest owners started to apply for the scheme voluntarily whether or not they fulfilled the minimum requirements based on some graded criteria (see table 2). In order to achieve at least a minimal competitiveness among the applicants, the total score of each application is listed and this represents the order of priority for funding.

Table 2: Eligible criteria

Criteria	**Eligibility level**
Slope	Less than 60%
Species	Presence of native species
	Additional scores have been given to rare and climax tree species
	Presence of fauna and flora of mature forests
Land size	Minimum 2.5 ha
Number of mature trees	0-50 units/ha (grading score)
Genetic quality	Trees from natural regeneration have higher score despite old sprouting stems
Stand type	Higher score has been given to multi-level and multi-age stands
Soil structure	**Higher score to soil with well-developed O-A-B layer.**

Once the agent has checked the eligibility of the different stands, they will be listed in an official bulletin and there will be funding for the first on the list onwards until the budget is finished (250,000 €/year half for private and half for public forests). Whether or not the forest owner accepts the contract condition, he/she will receive 80% of the total subsidies for the whole 25 years just by presenting a plan for a change in forest management, with the remaining 20% after signing the contract. However, a pilot area in the Montseny Natural Park was fundamental to test the feasibility of the scheme, improving weak parts such as contract withdrawal and monitoring. In fact, in the case where there have been some forest management

activities, the subsidies have to be sent back to the council, while in the case of forest fire damage only part of the money has to be given back according to the damage. Since the first half of 2011, 62 forest owners have been found scattered in 51 different places in the Girona area, accounting for 670 hectares, 0.34% of the total forest cover in the province [23, 47]. The future target will be to reach 1% of total forestland, however the dependency on private funding is related to the economy constraint and trend, hence difficult to maintain in a period of crisis.

Case study 4: Structuring carbon schemes in Veneto and Friuli-Venezia Giulia Regions (North Italy)

Carbon markets are generally divided into two branches: the large Institutional (Kyoto-related) market and the Voluntary Over-the-Counter (OTC) market. While the Institutional market has historically limited credits generated from land-use greenhouse gas mitigation activities, the OTC market has long been a steady innovation platform for ecosystem services generated by the forestry and agriculture sectors [48]. In 2011, $576 million were transacted on the voluntary carbon market (average price of $6.2/t), 30% of which were forestry and agriculture based credits [49]. Most of the forestry-offset projects are afforestation/reforestations and REDD+ (Reducing Emissions From Deforestation and Forest Degradation) developed mostly in South and North America and Asia.

The Mediterranean basin has seen few forest compensation projects so far. One of the most interesting case studies is CARBOMARK[8], a regional program encouraging local land-based reductions. The project was initiated by the EU LIFE Program and has established a pilot trading program in two regions in Italy (Veneto and Friuli Venezia Giulia). Enterprises operating in the two regions can, based on monitoring and reduction plans, directly purchase through public auctions credits generated by four project types – improved forest management (IFM), urban forestry, long-lived wood products and bio-char [49]. CARBOMARK has been developing its own methodologies based on Verified Carbon Standard and CarbonFix approaches for IFM and biochar credits.

Four public landowners (municipalities) have so far endorsed the setting-aside of an additional part of the wood increment available for harvesting in the business as usual scenario. As of 2012 300 tCO2 have been sold at a price ranging between €30-40 per tCO2. In the upcoming 5 years the program is expecting to place roughly 15,000 credits on the market and to track them thanks to an internal registry.

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[8] www.carbomark.org

The process of monitoring, reduction and compensation is controlled by internal verifiers while carbon accounting methodologies, transactions and registry keeping is run by Veneto's Directorate for Forests and Mountain Economy, and Friuli VG's Central Department of Agricultural, Natural and Forest Resources and Mountains acting as independent "Kyoto Observatories".

Even if CARBOMARK has an outstanding and innovative approach for lowering transaction costs and ensuring the quality of offset projects, all the same it is facing high risks of *double counting* of credits. In fact, under article 3.4 of the Kyoto Protocol forest management is partially accounted under the national reporting. Indeed, Italy is already heavily relying on forest management sequestration to meet the Kyoto targets (24% of the whole European amount under art. 3.3 and 3.4). Under these conditions, and with the new incoming monitoring reference levels for forest management in the Post-Kyoto agreement, the challenges facing the credibility of CARBOMARK are likely to increase.

6. Cross comparison

The case studies we have described may be summarized according to the [29] definition (see table 3). Although all the case studies have a clear definition of the traded ES, based on a voluntary system where conditional transactions occur, only three out of the four may be considered true PES schemes. The case of "*Romagna Acque S.p.a.*" has been reported to underline the effect of an inflexible legislative system on ES provision. Unlike the other cases, where there were clear definitions of buyers and sellers, here the sellers could only be publicly owned forests, due to the legal impossibility of direct economic transactions between public companies (*Romagna Acque S.p.a.*) and private agents (private forest owners. Apart from the carbon sequestration case, all the others work in a monopsony market where there is only one buyer. According to Bougherara [50] an ES market is more stable if buyers and sellers are concentrated, especially if there is a high risk of free riding on the demand side; in this sense monopsony represents an optimal situation.

Table 3: PES parameters in the case studies

	Catchment compensation for tap water supply: Romagna Acque S.p.a.	**Catchment compensation for soil erosion reduction in Tunisia**	**Biodiversity scheme for mature forest in Girona**	**CARBONMARK project: Carbon sequestration in forest**
ES definition	Forest cleaning service and erosion mitigation service.	Erosion mitigation service afforestation program	Forest aging for biodiversity maintenance	Additional carbon stock increase through forest management, biochar, wood products and urban forestry.
Buyer/s	Romagna Acqua S.p.a.	Water authority (government)	Private bank and provincial government	Private enterprises
Seller/s	Public forest owner within	Private landowners	Public and private	Forest owners, public urban

	the catchment area (while only indirectly private)	(mainly farmers)	forest owner within Girona Province	area with trees, private wooden houses and private agriculture land
Voluntariness of the parties	Full voluntariness	Full voluntariness	Full voluntariness	Full voluntariness
Conditionality	From intensive coppicing (actual BAU) towards close to nature silviculture	Farmland (actual BAU) afforestation with acacia trees maintained alive for the first year	Forest management from wood production (actual BAU) to natural evolution.	Increase in carbon stock following carbon accounting methodologies despite the actual removals (BAU)
Principle	User-pay-principle	User-pay-principle	User-pay-principle	Polluter-pay-principle
PES type	PES-like	True PES	True PES	True PES

Cross comparison among case studies highlights other important issues about PES. The need to understand whether PES achieve economic and social aspects has been stressed by some authors [51]. [43] has addressed some simple PES parameters to provide more information on the scheme effectiveness (see table 4), in other words how far target ES provision is achieved.

Table 4: Case study comparative analysis: the state of implementation

PES parameter	Catchment compensation for tap water supply: Romagna Acque S.p.a.	Catchment compensation for soil erosion reduction in Tunisia	Biodiversity scheme for mature forest in Girona	Carbon sequestration in forest
Start-up	Romagna Acque S.p.a.	Local public authorities	Girona provincial government	EU LIFE+ Project
Scale	Spring catchment basin or dam basin	Spring catchment basin	Girona province	Forest management unit level, urban forestry level within the Region
Ecosystem benefits	Water is filtered by forest with less nitrogen transport in the dam basin. Moreover, the avoided soil erosion lengthens the dam life.	Reduction of soil erosion and landslides to enhance water quality	Over-mature forest maintenance for biodiversity purposes	Increase of carbon stock in forest, agriculture soils and wood products.
Risks	Risk of losing additionality in the long term. Once the forest reach the climax status no environmental improvements may be added	High risk of losing the new plantation due to summer drought and landslides	Forest fires	Forest fires and double counting of carbon credits derived from forest management due to potential overlapping with art. 3.4 of the Kyoto Protocol.
Measurement	Water quality on nitrogen content and pH. Soil erosion is calculated annually according to the water volume traded and precipitation.	Variation of floods and landslide frequency	Presence/absence of a set of native species	Variation of carbon stock in forest or trees and volume of timber stock in houses
Constraint	Instable legal framework	Lack of ES suppliers who want to change their land use	Lack of ES suppliers who want to set aside	Lack of ES buyer
Directness	Direct payment between ES user and supplier	One intermediary (government) drives payment between ES user and supplier	One/two intermediaries (government and forest owners' association) drive payment between ES user and supplier	Direct payment between ES user and supplier
Payment source	Percentage of water bill (1-3%)	Percentage of water bill	Percentage of private bank revenue	Voluntary monitoring, reduction and compensation of CO2 emissions by local enterprises.
Payment mode and amount	Direct payment to the forest owner (100-200 €/ha). Total amount 0.5-1M€/year	Direct payment to the land owner (50-100 €/ha) when he ensures seedling life for at least a year.	Public auction with immediate payment for the ES provided to the winner. Total amount 0.25M€/year	Public inverse-auction. Carbon credits have been sold on 40 €/CO2t (30 was the minimum price). Consider that the average world price of a carbon credit is around 2-5 €/

				CO_2t
Opportunity cost	Price of dam-bed cleaning	Downstream defensive infrastructure	Price of forest wood production	Price of cubic meter of timber for forest management methodology.
PES Contract and length	Annual or multiannual agreement based on a formal contract	Potentially 20 years contracts	25 years of commitment based on a formal contract	5 year commitment period for enterprises based on a formal contract and minimum of 20 year commitment period for landowners.
Supplier exit possibility	Yes, without clause	No available information	Yes, with clause. Basically forest owners have to give back the money	Yes, with clause. Basically forest owners have to give back the money
Payment revision and flexibility	The revision takes place every year according to the forest operation needed, ~~and~~ the water quality parameter and ~~the~~ soil erosion effect	No available information	No revision	No revision
ES Monitoring	Romagna Acque S.p.a. monitors the water quality parameter hence indirectly the forest performance. The soil erosion is estimated according to the annual water quantity processed at the purifying facilities (according to annual rainfall)	Annual check of tree growth	Annual check of tree presence: no silviculture activities shall be done	Internal verification system. Carbon accounting methodologies, transactions and registry keeping is run by independent "Kyoto Observatories".
ES Reporting	Annual report within the accountability report for the traded ES.	No available information	Quarterly bulletin	Internally managed registry.

Key actors have usually been the public government and agencies, due to the uneasy dialog providers and suppliers have to undertake for the bargaining process. The ES reference scale depends on the ES characteristics, and generally CO_2 can be traded globally, while the others are linked to local or provincial scale. The risk of losing the ES can be grouped in two main categories: physical and methodological risks. The first consist of forest fires, storm damage or other catastrophes; however, they also include some social aspects such as acceptability of the PES (i.e. a forest fire might be triggered in the neighborhood and affect the forest where PES is in place). The second risk category is related to the methodology by which a given ES is measured. Forest carbon stock, water quality, and volume of soil erosion are costly measurements that must be guaranteed. Especially in a carbon sequestration scheme the problem of double counting can occur where lack of coordination and reporting exists, hence it may nullify the PES scheme effectiveness. Moreover, an unstable legal framework may affect the actual PES existence. For instance, a change in property rights or variation of the parameters for ES definition may enhance or withdraw the PES. Other constraints generally concern the presence of PES buyers and supplier. There are various motivations, but lack of information and education about the ES could be more relevant than economic aspects. Nevertheless, these last constraints may be partially overcome by increasing the directness between parties.

Moving on to the technical side of the PES, payment source, mode and amount and how it is calculated comparing alternative management opportunities are the basic features of the scheme effectiveness. Payment source also determines the price maker in the bargaining process. In the case of carbon, companies' willingness to compensate make them the weak figures in the PES. In fact they hold the scarcity dimension that lets them decide, especially when they have no return in terms of image. However, in all the cases presented here, the forest or land owner is the ES supplier. The way the payment is transferred from ES buyers to supplier is based on a direct agreement where only two actors are involved or a public auction where there are more than two. In the last few years, inverse auction has been promoted in order to stimulate a fairer price on the supply side [52], where a given ES supplier sets the minimum price for the auction as in the case of CARBONMARK. Opportunity cost has been considered as the minimum compensation price that may stimulate a forest owner to take action. All these technical aspects are introduced in the contract with different binding level. In fact, exit possibility and revision of the payment amount may facilitate both parties involved in the scheme. Finally monitoring and reporting are annual activities that describe the performance of the PES scheme for both parties. However, in most cases data and information are included in the accountability, hence are quite difficult to obtain.

7. Conclusion

Human behavior has affected the whole forest ecosystem. The increased perceived scarcity of certain ES and the evidence that forests provide a multitude of goods and services mean that forest stakeholders must address the challenging question as to whether forests should continue to maximize timber production. Despite the proliferation of norms and rules for managing forests that did not usually consider the equity principle, quantity based or market friction MBI have demonstrated the capacity to achieve better results where traditional approaches fail. PES schemes are an example and they represent the first step towards a market for ecosystem services. The rapid change in the demand has stimulated new sources of income for the forest sector. Water PES is an example. Among the Mediterranean case studies, water PES are more frequent, because it is relatively easy to define ES buyers and suppliers linked to water quality or quantity. Moreover, where a group of buyers builds up a monopsony condition this helps PES to be realized. The need to build a critical mass of land (suppliers) or ES demand (buyers) is the first step towards the success of a PES scheme. Landowners' associations could substantially decrease the transaction costs on the supply side, but the hugest effort should be made to increase the awareness of ES, de facto, the real engine of the green economyPES or PES-like schemes could probably substitute subsidy-based mechanisms in

order to operate existing schemes more dynamically especially in the Mediterranean area, but they are so far linked to specific situations, while applications of large schemes are still unrecorded. However, several companies and public administrations prefer land acquisitions and land rents instead of PES implementation due to the lower transaction costs and the certainty of obtaining the needed ES (full land rights acquisition). In fact, also in the case of Vittel or Romagna Acque S.p.a. land acquisition was the first step prior to PES implementation. PES are useful when property rights are fully recognized by the forest owner, hence expropriation is difficult; a simple commercialization may consequently avoid social problems. A clear definition of property rights is in fact a fundamental condition for implementing any MBI, hence PES. Finally, the future role of external trade should be considered, where not only goods are exchanged, but the price also covers the ES value.

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7. Paper 2: Comparing Profitability and Governance for Recreational Wild Mushroom Picking in Forest and Timber Production: a multiple case study in the Province of Vicenza.

Title: **Comparing Profitability and Governance for Recreational Wild Mushroom Picking in Forest and Timber Production: a multiple case study in the Province of Vicenza.**

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Abstract: In Italy, the recreational wild mushroom picking (RWMP) has become an important income source for forest managers, reaching a social and economic dimension at national scale. While timber production has shown a general decrement in terms of economic values and quantity output in the last three decades, the welfare growth has modify the forest product demand. Since the late '70s, recreational RWMP have attracted the attention of the policy makers. The over-demand of this forest activity affected dramatically the wild mushroom (WM) availability for industrial and local processors. While the market has immediately reacted with a massive import of WM to fulfil the demand of local enterprises unable to purchase enough rough material, policy makers have faced into the problem to regulate the collection of a public good, the WM. Only the early 90s, policy makers set up a law based picking limits, on licenses and picking permit fees; nevertheless, forest managers have rarely introduced the silviculture techniques to enhance WM in forest. By means of a multiple case-study approach, the paper analyses the experiences of RWMP after a decade of license and permit fee implementation in the province of Vicenza (North-East Italy), comparing different approaches of RMWP management. The more complex and well structured is the organizational management system, such as for recreation based on wild mushrooms picking, instead than only for timber production, shown higher capacity of local forest managers to keep their forest under control while getting better levels of profitability. A final comparison is carried out between the income generation based on timber production and the one based on wild mushroom picking, with a common indicator of profitability [€/ha]. We found that RWMP may account for 0.39-0.57 M€/year according WM availability in the forest, adding a 7 - 21% economic value the timber production in the province of Vicenza.

Introduction

The collection of wild mushrooms (WM) have been recorded at global scale as a extensive forest human activities in forest areas (Boa 2004). However, WM picking affect several other fields od interests like multilevel trade, law and property rights, rural economy, social science and lastly as forest tourism. Especially in the northern hemispheres, several works studied the role of commercial WM picking as first step to fulfil the international demand of WM (Chang 2006, Yang et al. 2008) or to meet the needs of local consumption and traditions (Pieroni et al. 2005, Winkler 2008, Voces et al. 2012), as well to study the extraction of particular chemical for medicinal reasons (Shu Ting 1999, Ikekawa 2001, Dai et al. 2009). The commoditization process of WM has been the consequence the massive market demand in several very densely populated areas. Core countries for the international "WM market demand", like Italy (Sitta and Floriani 2008), and Japan (Redhead 1997), have established similar economic patters to meet the request of their WM industry, unable to have sufficient rough material in the internal market since early nineties (McLain and Jones 1991, Schlosser and Blatner 1995). This was due to the rapid welfare growth that changed working condition on rural areas, moving people out from agriculture and forest sector. Whether on one side the lack of professional WM pickers caused the deficiency of WM availability for industrial processors, it allowed, on the other, the creation of a new forest demand based on recreational wild mushroom picking (RWMP): a rather new type of forest request for forest managers core issue of the present work.
WM picking brought also problems for the policy makers. Since commercial WM picking appeared, several countries started to argue about the picking sustainability, as well the implementation of a legal system to regulate forest access rights. (Dyke and Newton 1999) reported the effect of WM picking on the Scottish

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forest, where WM were collected in private and public land regardless WM ownerships, practically belonged by the land owner, but considered a commons goods by the picker side. The missed benefit transfer, generated several conflicts, as (McLain et al. 1998) similarly described the situation in the US Pacific Northwest. Moreover, another important issue has been the knowledge and habits transfer during the migration. The massive Italian and Chinese emigration flows to California brought a new habit that combined with the better standards sparked the RWMP (Arora 2008). The state was forced to introduce picking permit fee and legal constrains to stem the huge mass of Italian-American and Chino-Americans pickers enforced since nowadays. Though in the common law countries was relatively easy to modify the WM pickers access right because of the full recognition of land rights, in the countries where civil code system was enforced it has been rather difficult to implement any property right changes. According to the limits set up by the one's national Constitution, property rights might recognize the full land property right or just a part. The political sensitivity, together with the great number of people involved, has been a major constrain for the policy makers reluctant to change WM property rights. The variety of the each national legal streams addressing to this issue is enormous and it changes form place to place (Merlo and Rojas Briales 2000), waving from pure public goods in the northern countries, where everyman's rights on WM picking (Saastamoinen 1999), to full private land rights as in Italy and Spain, when forest owner "express" (generally with labels along property edge) "*the will*" to extend the property rights also on a specific forest externality such as WM and general non wood forest products (NWFP). Despite the complexity of each legal system, the concept of "*expressed will*" has been used by forest administration several times to avoid any monetary transfer because nobody do it, especially here WM picking permit fee is establish. On the other hand, this mechanism allowed forest owners to draw up contracts or sell private permit fees to WM pickers, either professional or recreational. Some examples have been recorder in Italy, along the Val Taro Valley, and Spain where some land owners built up WM reserves[2]; in general infrequently implemented in the forest sector with regards the most common practice: the free WM picking.

While legislation has evolved slowly towards the recognition of WM picking as a forest output (Alexander and Roger 2003), a new market approach has started to appear among forest managers willing to stimulate forest revenues by enhancing WM income. Based on the direct link between the WM picking permit fee and the improvements of forest management practices suitable to enhance WM production in forest, in British Columbia (Canada) or in Borgotaro Valley (Italy), forest managers built up a market-based mechanism to ensure high productivity standard on its forests (Berch et al. 2007, Pettenella and Kloehn 2007). Thanks to the results of a particular WM silviculture, forest managers were able to increase WM productivity in the forest and fulfil at the same time the increasing demand of commercial and RWMP. Moreover, the high quality WM production generated withi this approach since the past, allowed to the WM of Borgotaro Valley to be labelled with European protected geographical indication (PGI). Thought they represent a sort of limit cases, they helps to understand the ratio that legitimate WM picking permit fee, as potential revenue for the forest owner willing to step into WM production.

Estimation of forest management costs and the assessment of WM pickers' willingness to pay (WTP) for WM forest improvement allow to move the attention from legal and political aspects to active WM management, based on an economic dialog between the parties. Since forest WM production have been studied with some good results, for example on specific scot pine silviculture for *Lactarius deliciosus* and *Boletus edulis* (Giovannetti et al. 1998, Bonet et al. 2004, Martínez-Peña et al. 2012) or the enhancement of *Tricholoma magnivelare* production through forest cutting and litter regulation (Luoma et al. 2004, Luoma et al. 2006), the assessment of costs and benefits analysis have been improved considering the introduction of specific forest management techniques (Alexander et al. 2002, Palahi et al. 2009). On the demand side, several methodologies may be applied. Studies coming from Spain estimated RWMP access costs to forest (de Frutos et al. 2009) and WTP (Brey et al. 2007) to understand the pickers utility once a new WM management is enforced with an additional cost. The same approaches might be use to improve actual WM management once is already implemented (Tempesta 1996) helping the policy maker to redefine the WM picking fee base on the probability to have successful picking and time spent in forest. Other approaches have been used by (Cai et al. 2011) to assess the fear selling price by commercial WM pickers involved in the WM industry. Nevertheless where any WM picking activity is formally organized and recorded, the simple accountability may highlight trends and actual value of WM economy as reported in this paper.

[2] "*riseva di raccolta*" in Italian or "*coto de setas*" in Spanish

Forests management, legal system, multi scale market, and cultural knowledge are all factors involved a simple but extensive forest activity like WM picking. Unfortunately, the lack of data is another factor that characterized this sector and it has limited the study of wider perspective on the future outcomes.
The paper will focus on the wood market as proxy to identify trends and changes on WM market in Italy. Moreover a comparison between RWMP income and traditional wood gross production will be addressed through six case study in the province of Vicenza (North East Italy) over the last decade, in order to highlight the effect of different governance mechanism over the RWMP income. Aside the general introduction on WM picking and the conclusions sections, the paper is organized in four parts. The *first* describe briefly the methodologies and protocols we develop to collect the information. In the *second* part, the Italian timber production trends over the last 60 years are presented. The *third* part introduces the Italian WM sector and the changes transformed the sector in the last three decades: the market and the WM demand, as driving force of the change, the legal system implemented to manage the WM pikers and the implementation within the Veneto WM regional law of the national principle. In the *forth* part, some preliminary results are presented to compare some case-studies studied in Vicenza province about RWMP, in terms of profitability for the forest manager.

Methodology

The ratio beyond this work have been developed to explain the behaviour change among the Italian WM pickers, moving from a commercial toward a recreational WM piking. Basically, we investigated in three main aspects: i) trends and dimension of timber and firewood production as capital source for WM and in general NWFP production; ii) trends of commercial WM production and import; iii) and finally the economic dimension of RWMP in Vicenza province generated thought different WM governance approach.
The first two aspects involved the simple trend description of the main forest indicators (Forest Europe UNECE and FAO 2011) like forest surface, timber and firewood production, gross marketable production and forest productivity, based on the data series of Italian forest sector (ISTAT 2012). WM import series has been built with of (Eurostat 2012), merging quantity data from six commodities (see Table 1) according to previous studies (Zuchegna 2005, Stevens et al. 2008).

Table 1: Commodity code for WM import

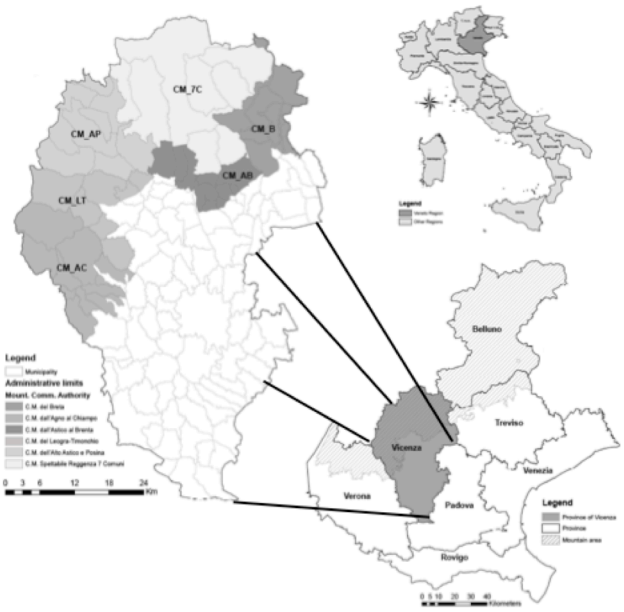
	CN8 – HS8 Codes	
Commodity	**Valid from 1988 to 2001**	**Valid from 2002 to 2050**
Fresh and Chilled Chanterelles	07.09.51.30	07.09.59.10
Fresh and Chilled Flap Mushrooms (ceps)	07.09.51.50	07.09.59.30
Other WM	07.09.51.90	07.09.59.90
Dry mushrooms	07.12.30.00	07.12.39.00
Dry *Auricularia* spp.		07.12.32.00
Dry *Tremella* spp.		07.12.33.00

Source: (Eurostat 2012)

Moreover, several information has been also collected informally during filed work, from local WM processors and traders, which help to interpretation and confirm of the WM market trends.
Moving to the third part, the study was carried out in the Province of Vicenza in each Mountain Community Authority[3] (six in total) (see), North East Italy. Characterized by large forested upland and humid valleys, the mountain areas have been always subject to WM harvesting due to the large population, accounting for 0.87 million dwellers. Since a regional WM law[4] implementation in Veneto region, few studies have addressed RWMP population. Being part of the sensitive information, Regional, Provincial, (MCA) and Municipal administrations ask to create a formal data collection protocol, to fulfil the requirements of privacy law.

[3] Mountain Community Authority is a intermediate embody between municipality and province deputes to administrate several municipal services (forest, waste, water, electricity, urban planning, etc.).
[4] R.L. 23/96 was implemented to register the RWMP; from January 2011 the law have been modify due to high cost of the bureaucracy, hence the registration is not anymore compulsory for RWMP.

Figure 1:Maps of the case study area: Vicenza Province and the six Mountain Community Authorities



Basically, we send 27 formal requests to the Regional Government, the Provinces (7 in total) and the MCA (19 in total) asking their forest and WM accountability and the list of pickers[5]. From their first feedbacks we forward the same request to the municipalities (21 in total) or private forest owner (1 in total) that managed directly the WM resources. Due to the large number of RWMP recorded (more then 0.2 million in Veneto Region) and the missing information about WM and forest revenues accountability, we decide to scale down at provincial level and pick up the most significant case: Vicenza province. Insofar, just one private real estate have applied for WM reserve, but due the limited quantity of WM produced and the WM management of the owner based on self WM collection , we decided to leave it out from the present work. Finally, the data have been grouped at MCA level basically the most common WM resources manager.

The data collected have been used to compare the traditional forest income (gross revenues from wood production) with WM income by selling RWMP permits. In order to be compared, all the income data (gathered in real value) have been transformed in "*current value*" according to the methodology suggested by (ISTAT 2012). Moreover, the RWMP municipal density have been calculated and mapped to highlight potential linkages between RWMP and forests: basic knowledge to address new WM policy advise.

The timber production in the Italian context: trends from the Fifties to nowadays

The decrease of traditional forest profitability is not a recent issue in Italy as well as in other European countries. Rural depopulation, together with the drop in wood prices, have triggered land abandon with the dramatic reduction of forest management practices, with negative consequences for rural areas over the mid-to-long-term especially in the Mediterranean countries (Forest Europe UNECE and FAO 2011). The need of innovative economic opportunities based on forest output differentiation and coordination continues to be a touchstone for many scholars (Rametsteiner et al. 2006). Nevertheless, this key-issue still triggers the debate in the Italian academic and professional communities due, on the one hand to the continue decrement of timber value, and on the other hand, to the specificities of Italian context (Gatto et al. 2009). In Italy, possible innovative solutions to the decreasing profitability of forest activities have often crashed into the current institutional and legal framework, basically built over a stiff top-down "command and control" approach where the public institutions play a relevant direct role in managing forest resources – thus leaving limited room to private-leaded initiatives or alternative forest management system as in the central Europe. The low effectiveness of multi-level, multi-sector and multi-actor coordination is an important limiting factor in the forest sector development and its financial viability within the country (Pettenella and Romano 2010). Here, the shift from government to governance in timber and NTFPs management, harvesting and commercialisation would be needed for rebalancing the use and management of forest resources among stakeholders (private and public).

Looking at the Italian forestry sector, these aspects come up immediately. Italy has approximately 30% of the total land area covered by forest (depending on the source of data, the range is between 9.1 to 10.4 M ha) (ISTAT 2009, FAO 2010), mainly (95%) concentrated in mountain and hilly areas. Slowly increasing since the II post-World War (Figure 2), the extent of forest is one of the key factors to understand forestry in the Italian peninsula. Between the two World Wars the households low income and the lack of job opportunities forced the exploitation of many remote areas, leading a general forest conversion mostly into grassland by the continue coppicing of broadleaf forest, extensive pasture and agricultural activities. At the same time, the

[5] The lists contained: the picking badge number, the validity dates, age and gender of the RWMP, and the municipality.

Italian autarkical program stimulated the domestic timber production, introducing also specific and rigid limitations to the use of forest in order to reduce the risks of floods, landslides and soil erosion, especially in deep mountain areas. The process ended up after the II World War, when general government reorganization and the Marshall's plan allowed the creation of alternative job opportunities and the Italian economic development. In the years, the growth of industry and building sectors, together with the demographic growth and urbanization processes, resulted in rural area abandonment and forest natural expansion. Also the progressive reduction of agricultural profitability and the lack of welfare enhancement in rural areas lead to an increment of 20% of the forest area in Italy in the last 60 years (ISTAT 2012). The migration from rural to urban areas did contract also the timber production (see Figure 3), especially on the private land due to the highly fragmented real estates (Canton and Pettenella 2010) split from large latifundium after the second post war. Nevertheless, thanks to the compulsory management of public land, timber production decrease mainly in economic value, while fuelwood production has stated again a constant growth since the first oil crisis during the early seventies. On the contrary, the gross marketable production (see Figure 4) as well as productivity (see Figure 5) got negative trend. The foundation of the European Economical Community (EEC) and the liberalization of the international market, together with the growth of wood industry (based on in furniture production and export), the micro-scale private forest ownerships and the rigid legislation on forest protection for reducing the hydro-geological risks, stimulated the roundwood and fuelwood imports, pointing out the structural inefficiency of the forestry sector. By looking at the GMP (see Figure 4) as an indicator of the economic pattern of forestry in Italy, three main peaks, corresponding to the economic crises in the Seventies, Eighties and Nineties, can be identified. Nevertheless, the general trend is clearly negative, especially in two macro-regions, North-East (NE) and North-West (NW), leaders in terms of productivity, GMP and specialized in roundwood production, but unable to compete with increasing competition coming from the international market. The Central (C) and South (S) macro-regions, less specialized in high added value timber products, were able to maintain and even enhance the level of their production based on firewood. Thanks to the mechanization of coppice forest management and harvesting practices (Picchio et al. 2009, Zimbalatti and Proto 2009) and the upsurge of oil (fuel) price, they have the highest share both in productivity and GMP (see Figure 4, Figure 5).

Figure 2: Forest area (M ha) in Italy, 1950-2006 by macro regions (NUTS1)

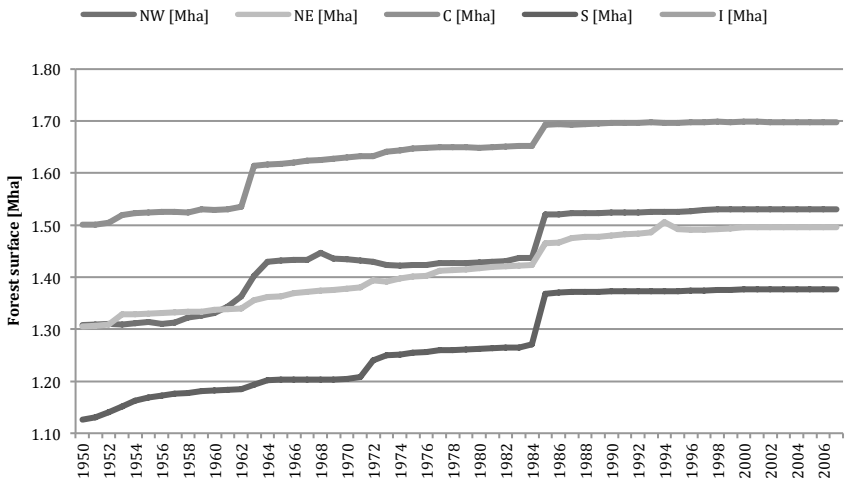


Figure 3: Timber and firewood production (Mm3) in Italy, 1950-2006 by macro regions (NUTS1)

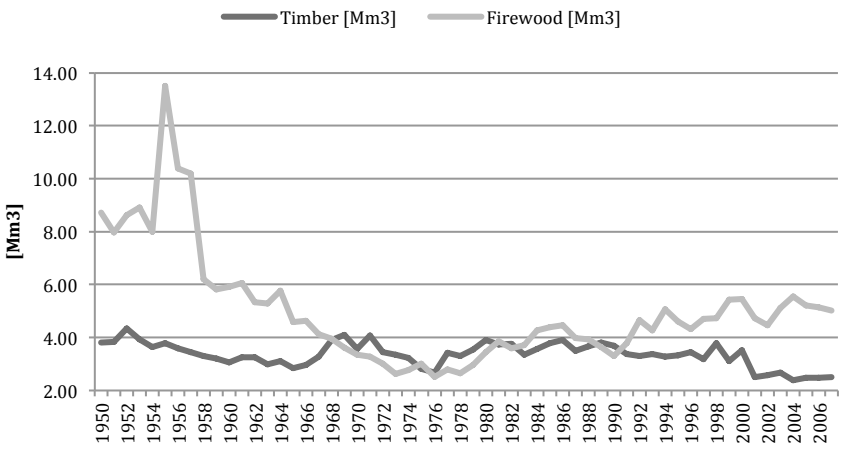


Figure 4: Gross Marketable Production (GMP) (M€) in Italy, 1950-2006, by macro regions (NUTS1)

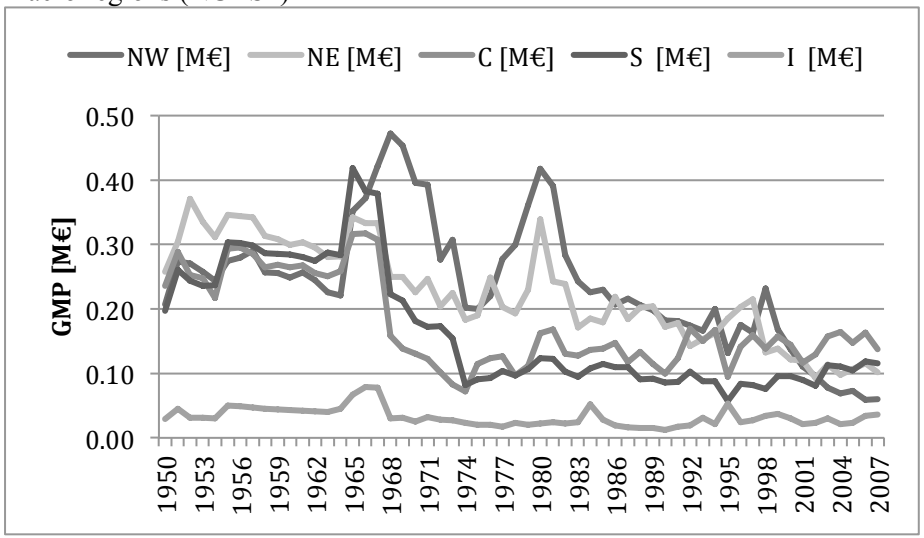
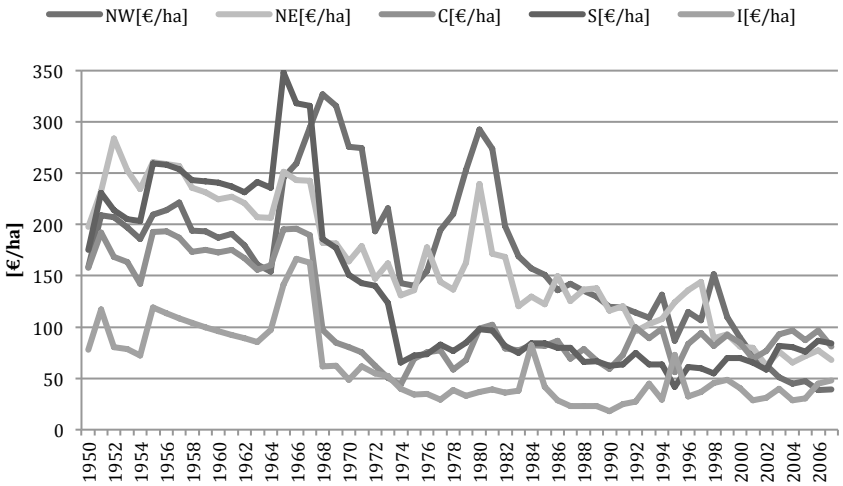


Figure 5: Forest productivity (€/ha) in Italy, 1950-2006, by macro-regions (NUTS1)



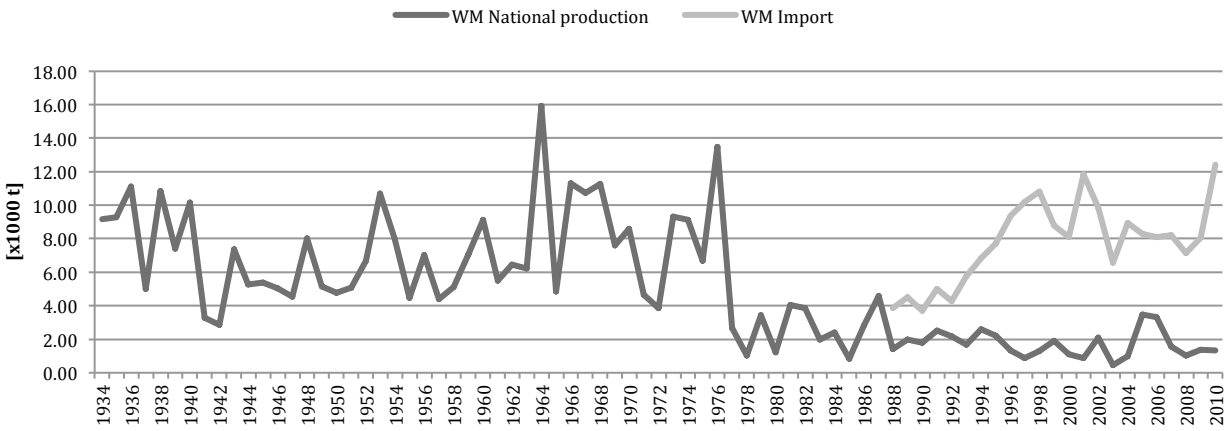
Note for Figure 2, Figure 3, Figure 4, Figure 5. North-West (NW) = Valle d'Aosta, Piedmont, Lombardy, Liguria; North-East (NE) = Trentino-Alto-Adige, Veneto, Friuli, Emilia-Romagna; Central (C) = Tuscany, Umbria, Marche, Lazio; South (S) = Abruzzi, Molise, Puglia, Basilicata, Campania, Calabria; Islands (I) = Sicily, Sardinia. Source: our elaboration based on (ISTAT 2012)

The limited capacity of policy-makers to have a long-term overview, the historical deep-roots of the Italian forest law oriented to soil and hydro-geological protection and other country-specific characteristics made the unprepared Italian forestry system unable to catch new opportunities. Among the key-factors in determining the current situation it is worth to mention at least: (i) the decentralization process began in 1977, when the central government let the 21 Italian Regions to lay down their own local forest laws within an out-dated national forest policy (Carbone and Savelli 2009); (ii) the unclear roles in legal framework and institutional setting, with the continuous redefinition of competences of Ministries and other central agencies in charge of forestry (Pettenella and Secco 2004); (iii) the lack of effective institutions for horizontal and vertical coordination, e.g. with regards to European institutions or international forest agreements (FAO 2005); (iv) the lack of "direct and coherent involvement of the forestry research community" (Carbone and Savelli 2009)in defining national forestry policy, led by competences/responsibilities overlapping and underling role of research to politics; and finally (v) the underestimation of the forest sector economic value by the government (Pettenella and Romano 2010). Coming up with this negative forestry framework it may transpire why WM and in general NWFP, have been an alternative income source for rural population.

The WM in Italy: from production to recreational WM picking.

Italy is a mycophilic country, accounting a long traditions handed down since the past. Before the 1900, Italy was consuming and exporting WM along the trade flows of Venice and Genova. The fist data officially recorded by the national statistical institute (ISTAT) were noted in the 1934 (ISTAT 2012). As we reported for the forest sector, commercial WM picking was linked with the rural economy; therefore the trends of timber and firewood production go over again in the WM production (see Figure 6). Despite the typical fluctuation of the WM production, after the seventies there has been a first collapse of the internal production, creating an internal deficit filled up only in the late '80s with a massive import of WM. Among the imported WM, fresh, frozen and dry ceps (*Boletus edulis*) have represented from 39 to 89% of the total weight.

Figure 6: Italian WM production and import (NUTS0)



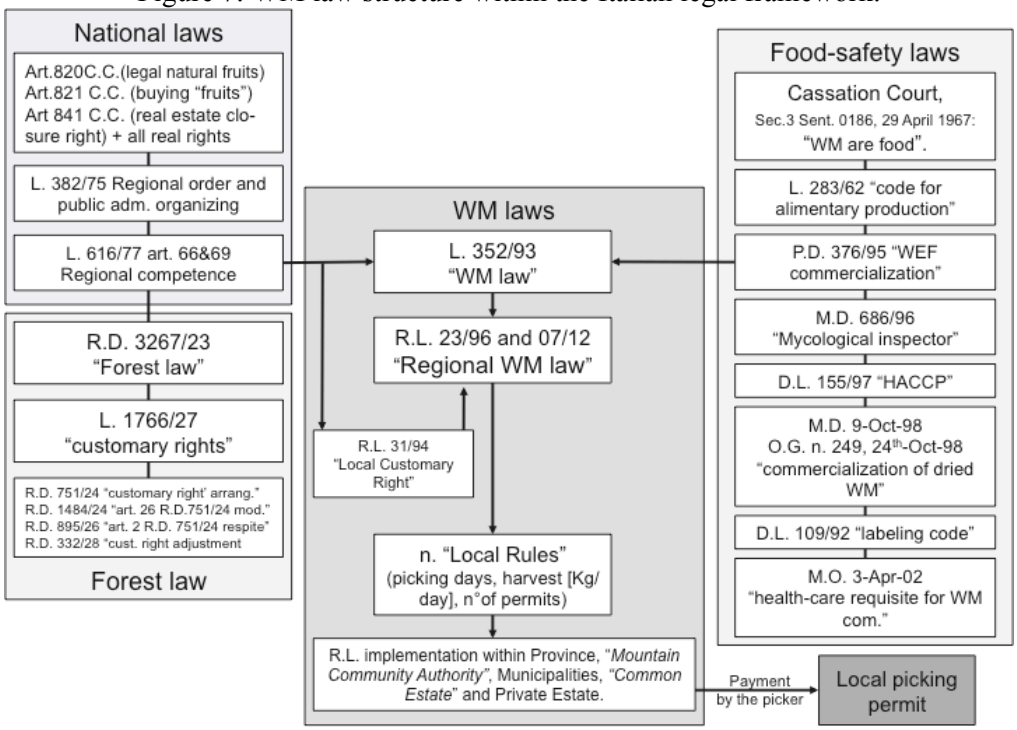
Note: the import curve considers fresh and chilled chanterelles (HS8 code 07095130, 07095910), fresh or chilled flap mushrooms (HS8 code 07095150, 07095930), other WM (HS8 code 07095190, 07095990), dry WM (HS8 code 07123000, 07123900), the genus *Auricularia* (07123200) and the genus *Tremella* (HS8 code 0712330). Source: (ISTAT 2012) for WM Italian production; (Eurostat 2012) for trade between 1988 and 2010.

At the same time, people improved their life standard and they stated to collect WM as a recreational activity competing with professional WM pickers. Evidence of this widespread phenomenon have been described in the preliminary report[6] of the law 352/93 (the mushroom law) aiming to solve the rights conflicts between

[6] Law draft n. 226, 20th May 1992: law report.

professional and recreational WM pickers as well with real right holders[7]. Going back to Italy, also customary right holders were addressed by the law that point out the important role of saving traditions on the use of WM. Basically the national law 352/93 stated the full property right of the landowner, that has anyhow to manifest its willing, labelling the edges of the forest. WM, considered at that moment a forest externality (*Res Nullius*), becames effectively semi-private goods. Moreover, it set up particular standards for boletes or cep importers, till today a sort of pillar to determine product class quality at international level. The law was a merging point of several concepts contained in other decrees of forest and food sector. In this context, a lot of attention have been given to RWMP in which the legislator want to ensure the sustainability of the WM use, setting up harvesting limitations in order to reduce their harvesting impacts. Afterwards, due to a devolution process, the Italian Government delivered to the Regions the responsibility to control and regulate the WM and maintain the local customary rights especially in mountain areas. Each regions, within the limits of the national WM law, set up its own WM management system. Figure 7 represents the structure of the national WM national law, coordinated with the Veneto's regional WM law, where concepts contained in three main legislative topics have merged. The results was a complex law in which forest and alimentary prescriptions have been set up for different groups of WM pickers.

Figure 7: WM law structure within the Italian legal framework.



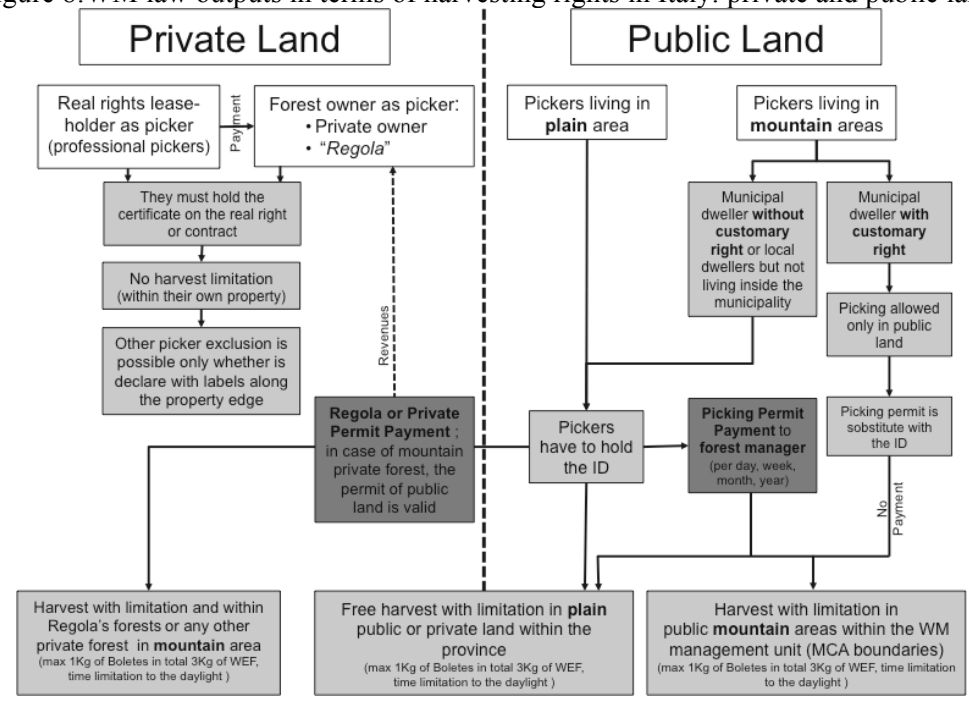
Note: Abbreviation: O.G.=Official Gazette; C.C.=Civil Code; L.=Law; D.L.= Decree Law; M.D.=Ministerial Decree; M.O.=Ministerial Ordinance; P.D.=Presidential Decree; R.D.=Royal Decree; R.L.=Regional Law

The overall effect of the national WM law implemented in Veneto Region (similarly to other regions) was the differentiation of WM pickers, with a clear distinction between professional and RWMP. Due to the several restrictions and harvesting rights we summarized schematically the main categories of pickers and their rights (see Figure 8). On one side, real right holders can pick up WM just bearing a certification of the property or the contract, and they may exclude other pickers with the application of labels along the property edge. On the other, RWMP are differentiated in three: i) living in plain areas, ii) living in mountain and holding customary rights iii) and lastly pickers living in mountain area without customary rights. So, holding the ID, pickers can go to pick up mushroom freely in plain or purchase a picking permit for mountain areas. Before 2012, the these permit were all recorded within a picking badge, but after the implementation of Regional Law 07/12, the regional WM authority remove the WM picking badge, a sort of ID for RWMP,

[7] This social occurrence was not only an Italian problem, since it have been recorded also in the states where Italian emigrants entered. An example is US, where Californian government faced into the same problem manifest in Italy (Arora 2008) due to the invasion of Italian RWMP.

simplifying the payment mechanism with a direct compensation to the forest managers (private and public). Moreover, the harvest limit is set up to a maximum of 3 kg of WM and only 1 Kg of the most valuable WM species[8].

Figure 8:WM law outputs in terms of harvesting rights in Italy: private and public land.



Note: "Regole" are a type of community-based land quite well-represented in North-East Italy. In practice, it is a common private land owned by local families, where the rights/duties connected with the use and management of forest and grassland are shared by all residents. Some of them are ancient institutions, typically in mountain areas. Abbreviations. ID: Identity Card;WEF: Wild Edible Fungi.

The law did not addressed to the income let forest managers decide. So either private or public owner may use WM revenue as normal income. Thanks to this legislative gap, we searched the actual economic results in six MCA that adopted different WM governance methods based mainly on the control of RWMP forest access right as well on the revenue reinvestment: two major factors affecting WM revenues out of environmental parameters like summer rainfall and temeperature.

RWMP and Timber Production: comparison among six case studies.

A comparison between the levels of profitability for the two different forest functions, RWMP, and timber production, has been carried out in six case studies (the six MCA). Altogether the RWMP were 60111, accounting for the 6.9% of the Province population; 30747 in plain area and 29364 living in mountain distributed among the six MCA. Since RWMP is the most common forest paid recreational activity, it has played an important roles where encompassed within the forest management plan and put into effect, in organizational, silvicultural and marketing terms. In Table 2, we briefly introduce the general aspects that characterized the six MCA considered, representing the administrative embodies managing the mountain areas in the province of Vicenza. As already mentioned above, the forest managers have to respect only the minimal standards set up by the Regional WM law, such as sell the permits and keep the RWMP record, but nothing is specified about WM revenues use.
In order to compare the economic outputs between traditional forestry production and RWMP, we built a set of historical series on gross income, gross revenue per hectare. The data come the accountabilities of the municipalities, nevertheless the average wood price within the year and the time we consider (2000-2010) has had a minimal variation; this fact might be explained by the small dimension of the local forest sector,

[8] *Agrocybe aegerita, Amanita caesarea, Boletus edulis, Calocybe gambosa, Cantharellus cibarius, C. lutescens, Clitopilus prunulus, Clitocype geotropa Craterellus cornucopioides, Macrolepiota procera, Russula virescens* and all the edible species of genus *Morchella*, *Tricholoma* and *Polyporus.*

linked mainly with building construction and packaging (timber) or firewood production locally consumed. On the contrary, WM income has varied cause of the quantity of summer and autumn rainfall: one of the key factor that affects WM sprouting season.
Comparing the gross income of wood and RWMP, CM_7C is a core area in absolute terms for wood and WM, due to forest extension and the type of forest (see Figure 9, Figure 11). The high stand forests have generally a high added value compare coppice forest, so is generally much valuable than coppice forest; this may be seen also in terms of gross productivity per hectare (see Figure 10), but opposite figure comes up if we look the WM gross income per hectare (see Figure 12). While high stand forest needs a longer period to increase WM (Perini and Laganà 2004, Salerni and Perini 2004) and lengthen of the forest turnover, coppice forest is generally more reactive (Giovannetti et al. 1998) if silviculture practices aim to replace old stumps and keep young the forest. Moreover, broadleaf forests have longer sprouting season, with a large variety of edible WM, while coniferous forests have a smaller WM season that in relative terms, gross income per hectare results lower. For instance, CM_LT promote active forest management with general investments on forest silviculture techniques that aim to enhance the chestnuts productivity (Marcolin et al. 2012) and beeches stability (high stand forest), indirectly it allow to have better performance also in relative terms for WM gross income (see Figure 11, Figure 12); comparable or even higher than very attractive WM area such as CM_7C. Also in the case of CM_AP, despite the low wood productivity per hectare, the active management of coppice forest enhanced the WM production.
Low forestry level like in the case of CM_AC may result in a relatively good WM income performance, but this is due to the local WM collection habits, linked to the collection of *Armillaria* species, generally sprouting in abandon, degraded forest or after the forest cuts. According to the information gathered by the local forest manager (MCA) land abandon has been the cause-effect of this WM income performance, decreasing in the time due to the progressive forest depletion.

Table 2: Main features related to WM collection in the six MCA

Case-study code	**CM_7C**	**CM_AB**	**CM_AC**	**CM_AP**	**CM_B**	**CM_LT**
Name of the WM manager	CM dei 7 Comuni	CM dall'Astico al Brenta	CM dall'Agno al Chiampo	CM dell'Alto Astico e Posina	CM del Brenta	CM del Leogra e Timonchio
Type of embody	Public coordinator	Public coordinator	Public coordinator	Public coordinator	Public coordinator	Public coordinator
Forest surface	30333 ha	4557 ha	13163 ha	23460 ha	11432 ha	10008 ha
Public land	81%	41%	11%	12%	31%	5%
Main forest management	High stand and coppice	High stand and coppice	Coppice	Coppice	Coppice	Coppice and high stand
Number of recorded pickers (total n.)	6612	1515	6404	3042	2960	8831
Daily picking permit (average)	16700	n.a.	423	2772	n.a.	304
Month picking permit (average)	296	n.a.	167	184	n.a.	233
Annual picking permit (average)	1099	n.a.	1131	1114	n.a.	2288
Cost of picking permits for non residents[9]	daily 8€; monthly 42€; annually 77€	daily 6€; monthly 17€; annually 32€	daily 5€; monthly 20€; annually 40€	daily 6€; monthly 30€; annually 77€	daily 6€; monthly 30€; annually 60€	daily 5€; monthly 35€; annually 50€
Main WM collected[10]	*Boletus* spp; *Armillaria* spp.	*Boletus* spp; *Armillaria* spp.	*Armillaria* spp.	*Boletus* spp; *Armillaria* spp.	*Armillaria* spp.	*Armillaria* spp. *Boletus* spp.
Level of field control on picking	Constant during the WM season	Very low	Frequent during the WM season	Constant during the WM season	Very low	Frequent during the WM season
Investments in forest for WM	Some investments on WM resources management.	No or scarce (one in 2011)	No or scarce	Indirectly. Investments to keep active forestry	No or scarce	Indirectly. Investments to keep active forestry

Source: own elaboration. CM= "*Comunità Montana*" authority, in English Mountain Community Authority (MCA).

Silviculture is an import aspect for WM production in forest, but alone standing, it may have undesired effects. In fact, low RWMP control (see CM_AB case) may results in a low WM income, due illegal picking, which is a self-feeding behaviour. Nevertheless, there are also areas like CM_B not very productive in terms of WM production because of the rugged topography. We also mapped and compare with RWMP

[9] Generally, local residents without customary rights may purchase the WM picking permit for half price.
[10] Several other mushrooms are collected.

distribution as rate of municipal population and the average WM gross income (see **Errore. L'origine riferimento non è stata trovata.**Figure 13). The results show a clear linkage between RWMP density and the most productive WM areas (CM_LT, CM_7C, CM_AP), while lower presence are recorded where there is low attention on RWMP. It is worth to mention that local customary rights affect only to a minimum the RWMP income, because the majority of the pickers usually purchase the picking permit for the surrounding municipalities, where they cannot claim their customary rights.

The results highlight the concept of forest active management with a cause-effect link results between active silviculture in coppice forest and RWMP. Nevertheless, local RWMP governance is fundamental to achieve good economic results in all the forest output. The RWMP control may enhance the WM gross revenue for the forest manager, but without an investment on forest sector, it may generate a contrary effect. In fact, the case of CM_AC highlights this phenomenon, with a constant decrement of WM gross income along the time. Among the reasons that take RWMP in the forest, the change to have good picking experiences is fundamental and it represents a core issue on RWMP governance. According to (Tempesta 1996), the chance to have good picking determines also higher willingness to pay and consequently a wider margin for the forest manager that justify the picking permit price increment, as occurred in the case of CM_7C and CM_AP. These trends confirm empirically the comparison between Italian wood and WM market. In fact the land abandon, common issue in Italy, together with the political changes in EU, are among the causes of market dumps and low productivity, typical scenario of the late seventies for WM and timber market.

RWMP may be a driving force for the local development as it happened in the case of "*Borgotaro Consortium*" (Regni 2005, Pettenella and Kloehn 2007); place where local economy exploited, not only the RWMP, but mostly the ability local stakeholders to provide a wider range of forest and non-forest activities, interlinked with WM resource. In fact, local forest managers consolidated RWMP through the creation of a complex network[11]. The forest silviculture have been coordinated within the local context, through the integration of a wider number of stakeholders like touristic agencies, restaurants, other agricultural producers and international WM traders to fulfil the huge demand of WM, generally activities horizontally integrated. WM in Borgotaro were much more than a commodity or recreational service and they represented the key-component of a larger network based on the concept of "*territory*", with the WM as a brand (*imago product*) (Secco et al. 2009). The result was the increment of WM gross revenue. In fact, the Consortium was able to provide a consistent portfolio of products and services, while the contribution to the local economy was impressive: from permits selling the Consortium is able to gain about 420,000 Euro/year (approximately 18 €/ha) and an additional 2.8 M€ was estimated as total income deriving from WM tourism in the area (Pettenella and Kloehn 2007), approximately 120€/ha (excluded wood production).

[11] In this context, the definition of network by (Human and Provan 1997) – modified is referring to: "An intentionally formed group of small- and medium-sized firms in which the firms: 1) are geographically proximate; 2) share some inputs and outputs, and 3) undertake direct interactions with each other for specific business outcomes. The interactions may include joint production, new product development, collective marketing and employee training"

Figure 9: Wood gross income in thousand euros (2000-2009)

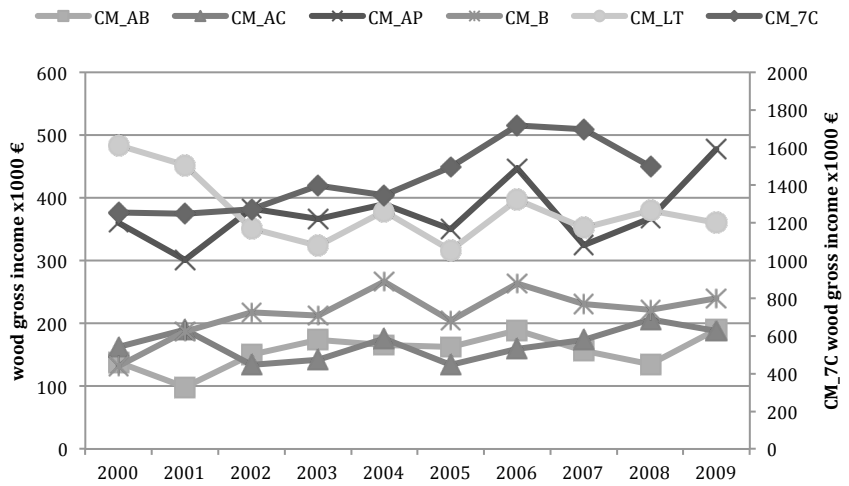


Figure 10: Wood gross income per hectare (2000-2009)

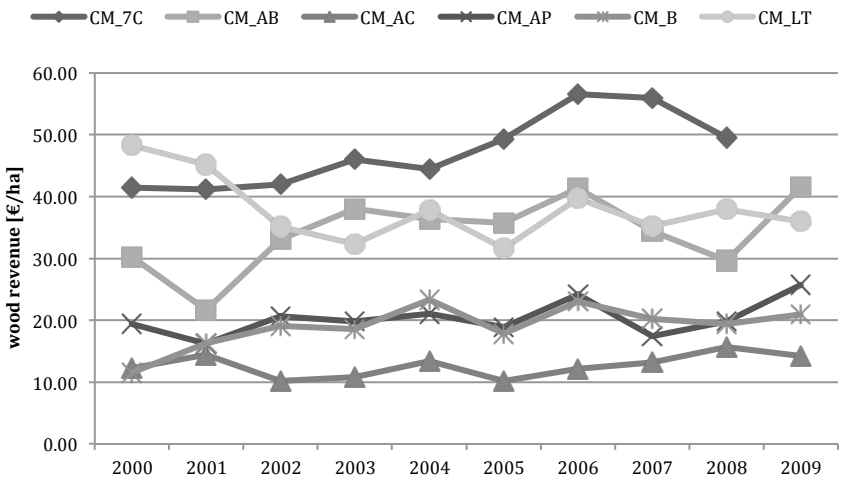


Figure 11: WM gross income in thousand euros (2000-2010)

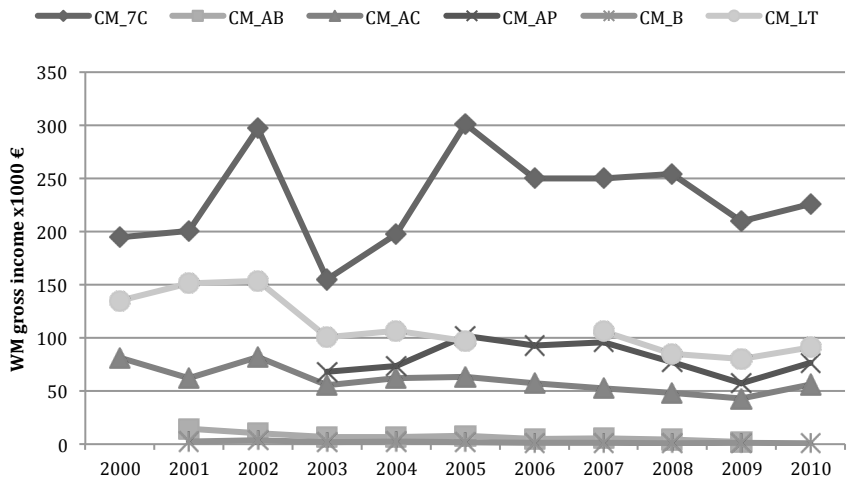


Figure 12: WM gross income per hectare (2000-2010)

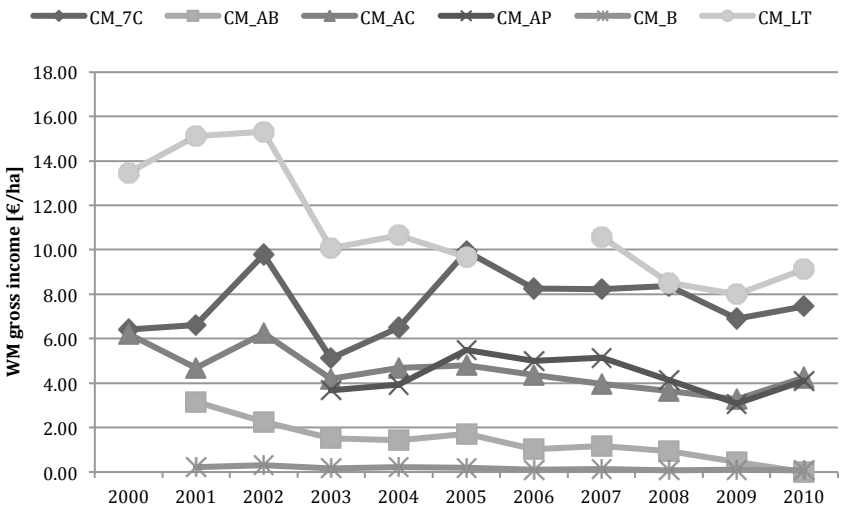
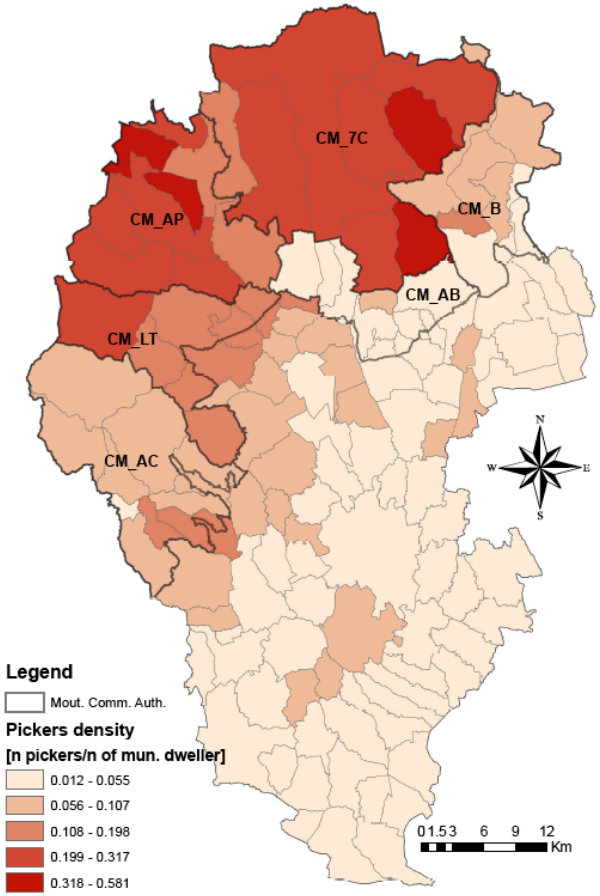
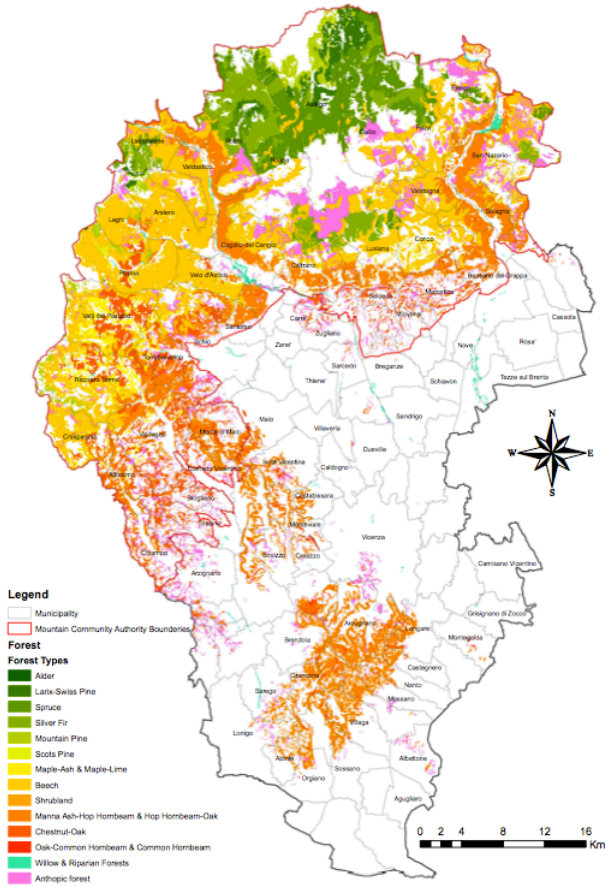
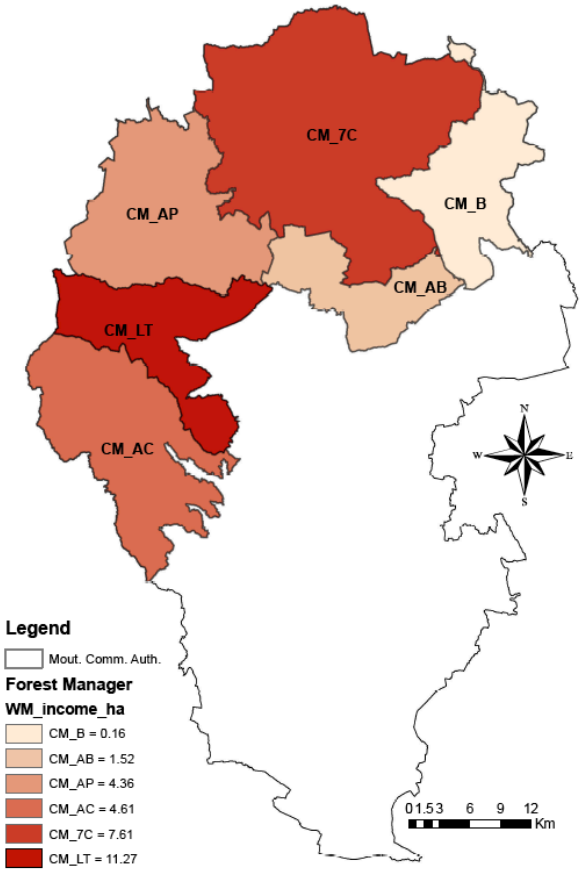


Figure 13: RWMP and average WM gross income: visual distribution

The case of recreational mushroom picking in Vicenza Province

RWMP distribution as rate of municipal population	**Forest types**	**Average RWMP income per hectare**
		
Note: Pickers' distribution	Note: the majority of symbiotic mushroom (Boletus spp) are produced in from green to dark yellow forest areas (coniferous, beech and chestnuts forests), while orange and other colour area are less productive.	Note: average mushroom income per hectare by forest managers (MCA). High values occur where silviculture is active.

Conclusions

While a general failure of the forest sector on the production of high added value timber products can be recorded, wild mushroom resources represent now an interesting forest output for the forest managers. Unlike wood production, mushroom production is characterized by great variability in the annual yield, which is linked with a high perishability requiring timely collection and marketing strategies. These characteristics, combined with the lack of knowledge on new silviculture techniques among the practitioners, make difficult to integrate forest managers with WM production.

The positive commercial trends of RWMP in the last decades, together with the high WM profitability at forest level should thought as a new milepost in the future forest management plan. Focusing on the potentials and challenges for enhancing new types of forest-based business, like WM resources to forest owners, it seems the organizational model is one of the most important key-issues: from our preliminary findings, levels of profitability depend on the how a give resource like WM is consider, managed and coordinate with the other forest outputs; hence the most advanced level of profitability from WM are reached through networks models. Despite the annual revenues of about 0.45 M€ of the whole WM gross revenue in Vicenza province (~88000ha), the same amount of revenue have been achieve in a smaller area 33.000 ha through a well-structured organisation of the value-chain based on territorial marketing initiatives.

The case studies in the province of Vicenza, where no or few forest investments have been done or neither controls on RWMP, the income from this type of products is even more limited and decreasing. On the contrary, the "*net-system approach*" enhances the local values, increasing as well the local economic resilience basically starting from creating or consolidating ties among the different players of the supply chain. By improving the local governance mechanisms, by introducing innovative private-public initiatives based on stronger relationships among wild mushroom-tourism-forest, by enforcing and locally adapting forest and wild mushroom laws/regulations, by re-organising in networks the value chain, and by creating mutual trust among the involved actors (where not only commodities are provided as output but also relational goods), rural communities would have the possibility to improve their market position and invert the decreasing trend of their forest profitability.

It is worthwhile to mention that property rights regulations are important, indeed, for pickers and forest owners, but more important is the chance of entrepreneurial innovation. Nevertheless, even if the development of a WM business represents a potential opportunity in the rural scenario, it cannot always be considered "*the*" solution for rural communities problems, such as employment opportunities. The strong dependence on climate seasonality and instability makes mushroom production inconstant and time-limited (two-three months) along the year. Only a very well structured system, based on diversification strategies and a large portfolio of products and services, may allow to maintain permanent jobs and guarantee acceptable stability. However, indubitably RWMP contributes to the diversification of rural economy, and indirectly supports an active management of landscape. The straight involvement of the different actors guarantees the sustainable use of the resource, and in order to do this, part of the revenues are reinvested in forest and forest management. Moreover, larger stakeholders participation into WM business not only would favour the local entrepreneurship growth, but also the mutual control of all the partners involved in resource management.

In Italy and Europe, specific and detailed RWMP case-studies are lacking. Additional research would be needed in estimating trade-offs between RWMP and other recreational forest uses. The complexity of inter-relationships occurring among the different aspects connected with WM uses in rural areas (i.e. economic activities, natural resources management, mushroom biology, social demands, etc.) requires interdisciplinary communication and cooperation.

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8. Paper 3: Income generation from wild mushrooms in marginal rural areas.

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Income generation from wild mushrooms in marginal rural areas

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ABSTRACT

Harvesting wild edible fungi for recreation, home consumption or to supply small local markets has traditionally been a popular activity in rural Finland. Yet some species, such as ceps (*Boletus edulis*) and pine boletes (*Boletus pinophilus*), which are well appreciated in Southern Europe, were not exploited commercially. In the past decade, international trade in previously unused mushroom resources has increasingly provided rural communities with additional earning opportunities. In this article we document the emergence in Eastern Finland of a wild edible fungi industry, describe its value chain, and assess its significance as a source of income for disadvantaged rural dwellers. The data for the analysis were collected through interviews with the management of Finland's largest wild mushroom business, and an extensive survey of the pickers who supply the company.

1. Introduction

Over the past two decades, interest in commercial harvesting of wild edible fungi (WEF) has increased considerably in many regions (Monserud et al., 2003; Merlo and Croitoru, 2005; Pettenella and Kloehn, 2007). In most cases, this happened as expanding markets for specialty products, decreasing wood prices and restrictions on logging made the economics of wild mushrooms more attractive (Alexander et al., 2002; Palahí et al., 2009). In some forests the market value of wild mushrooms may well be as high as that of timber (Pettenella and Secco, 2006). Indeed, several countries have attempted to promote the emergence of a WEF industry as a means of providing incentives for forest conservation and improving the earning opportunities of people living in marginal rural areas (Härkönen, 1998; Ortega-Martínez and Martínez-Peña, 2008; Kilchling et al., 2009).

Despite the growing interest in picking wild mushrooms in developed countries, in most cases the social, economic and environmental implications are largely unknown because of a substantial lack of data. Statistical information on volumes collected and values is patchy and often unreliable (Vantomme, 2003; Boa, 2004) and there are only a few published accounts of how the WEF industry operates. The region where commercial picking of wild mushrooms has probably been most thoroughly described is the Pacific North-Western United States (e.g. Schlosser and Blatner, 1995; Pilz and Molina, 2002). In Europe, few studies of commercial wild mushroom gathering could be located: Dyke and Newton (1999) surveyed pickers, buyers and landowners to assess the sustainability of the WEF industry in Scotland; in Northern Spain, De Román and Boa (2006) analyzed the extent to which a small rural community has been affected by the gathering and marketing of *Lactarius deliciosus*.

In this article we document the emergence of commercial wild mushroom harvesting in Eastern Finland, describe the industry's value chain and assess its contribution to rural development in an area where the population is slightly more than half a million, sparse and dwindling, and the rate of unemployment has historically been high compared to its national counterpart. In 2009, indeed, the unemployment rate in Eastern Finland, which until recently was designated as a less developed region under the European Union's regional policy, exceeded 11%, second only to that of Lapland, the northernmost part of the country (Statistics Finland, 2010).

In addition, a combination of external shocks (e.g. the Russian adoption of a wood export tariff in 2008) and long-term downsizing trends in the wood and paper sector have resulted in significant job losses in forestry and related industries, which traditionally represented a key component of the regional economy.

Our analysis devotes particular attention to the harvesters who gather the WEF from the forest, as they represent the vast majority of those involved in the industry. Even in developed countries, very little is usually known about the socio-economic characteristics of the pickers, their practices, and returns from the activity. With the aim of identifying how many and what types of people engage in commercial gathering of WEF, quantifying the time devoted to the activity and the amounts collected, and assessing the economic significance of this source of income, we ran an extensive survey of Eastern Finland's pickers. Our analysis has been facilitated by the presence in the area of Finland's largest WEF company, Dalla Valle OY.

Forest managers and researchers in several countries have reported that pickers are unwilling to share information about their activities because of a combination of jealously guarding good sites, awareness that they access the resource without a required

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authorization, and worries about possible changes in WEF regulations. In the specific case of Finland, friendly legislation leaves pickers with few reasons to be suspicious of inquiry. Under the so-called every-man's right, anyone is entitled to collect wild foods from a forest, irrespective of land ownership. Also, any revenues from the sale of their harvest are exempted from income tax.

Indeed, Finland's pickers of wild edibles have been the subject of a handful of studies. Once necessary for subsistence, collecting wild foods from the forests now largely represents a form of recreation. While its popularity is sometimes described as declining, the activity is still very common: more than one Finn in two appears to participate to some extent in the collection of wild edibles (Kangas and Niemeläinen, 1996; Saastamoinen, 1999). Most studies of pickers, however, have concentrated on berries, which are more widely collected than WEF (Saastamoinen and Lohiniva, 1989; Saastamoinen et al., 2000; Kangas and Markkanen, 2001; Pouta et al., 2006). A study specifically on the collection of WEF was carried out by Sievänen et al. (2004) using data from a large survey of outdoor activities conducted in the late 1990s. They observed that as many as 73% of Finnish adults possess the necessary skills to pick WEF (e.g. distinguishing edible from poisonous mushrooms, wandering in a forest without getting lost, a basic understanding of the forest ecosystem). While picking abilities are widespread, actual involvement and target species vary widely across locations, with Eastern Finland being the region with the largest share of WEF pickers (50% of the population). Picking effort is also found to respond to the abundance of the crop. Being closely linked to the weather, the availability of WEF can vary dramatically from one year to another. When the crop is poor, both the rate of participation and the number of harvesting trips to the forest appear to decrease substantially. Unfortunately, the study by Sievänen et al. (2004), consistently with its focus on recreation, produced little evidence on the commercial aspects of WEF collection. No information is available about the quantities picked, the share that is collected for sale as opposed to home consumption, and the earnings of the pickers.

The remainder of this article is organized as follows: Section 1 gives a brief description of the survey and outlines the methodological aspects of the subsequent analysis; Section 2 documents the emergence of a local WEF business; Section 3 presents the results and the discussion of our survey; Section 4 concludes.

2. Materials and methods

The operations and socio-economic impacts of Eastern Finland's WEF industry are described using information from two main sources: interviews with the management board of Dalla Valle OY, a WEF business with large operations in the area, and a survey of the pickers who supply the company. The wholesaler that places most of Dalla Valle OY's fresh ceps on the Italian market was also interviewed. Due to the tight schedules of company staff during the WEF high season, the interviews took place over a relatively long period of time stretching from late 2007 to late 2008. Whenever possible the answers were validated against official forestry statistics (METLA, 2008).

The survey of the pickers was conducted in August and September 2008, throughout the mushroom gathering season. At selected Dalla Valle OY purchase points located throughout North Karelia, in Eastern Finland, pickers who approached the company to sell their harvest were administered a questionnaire which asked for information about their mushroom gathering activities, socio-economic characteristics, and concerns pertaining to the picking of wild mushrooms.

Of the 1652 questionnaires handed out, about 59% were returned, but only 750 had complete answers to all the questions of interest, which amounts to a 45% response rate. In fact, the only problem with the great majority of the incomplete questionnaires is that they lack answers to the questions about collected quantities (i.e. about revenues). However, no evidence was found of selection bias, and it can be safely assumed that answers are missing at random.

Using cluster analysis, pickers were divided into internally homogeneous groups on the basis of measures of their picking effort (amount collected and picking days per season, percentage sold, and length of a typical gathering trip). At a preliminary stage, hierarchical clustering algorithms were used to identify the appropriate number of groups. Subsequently, the sample was partitioned using the k-means algorithm with Euclidean dissimilarities. Variables were rescaled to be in the [0,1] interval. Differences among groups are described by means of linear discriminant analysis.

The probability that a picker belongs to a given group was then modelled as a function of socio-economic characteristics (age, sex, education and occupational status) using logistic regression. We also present the results of separate ordinary least-square regressions of time spent on mushroom gathering trips and total commercial harvest on socio-economic characteristics. The statistical analysis was carried out in Stata (2007).

3. The development of a local WEF industry Dalla Valle

Over the years, Finland's governments have tried to promote the use of wild mushrooms through a variety of rural policy measures. Early attempts to encourage collection for food after World War II were not very effective (Härkönen, 1998). In the 1970s, efforts intensified to develop the commercial uses of wild mushrooms and other non-timber forest products. Several local and national projects were established to train mushroom advisers. Revenues from collecting wild edibles were exempted from income tax, and tax relief was introduced for companies purchasing wild mushrooms or berries (Saastamoinen, 1999). A statute on WEF was passed and a list of commercial species published.

For a short period in the mid-1990s, direct subsidies were implemented to encourage mushroom and berry businesses to expand their operations. A trader would receive 3 Finnish Marks (about .50 Euro) for every kilogram of mushrooms bought from the pickers. It was at about this time that two wholesalers and a berry entrepreneur teamed up to found Dalla Valle OY.

Until mushroom export companies began to appear in the early 1980s, very few businesses were active in mushroom collection in Eastern Finland and focused only on marketing a few locally well-known species (*Lactarius trivialis*, *Lactarius rufus*, *Cantharellus cibarius* and *Russula* spp.) in the urban areas of the country. Some species that command fairly high prices on foreign markets, such as ceps (*Boletus edulis*), received little interest.

Since the 1997 season, Dalla Valle OY has purchased wild mushrooms — mainly but not exclusively ceps — from pickers, and marketed most of its output in Southern Europe. Because ceps were not popular among North Karelia's pickers, the company had to devote substantial effort to training. Leaflets were distributed to explain why, when and how to collect boletes. Communication with potential pickers is also crucial in order to secure a stable supply of mushrooms. Ensuring that enough mushrooms are available for sale is one of the most critical issues in the WEF industry. To this end, Dalla Valle OY advertises massively in the local and national press, and dispatches information to pickers through its newsletter. In the summer of 2008, Dalla Valle OY's website had about 14,000 registered users who regularly received mushroom news on their cellphones. At the peak of the 2003 season the number of pickers supplying the company was reportedly between 15,000 and 20,000.

In each major town, the company operates permanent ‘collection points’ where pickers can sell their harvest throughout the season. In addition, daily trucks (‘lines’) drive to more remote areas that are deemed strategically important. Depending on the local crop and the conditions that prevail on the international market, picker-level prices range from 3 to 10 Euro/kg for high-grade ceps, and from 1 to

3 Euro/kg for medium-grade. Low-grade ceps are purchased for less than 1 Euro/kg. Chanterelles (*C. cibarius*) and black trumpets (*Craterellus cornucopioides*) are bought for 4 to 7 Euro/kg.

At day's end, the whole harvest is delivered to the central processing facility in Sotkuma, from where it can take three different routes. Ceps may be sold either fresh or frozen, depending on quality and market demand, and shipped to Italy or, more rarely, to other Southern European countries. Mushrooms other than ceps, which account for only a minor share of Dalla Valle OY's revenues, are sold locally to food processors or as fresh products at municipal markets.

Fresh boletes are sorted, cleaned, packed in suitable boxes and shipped either on the same day they were collected, or within the next 24 h if the amount fails to reach a certain threshold size. Because of the difficulties in supplying a multitude of buyers with modest quantities of a highly perishable product, the company relies on a wholesaler to place its fresh ceps on the Italian market. Typically, wholesalers buy fresh high-grade ceps at prices between 9.50 and 12 Euro/kg. Rarely does the price of medium- and low-grade mushrooms exceed 3–5 Euro/kg.

While many mushroom wholesalers operate in Italy, only a few of them trade in fresh products. As a result of high handling costs and wholesaler market power, retailers pay prices in the range 16–24 Euro/kg for fresh high-grade ceps. Consumer prices vary between 18 and 40 Euro/kg.

Production exceeding demand for the fresh product and lower-grade mushrooms that are not suitable for sale as fresh are frozen. Far less perishable, the frozen product is marketed, at least partially, without intermediation by a wholesaler. Dalla Valle OY directly supplies many small and medium Italian firms at prices of about 12 Euro/kg plus shipping costs (.20–.40 Euro/kg) for high-grade ceps and 5 Euro/kg for medium-grade.

In 2007, Dalla Valle OY accounted for about 45% of the total volume of WEF collected in Finland (90% of ceps). Inevitably, its revenues are closely linked to local availability of WEF. A poor crop affects output not only because there are fewer mushrooms to be picked, but also because fewer pickers collect them. Sale prices, on the other hand, are relatively unresponsive. As a result, the company's turnover can change by one order of magnitude from one year to another. Over the past few years, Dalla Valle OY's total revenues ranged between 444,000 Euro in 2007 and 5.5 million Euro in 2003.

Following a boom harvest in 2003 (1100 tons), the company received enthusiastic coverage from the local media and official praise from the government for generating considerable economic opportunities for disadvantaged rural dwellers (Minister of Foreign Affairs of Finland, 2007). Regional forest planning documents cited Dalla Valle OY as a model that should be replicated with other natural products and in other regions (Forestry Centre North Karelia, 2005).

4. Results and discussion on the socio-economic characteristics of the pickers

Because the availability of WEF is intrinsically variable, a survey of the pickers may produce rates of participation and estimates of quantities collected that are remarkably different depending on whether the research hits a favourable or an unfavourable year. In this respect, the 2008 season was average and, to some extent, can be taken as representative of a typical year. Table 1 presents summary statistics for key socio-economic characteristics and measures of mushroom picking activity.

Enumerating all the pickers who supplied Dalla Valle OY was not possible because of time and budget constraints. Yet, company records, survey results and anecdotal evidence combine to suggest a total number of between 2500 and 3000.

Levels of activity can differ markedly from one picker to another. On average, over the course of the season, a picker spent about 90.76 h (s.d. 105.00) collecting mushrooms in the forest and sold 113.91 kg (s.d. 181.42) to Dalla Valle OY. At 2008 prices, this implies revenues of around 420.32 Euro. Mean harvest is 1.69 kg/h (s.d. 1.51), which would earn a picker about 6.22 Euro/h, little more than half the wage rate for a regular forestry worker (10.51–12.84 Euro/h) (METLA, 2008).

Table 1
Summary statistics of the study area.

A. Mushroom collection activity

	Mean	St. Dev.
Days picked per season	24.50	21.30
Duration of typical picking trip (h)	3.39	1.64
Mushrooms collected per season (kg)	136.77	196.13
Percent sold	72.13	27.50

B. Socio-economic characteristics

	Proportion		*p*-value for equality of proportions
	Sample	Eastern Finland	
Male	.559	.494[a]	<.001
Retired	.321	.189[d]	<.001
Unemployed	.108	.110[a]	.861
Basic education	.355	.352[c]	.863
Secondary education	.471	.385[c]	<.001
High education	.175	.263[c]	<.001
Age ≤ 26	.088	.302[b]	<.001
Age 27–35	.072	.085[b]	.189
Age 36–42	.095	.086[b]	.383
Age 43–55	.313	.206[b]	<.001
Age 56–65	.276	.139[b]	<.001
Age > 65	.156	.181[b]	.078
Based at summer cottage	.056	n.a.	–
N	750		

[a] Year 2007 (EUROSTAT, 2009b).
[b] Year 2006 (EUROSTAT, 2009b).
[c] Whole Finland, year 2006 (Statistics Finland, 2008a).
[d] Whole Finland, year 2007 (Statistics Finland, 2008b).

While the data from our survey are not amenable to a detailed analysis of the determinants of participation in commercial picking, hints may come from comparing the socio-economic composition of our sample with that of the general population of Eastern Finland. Dalla Valle OY's pool of pickers appears to differ from the general population in several ways. Consistently with the findings of other studies on participation in wild food collection, people who are comparatively older, less-educated and retired are over-represented in the sample. However, even though those with low opportunity cost of time appear more likely to engage in commercial picking, there is no evidence of the unemployed becoming heavily involved in the activity.

Clustering algorithms were used to identify groups that are homogeneous with regard to their mushroom gathering activities (i.e. with respect to the variables in Table 1, part A). From a preliminary hierarchical analysis with Ward's linkage, Euclidean dissimilarity and variables rescaled to be in the [0,1] interval, three emerged as the appropriate number of groups. This result proved fairly robust to the choice of other data transformations and clustering methods. The k-means algorithm was then used to form three partitions of the sample. Table 2 reports cluster sizes and center

Table 2
Cluster centers.

Group of pickers	*n*	Harvest (kg)	Days picked	Duration (h)	% sold
Professional	164	369.58	45.21	5.52	88.29
Ordinary	403	82.66	19.50	2.85	84.45
Recreational	183	47.30	16.93	2.65	30.51
N	750		Calinski-Harabasz pseudo-F		427.3

points. A different choice of starting point or limiting the analysis to a subsample has little influence on these results.

Linear discriminant analysis was performed to describe the relative importance of the four variables in separating the three groups. In the first function, which accounts for about 74% of discriminating power, the largest standardized coefficient (in absolute value) is the one on percentage of harvest sold. Duration of a typical picking trip has the second-largest absolute value coefficient in the first function and the largest in the second function. All variables, being closely linked to one another, have similar correlations with both the first and the second discriminant functions.

In broad terms, what seems to differentiate pickers into different groups is their degree of professionalism. About one in four pickers appear to be gathering mushrooms mostly for recreational purposes. While relatively frequent, their trips into the forest to gather mushrooms tend to be short. They harvest relatively modest quantities and sell only a fraction to Dalla Valle OY. While sizable, this group only accounts for 3.5% of the company's purchases of mushrooms. For convenience, we label these people "recreational pickers".

At the other end of the spectrum there appear to be "professional pickers" for whom mushroom collection represents the main occupation, at least at the peak of the season. Despite representing slightly more than one picker in five, this group supplies almost two-thirds of all the mushrooms the company buys. On average, a commercial picker earns about 1224 Euro over the course of the season.

About half of all pickers ("ordinary pickers") fall somewhere between those two groups. Compared to commercial pickers, their mushroom gathering trips to the forest are both fewer and shorter, yet their harvest is almost entirely sold for cash and represents about 33% of Dalla Valle OY's purchases. Overall, earning extra income appears to be their main motivation for picking mushrooms. For people in this group, mean seasonal revenues from mushrooms amount to about 257 Euro.

Using a multinomial logit specification, we modelled the probability of a picker belonging to a given group as a function of socio-economic characteristics (i.e. the variables in Table 1 part B). The base category is ordinary picker. The estimated parameters are reported in Table 3.

Because the magnitudes of logit coefficients can be difficult to interpret, average partial effects were computed by averaging the predicted individual partial effects across the sample (Wooldridge, 2006) and are displayed for selected variables in Table 4.

The chances that a person engages in mushroom picking for leisure rather than for income increase with the level of education. Having a higher education increases the probability of being a recreational picker by .109. The probability of being in the recreational group is about 30 higher for those people who pick mushrooms while taking time off at their summer cottage. Male pickers are significantly less likely than female to be in a group with lower mushroom gathering activity. Those aged below 26 are more likely to be in the intermediate group by about .15. Yet, there is no other evidence that the intensity of a picker's effort is related to his or her age or retirement status. Also, the coefficient on unemployed is only significant at the 10% level in the equation for commercial versus ordinary.

Regressing the natural logarithm of total time spent collecting mushrooms and the log of total kilograms sold on the socio-demographic characteristics produces qualitatively similar results. The estimates are reported in Table 5. While a lot of the variability in picking effort appears to relate to factors other than the socio-demographics, some patterns are clear. Higher levels of education are associated with low mushroom gathering effort: compared to a picker with basic education, a highly-educated one seems to devote 29% less time to mushroom gathering and harvest 36% fewer kilograms for sale. Being based at a summer cottage is associated with 58% less time spent picking and 66% smaller commercial harvest. Males spend more time picking in the forest and sell much larger quantities of mushrooms than females. Age turns out to be not significant, with the exception of the dummy for being 26 or younger, which appears to reduce time and amounts collected by 28% and 42% respectively. There is little evidence of retired or unemployed people putting more effort than others into mushroom gathering.

Table 3
Multinomial logit analysis of picking efforts.

	Professional picker	Recreational picker
Male	.378*	−.538***
	(.200)	(.188)
Retired	.370	.320
	(.282)	(.286)
Unemployed	.541*	−.010
	(.303)	(.331)
Secondary education	−.284	.178
	(.219)	(.226)
High education	.073	.604**
	(.296)	(.282)
Age ≤ 26	−.430	−.899*
	(.504)	(.461)
Age 27–35	−.796	−.693
	(.588)	(.452)
Age 43–55	.522	.049
	(.384)	(.324)
Age 56–65	.326	−.278
	(.414)	(.367)
Age >65	.236	.021
	(.496)	(.455)
Based at summer cottage	−.880	1.221***
	(.645)	(.352)
Constant	−1.404***	−.736**
	(.407)	(.350)
N		750
Log-likelihood		−717.470

*: 10% significant; **: 5% significant; ***: 1% significant.
Standard errors in brackets; ordinary picker is the base outcome.

5. Final remarks

In recent decades, non-timber forest products have been the object of considerable public interest as a potential source of revenues for the forest sector that are complementary or alternative to timber. While enthusiastic assumptions have sometimes overplayed the potential role of non-timber forest products for rural development (Sheil and Wunder, 2002), success stories do exist. In this article, we have described how a small but economically viable WEF industry emerged and operates in a marginal area of Finland.

Our account revolved around Dalla Valle OY, a company that purchases wild ceps from pickers in North Karelia, where virtually no demand exists for this type of mushroom, and exports its output, either fresh or frozen, to the markets of Southern Europe like Italy, Spain and France, where this product commands quite high prices. Our survey produced evidence that, for a fairly sizable group of people, the presence of this business generates the possibility to earn significant additional income.

Table 4
Logit average partial effects (selected variables).

	Professional	Ordinary	Recreational
Male	.087	.026	−.113
Retired	.045	−.082	.037
Unemployed	.098	−.067	−.031
Secondary education	−.054	.010	.044
High education	−.021	−.088	.109
Age ≤ 26	−.035	.151	−.116
Based at summer cottage	−.157	−.146	.303

Table 5
Ordinary least-square analysis of picking effort.

	Log time spent picking	Log kilograms sold
Male	.297***	.642***
	(.082)	(.132)
Unemployed	.211	.331
	(.136)	(.219)
Retired	.218*	.265
	(.124)	(.200)
Secondary education	−.300***	−.257*
	(.095)	(.153)
High education	−.342***	−.443**
	(.124)	(.200)
Age ≤ 26	−.324*	−.551*
	(.189)	(.304)
Based at summer cottage	−.876***	−1.094***
	(.176)	(.284)
N	750	750
R^2	.107	.085

*: 10% significant; **: 5% significant; ***: 1% significant.
Standard errors in brackets. Constant and age dummies included but not displayed.

In a typical year, between 2500 and 3000 pickers supply the company over the course of the season, which lasts for most of August and September. However, because mushroom crops are both highly variable and very difficult to predict, the number of people who take part in harvesting in North Karelia may vary widely from one year to another. As a share of the region's total population, the number of pickers may vary from less than 1% in a bad year to about 8% in an exceptionally good one (e.g. 2003), and is the same order of magnitude as the number of forestry workers (METLA, 2008).

Although about 25% of all pickers, especially those based at a summer cottage, gather only trivial amounts and appear to have mostly recreational motives, more than one in five harvest WEF almost as a full time occupation during the season, devoting on average 5.5 h per day to the activity over 45 days. In the 2008 season, such professional pickers earned on average 1224 Euro, which exceeds 5% of the average net annual household income in Finland (EUROSTAT, 2009a). The remaining majority of the pickers, which includes most young pickers, spend much less time in mushroom gathering but still appear to be driven by the possibility of earning some extra income. On average their revenues amount to 257 Euro per season and their collective harvest accounts for one-third of Dalla Valle OY's total purchases.

As expected, rates of participation and picking effort tend to be higher among people with lower education, that is, among those with presumably fewer earning opportunities. There is only weak evidence, however, that particularly vulnerable groups, such as the retired or unemployed, are turning to intensive mushroom harvesting as a source of income.

It is worth mentioning that professional pickers display a general preference for spruce forests, where the availability of fruiting bodies during the sprouting season is typically higher. Pine forests, on the other hand, are more popular destinations for recreation.

The ecological impact of collection activities on Eastern Finland's WEF resources appears very limited. Nevertheless, pickers often remark about the scarcity of boletes in the forest. Most likely, what causes this perception is, rather than actual ecological degradation, the fact that most pickers tend to concentrate in areas that are close to urban centres and easily accessible through the road system.

A recurring question in the literature on the commercialization of NTFPs is what determines success. While it is hard to generalize from a single example, it is clear that the everyman's rights and the widespread custom of collecting mushrooms and berries made Finland a very favourable environment to begin with. Most likely, the short-lived government subsidies of the mid-1990s and the exemption of mushroom revenues from taxation played a significant role in kicking off the industry. However, even though any policy change making mushroom harvesting less economically attractive (e.g. permit fees or income tax) would presumably put off a substantial portion of the pickers and reduce Dalla Valle OY's output, a crucial aspect for the establishment of a successful value chain was in this case represented by entrepreneurship. As te Velde et al. (2006) have argued, NTFP entrepreneurs fulfil the function of creating the links with attractive and often distant markets where the products of local rural communities can be placed. The role of entrepreneurs will also be critical in any attempts to replicate the North Karelian WEF business model in broadly similar contexts (e.g. in Eastern Europe), as doing so will require devising effective logistic solutions and a fair system of payments to the mushroom collectors. According to anecdotal reports, indeed, firms that have tried to operate similar models in Poland and Romania have often received little interest from local communities, in most cases because their grading and payment systems were not attractive or transparent enough.

Data about the working of the WEF industry are scarce and it is sometimes claimed that the major barrier to entry in this market is lack of information (Sievänen et al., 2004). Uncertainty about potential output, costs, revenues, and marketing channels may be holding back the development of a WEF business in locations where it could be economically viable. Without trying to abstract too general lessons from the case examined here, this study has contributed new data on some of these issues. From an applicative perspective, identifying types of pickers can be useful for the purpose of designing more effective procurement marketing strategies. In the WEF business, where ensuring a stable supply of the key input is often a major problem, aiming one's promotional efforts at those pickers who are more likely to become productively involved can be crucial.

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9. Paper 4: Paying for water-related forest services: a survey on Italian payment mechanisms.

Paying for water-related forest services: a survey on Italian payment mechanisms

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The paper reviews the state of implementation of one of the most relevant mechanisms of payments for environmental services (PES) in the forestry sector: the systems of payments for water-related forest services. Three water services with economic relevance are analyzed with reference to the Italian context: hydropower generation, tap-water supply and mineral water use by industry. Using the consolidated definition of PES as a basis for the analysis and considering the regulatory framework on water, we compared the three water-related services to describe the strengths and weaknesses in environmental services provision. From the analysis we deduced that pure PES schemes do not exist in the water sector in Italy, while PES-like schemes driven by public authorities have a relatively long and consolidated tradition, but need to be better oriented and more widely implemented in order to compensate the providers of the services.

Keywords: Payments For Environmental Services (PES), Water, Environmental Services, Italy

Introduction

Forests are worldwide considered generators of a multitude of environmental goods and services. Due to increasing problems of scarcity and quality, the water-related services are assuming a priority role among forest-based ES (FAO 2008, Birot et al. 2011).

The essential role of water for human life is being recognized by many water legislative frameworks in Western society (Scott & Coustalin 1995, Cullet 2011, Grafton & Hussey 2011), which are setting out rights and duties on its use, as a result of demographic expansion, use conflicts and perceived problems of scarcity (Dosi & Muraro 2003, Kuks 2004). Despite this, in the European Union (EU) and in many countries no specific normative tools directly address the link between forest and water production. For example, even if the EU Water Framework Directive (WFD - Directive 2000/60/EC) has pointed out the key role played by environmental resources management policies in the water cycle, especially for water quality, it does not refer explicitly to forests. Nonetheless, scientific evidence is growing of the cause-effect links between forest management and water quality: recent papers have highlighted the role of wooded areas on water quality maintenance (Neary et al. 2009, Eriksson et al. 2011, Robinson & Cosandey 2011), underlining the possible management options to enhance quality parameters in rivers as well as in shallow aquifers.

In some countries, both the most advanced and developing economies, the cause-effect scientific proofs combined with gaps in the legislative framework allowed private or public entities to create payment schemes on a voluntary basis in order to ensure higher water quality standards, using economic tools to stimulate the catchment areas' landowners to change their management practices. An historical example is the payment mechanism promoted by the New York City Council to enhance water quality, compensating landowners in the catchment area when they improve their management practices (NYC-DEP 2010). Several public authorities in France have also encouraged the production of forest drinking water by drafting a similar compensation scheme (Ferry 2006). Again in France, a private company (Vittel) producing bottled mineral water has implemented a payment scheme to compensate land managers for their farming practices aimed at water quality protection (Perrot-Maître 2006).

These mechanisms are better known as Payment for Environmental Services (PES), defined as a "voluntary" transaction where a "well-defined" environmental service (ES) (or a land-use likely to secure that service) is being "bought" by a (minimum one) ES "buyer" from a (minimum one) ES "provider", if and only if the ES provider secures ES provision (conditionality - Wunder 2005). Nevertheless, in many cases one or two out of five parameters are not fulfilled, so Wunder (2007) suggested the use of the term PES-like schemes. Generally, PES are contract-based schemes acting as a financial tool. They target ES as goods traded among the parties, particularly where no public regulations have been implemented. In Western society, local or national governments have only recently promoted PES schemes, while they continue to develop and implement PES-like approaches based on legislative tools. However, in several cases the complex and rigid legal systems lack a clear property rights definition, this being the main obstacle for the promotion of economic tools such as PES.

PES schemes in Italy have not yet been implemented or investigated in detail, except for some scattered cases linked to non-timber forest products (Pettenella & Kloehn 2007) and some exploratory case-studies on water (Gatto et al. 2009). This paper analyzes three Italian water-related payment schemes based on: (i) hydropower generation; (ii) tap-water supply; and (iii) mineral water production. Each scheme is embedded in a national legislative framework that sets limitations and constraints on water use, as well as how its benefits should be redistributed to the catchment areas (thus reflecting the basic principles of PES-like schemes).

Starting with a brief description of the Italian regulatory framework on water, we compared the three water-related services to describe the strengths and weaknesses in environmental services provision, concluding with some political findings.

Methods

The regulatory framework related to water resources and environmental services has been defined making reference to the relatively ample literature and the official Acts approved by the State and regional authorities.

For the comparative analysis of the three services we used the six parameters defined by Wunder (2005, 2007) as key-criteria to make a distinction between PES and PES-like schemes, as well as the five key-criteria defined by the OECD (2010) to address the cost-effectiveness of PES schemes.

In detail, starting with a definition of the PES scope, we compared the different cases analysing the presence of monitoring and reporting frameworks, cost-benefit targeting, contracts-based payment mechanisms and systems of payment revision.

Water and environment: the Italian regulatory framework

PES schemes vary case by case, according to the type and scale of traded ES, payment source, measures and practices implemented to enhance the ES, output performance, and payment transfer between the parties (Engel et al. 2008). A crucial role in PES development is played by the implementation of a proper property rights regulatory system. As already known, common or public goods and services (like ES) are much less tangible than private goods and services normally exchanged on the market, even if resource scarcities connected with certain public services are quite clearly perceived. Moreover, the uncertain property rights and high fragmentation of demand and supply of ES contribute to limiting the market development. Due to these factors the transaction costs are expected to be very high, thus representing the major constraint to the implementation of PES-like schemes. In such conditions, local, regional or national governments play essential roles in promoting a more effective system based on defined, defendable and divestible economic property rights (Yandle 1999, Bougherara et al. 2009), as well as embodying supply-demand coordination.

In Italy PES-like schemes related to water have been developed in the national legislative framework on the basis of the principle of keeping the ownership of the resources in public hands. According to Act 36/1994, surface and underground water belongs to the State. Private water ownership may be established only if the rain is collected on private property.

Public ownership of water is connected to the strict link between water services and mountain forests: almost two thirds of the land surface consists of mountain areas, historically facing major social and economic problems such as unemployment, depopulation, loss of identity and cultural heritage. Some 66.3% of the national forest cover (8.7 million ha on the basis of the 2004-05 National Forest Inventory - http://www.infc.it) is located in areas at altitudes above 500 m and 44.6% has a slope over 40%. Consequently, the national government developed a set of regulations in order to ensure a financial support for maintaining a viable mountain environment and to control deforestation and forest degradation processes. The first important Act was approved in 1923 (the "Forest Act" - Decree 3267), in which strict restrictions were set out on forest land use and conversion; 95% of the national forest cover still comes under these restrictions to prevent soil erosion and regulate the water cycle. In theory, the Act established the creation of a compensation fund, but in practice, the lack of public financial resources has limited its use. A decade later, a water and hydropower Act (Decree 1775/1933) established a compulsory fee for each water use. Under this Act, the hydropower companies had to pay a certain sum of money per kilowatt installed in the power plant (this sum is now about 7.0 €/kWh). This payment is transferred both to the municipalities included in the catchment basin and those downstream where the water is reintroduced in the riverbed. The payments compensate the municipality's opportunity costs of the potential water uses and the money have to be invested in local public services. In many mountain regions these funds represent a relevant income for local administrations, and have also been used to improve forestry operations and management.

The water legislative framework continued to evolve for half a century with minor regulations until the Water Quality Act (Law 183/1989) was approved. A few years later, Galli's Act (from the name of the main proposer - Law 36/1994), formally introduced the concept of catchment area compensation (art. 18), even though it was just addressed to public or collective lands (art. 24), thus implementing a principle already stated by Law 183/1989 concerning environment protection. However, its implementation has been limited and has occurred only at local level. Indeed, only a two regional public authorities (Piedmont and Veneto Regions) have fully implemented Galli's Act in their local legislative framework. This law basically resets the fragmented municipal-based water supply into a wider integrated system (based on the principle of whole river basin supply). Six years later, the EU Water Framework Directive (WFD - Directive 60/2000) enforced a regulatory system of the entire water cycle, especially in terms of water quality maintenance. This issue has been considered in Legislative Decree 152/2006; the Decree affirms the three driving principles of the WFD: (i) the "full-cost-recovery principle"; (ii) "polluter-pay-principle"; and (iii) "access-right-guarantee principle" (Kissling-Naf & Kuks 2004). The "full-recovery-cost" key-concept has been an important step to recognize the role and costs of ES on water supply quality, recently withdrawn in a national referendum.

Given the complexity of the Italian regulations, some public as well as private organizations have used gaps in the legislative framework to promote and build PES-like schemes, moving towards an innovative economic approach based on ES supply and demand for water quality.

The state of water-related PES implementation

Hydropower generation

Italy has traditionally taken advantage of the many streams and rivers in its mountain areas and, since the last century, dams and plants have been built to produce hydroelectric power. Today, hydropower represents 16.6 % of the total Italian electricity production, and is the top national renewable energy source (ISTAT 2010). The infrastructural impacts had already been well recognized in the 1930s, when the first compensation scheme was implemented by Decree 1775/1933 through the creation of a quite complex system of public agencies and governance rules.

Basically, the rationale is that the canalization of mountain streams greatly reduces the water availability for the local residents, hence reducing the land opportunity costs on the areas between the catchment point and the place in which water is re-introduced in the riverbed. In the compensation scheme introduced by Decree 1775/1933, the payment was based on the installed power capacity of the power plants, strictly linked with the quantity of exploited water. To define the amount of the annual payment the installed power of the power plant is multiplied by three economic parameters: the state fee concession (min 9.65 - max 35.03 €/kW), the extra-fee for the Mountain Basin Agency[1] (28.00 €/kWh) and a further extra-free to compensate those municipalities located between the catchment and the place where the water is returned to the riverbed, named Coastal Municipalities (7.00 €/kWh). Law 925/1980 let the extra-fee be reviewed every two years. Finally Law 122/2110 increased the extra-fee up to 28.00 €/kWh (instead of 21.08 €/kWh) and established another extra-fee to be delivered to Coastal Municipalities (7.00 €/kWh). The repartition of the second last extra-fee among actors is based on Ministerial criteria[2], while 20% of the Coastal Municipalities extra-fee is delivered to the Provinces. The three mentioned agencies are formally the beneficiaries of the ES, while private or public hydroelectric companies represent the suppliers. The fund allocation is driven by political decisions and priorities, but is generally reinvested in public infrastructure and innovation including in the forest sector, especially in slope stability and rural area investments. A feeble point of the PES-like scheme is surely the competence overlapping among the involved agencies that can create conflicts in some cases; moreover, the linkage between land stability provided by forests and its compensation seems to be rather weak. In fact, the prevention of soil erosion is one major externality of forestland that guarantees slope stability and reduces damages to the artificial chan-

nels and water infrastructure for hydropower production. The scheme today involves almost one-fourth of Italian municipalities (1684 municipalities all located in mountain or hilly areas with 518 hydropower plants) and is managed by Mountain Basin Authorities (consortia of municipalities).

Tap-water provision

Water for human consumption has formally been declared a priority by the State with regard to the alternative uses (art. 2, Law 36/1994 - Galli's Act). Hence, this assumption sets a sort of hierarchy on water uses, where environment maintenance has been addressed (Kuks 2004). The compensation (art. 18) is directed at public owners (art. 24 - municipalities and other public authorities), probably because of the high fragmentation of private land, which has been considered an obstacle in managing the scheme due to high transaction costs and huge numbers of landowners. However, ES payments based on an extra-charge on the tap-water bill ("user-pay-principle") have only been introduced in some local contexts, namely two Italian Regions: Piedmont and Veneto. Piedmont Region (Regional Act 13/1997, art. 14) built up a structural fund with 3-8% of extra-charge on water bills to compensate mountain areas in terms of projects or infrastructure aimed to improve local land management practices. In the same way, the Veneto Regional Decree no. 3483 of 10th December 2010 set up a financial tool for mountain areas (3% of the water bill) partially covering the costs of new hydraulic infrastructure or forest operations close to areas of slope instability, in order to protect the downstream population. There are few examples in addition to these two regional payment schemes. It is worth mentioning the case of *Romagna Acque S.p.A.*, a public company owning and managing all the drinkable water resources of Romagna sub-regional area. Started as a consortium of municipalities to reduce the cost of drinking water supply in 1966, it was able to cover the distribution of water to the whole Romagna area in 1989 and just a few years later, in 1994, *Romagna Acque S.p.A.* was founded, becoming owner of water resources in 2004. The most important water source of the company is a dam-basin in the central Apennines (Ridracoli, municipality of Bagno di Romagna), which covers 50% of the entire Romagna tap-water demand (108 M m^3/year). Since its construction, the biggest problems have been dam sedimentation and the maintenance of high water quality. In 1993, the company invested in research to understand the link between forest management and soil erosion as well as water quality stabilization. The research (Bagnaresi et al. 1999) shows the clear impact of forest operations such as clear-cut or forest conversion from coppice to high stands on soil erosion, while minimal silviculture treatments or natural evolution of stands markedly reduce the erosion. These last two practices were also demonstrated to have a positive influence on nitrogen reduction and pH stability. Acknowledging these problems, part of the revenues deriving from the water tariff payments (1-3%) has been used to compensate landowners in the catchment areas, helping them to cover the costs related with management practices changes. The positive impact of the PES scheme was accounted in a general decrease in soil erosion of 25% (from an initial 40 000 m^3/year to the ongoing 30 000 m^3/year), and a consistent nitrogen reduction as well as pH stabilization. In terms of performance both *Romagna Acque S.p.A.* and the landowners have increased their utility: the company has reduced its costs for water purification and assured longer dam life, while the landowners have increased or maintained their annual forest revenue. Anyway, due to the complex bureaucratic process, a public company cannot deliver public funds or subsidies to a singe landowner if there are unclear traded goods or services, hence *Romagna Acque S.p.A.* decided to directly acquire the land whenever this was possible, or to promote forest road maintenance for the other landowners in the catchment area. Part of the compensation has been invested in programmes to inform the public on the use of tap water and the effects of the management practices adopted in the catchment area. The positive example of *Romagna Acque S.p.A.* represents a PES-like scheme built on legislative gaps (art. 18 and 24 Act 36/1994); it cannot be categorized as pure PES due to the overlapping between the ES supplier and consumer: in some way, they are both represented by *Romagna Acque S.p.A*.

Mineral water supply

Italy has been one of the first five world bottled mineral water consumers since 2002 and (with 191.7 liters *per capita* consumption in 2009) the second *per capita* mineral water consumer in the world, after Mexico (see statistics at the IBWA website - http://www.bottledwater.org). Considered as the safest water for human consumption, since the 1980s bottled water has been promoted by several industries due also to the introduction of new plastic polymers like polyethylene terephthalate (PET) instead of the traditional glass (Niccolucci et al. 2011). Nowadays, there are approximately 230 mineral springs in Italy, with a total production of 12.2 billion liters and an annual sector turnover of 2.3 billion euros (Beverfood 2011). Nevertheless, there are no substantial differences in terms of qualities between bottled water and most of the tap water currently offered by the aqueduct companies.

Bottled water production is a concession-based business where a given company applies for the extraction license of a particular spring. The fee[3] considers the compensation to the local municipality for the land that is covered by the mineral water plant and a general production fee based on the water extracted in the power plant, but no compensation is addressed by law to the surrounding catchment areas. However, the environmental code addresses the preservation of any water resources (Decree 152/2006) and some positive examples do exist.

According to *Mineracqua* (personal communication) there are several contract-based

Tab. 1 - PES parameters to classify Italian PES-like schemes (source: Wunder 2005 - modified).

PES parameters	Hydropower generation	Tap-water provision	Mineral water supply
Start-up (voluntariness)	Compulsory compensation. Governmental and legislative driving force (Decree 1775/1933 and Law 959/1953)	Voluntary compensation, following the Galli's Act indications (art.18 and 24, Law 36/1994)	Voluntary compensation, following Decree 152/2006
ES definition	Forest hydrological protection (indirectly mentioned in Decree 1775/1933 and Law 959/1953)	Water cleaning service and erosion mitigation service	Set aside forest land to improve its natural evolution
Buyer/s	Hydropower companies	*Romagna Acqua S.p.A.*	Mineral water industry
Seller/s	River basin municipalities and forest owner associations	Municipalities in the catchment area	Municipalities in the spring catchment area
Conditionality	Forest operations to reduce erosion, landslides and forest instability	Forest management change towards close-to-nature silviculture	Land management change to reduce pollutants in the watershed
Basic principle	Polluter-pay-principle	Buyer-pay-principle	Buyer-pay-principle

Tab. 2 - Cost-effectiveness of PES schemes: a comparative analysis of the three types of water uses (source: OECD 2010 - modified).

PES parameters		Hydropower generation	Tap-water provision	Mineral water supply
Purpose and scope	Environmental objective	Reduce soil erosion and enhance forest stability in the river basin	Enhance water quality through close-to-nature forest practices	Enhance water quality through grazing intensity reduction
	Social objective	Compensate the water opportunity cost for local populations	Compensate the water opportunity cost for local populations	Compensate the water opportunity cost for local populations
	Principal ecosystem services	Soil erosion, water quantity	Water quality, soil erosion (only in the case of dam), biodiversity	Water quality, biodiversity (only in the case of *Acqua Panna - Nestlé* group)
	Scale	River basin	Spring catchment basin or dam basin	Spring catchment basin
	Reference law	Decree 1775/1933 and Law 959/1953	Law 36/1994 (Galli's Act) and Decree 152/06 (environmental code)	Decree 105/1992 and 339/19
Monitoring & reporting	ES Monitoring	Linked to the given municipality consortium statute; generally it is performed by the Mountain Basin Authority	Romagna Acque S.p.a. monitors the water quality parameters, hence indirectly the performance of forest ecosystem. Soil erosion is estimated according to the annual water quantity processed at level of tap-water facilities, annual precipitation and water losses	The monitoring depends on the contracts or agreements between the mineral water company and generally the municipality that manages the catchment area
	ES Reporting	Generally no ES reports are preformed	Romagna Acque S.p.a., under its corporate social responsibility policy, is publishing an annual environmental report	Generally no ES reports are produced; scattered information is sometimes provided in company advertising campaign
Benefit-Cost targets	Ecosystem benefits	Forest stability and reduction of landslides	Natural evolution of forest areas with an enhancement of biodiversity richness and stability. Minimal anthropogenic pressure.	Nitrogen reduction in the water environment. Only in the case of *Acqua Panna* biodiversity enhancement is measured in terms of species.
	Additionality	Number of forests or forest operations in the river basin (prescribed by law)	Forest management changes are considered additional (indicated but not prescribed by law)	Land and pasture management changes are consider additional (mitigation on the catchment is prescribed by law). In the case of *Acqua Panna* species presence such as wolves is considered additional
	Risks	Conflicts within the municipal consortium may lead to political instead of technical decisions	Risk of losing additionality in the long run. Once the forest reaches the climax status no environmental improvements may be carried out by the company	Where deep springs are exploited, the rock filters and cleans the water, so there is no need to invest in PES
	Opportunity cost	It is estimated by the government that consequently fixes concession extra-fee	*Romagna Acque S.p.A.* estimates it according to the constraints induced by the water withdrawal along the catchment basin valley	No available information
Payment mechanism and contract	Payment source	Hydropower concession fee	Percentage of water bill (1-3%)	Mineral water industry's direct payment
	PES contract and length	The coastal and catchment municipality consortium statute and the River Basin Authority decide the length and the priorities of the action. Theoretically the PES scheme will last until the law is repealed	The PES scheme will be enforced as long as Romagna Acque S.p.a. and the local municipalities (*i.e.* , the company shareholders) consider it useful. Anyway, any law change in terms of fund transfer may limit or delete the monetary transfer	No available information
	Payment mode and amount	Monetary transfer to the municipalities within the consortium. The actual extra-fee is fixed at 28 + 7 €/kWh installed in a given power plant, but no data are available in terms of direct reinvestment in forest of hydraulic operations	Monetary transfer to the municipalities in the catchment area. The actual water bill percentage is between 2 and 2.5% for an overall monetary transfer of half a million euro/year	No available information
Revision	Payment revision	The revision takes place every two years, but the forest operations rely directly on the consortium's decision and the River Basin Authority	The revision takes place every year according to the forest operations needed and the opportunity cost of the forest owners (mainly municipalities and *Romagna Acque S.p.A.*)	No available information

mechanisms between the mineral water plants and the local municipalities to reduce the grazing intensity in the catchment areas, as well as to convert meadows into set-aside lands, to leave lands to their natural evolution or to change intensively cultivated farmland to organic farming systems. Two singular cases in Italy involve two *Nestlé*-controlled water companies: *Levissima*, which is using large plastic sheets during summer time to reduce the glacier melting in its Alpine catchment area; and *Acqua Panna*, which is promoting natural evolution of forestland to enhance biodiversity around the spring. Unfortunately, specific data and reports are lacking, and information is still incomplete.

Notwithstanding the massive investments in advertising and communication by all the mineral water producers, only scattered and limited information is provided on the catchment areas management policies. We presume that, generally, mineral water industries do not directly invest in ES within the catchment areas because they use deep spring water, hence the role of forest is probably considered minimal in comparison to the filtering effect of rocks.

Tab. 1 summarizes the main findings of the analysis comparing the three services on the basis of the six parameters defined by Wunder (2005, 2007), while Tab. 2 presents a summary view of the issues connected to cost-effectiveness of PES schemes using the five key-criteria defined by the OECD (2010).

Discussion and conclusions

From the analysis of the three payment mechanisms described above, we can deduce that pure PES schemes do not exist in the water sector in Italy, while PES-like schemes driven by national government are well represented among the different water uses.

As a matter of fact Italy represents a emblematic case where the implementation of economic tools such as pure PES schemes is inhibited by the presence of a complex regulatory and institutional framework. According to some authors (Aubin & Varone 2004, Carbone & Savelli 2009), the accumulation of norms, customary rights and formal institutions have limited the effectiveness and coordination of policy and rules implementation in Italy. Besides, Italy is facing two significant constraints to any PES implementation in the forestry sector: (i) the highly fragmented landownership structure; and (ii) the limited number of forest owners' associations, which both determine higher transaction costs and limit the capabilities of ES potential investors or suppliers to take action. In such conditions the role of national or local governments is fundamental, due to the fact that the economic agents involved in any PES scheme trade mainly access rights to the resources (Hill 1997, Yandle 1999). The perceived environmental scarcity has stimulated regulatory interventions, but only in terms of new command and control instruments (thresholds and constraints). Despite common law, civil law systems like the Italian one lack efficiency due to the delay in updating the regulatory framework with the inclusion of the new stakeholders' needs and expectations connected to rapidly developing issues like water resources management. Due to the Italian water legislative framework the PES schemes should operate within the legislative gaps, so quite a few ES trades may be put in practice and in most cases linked with the public authorities. From the political point of view, although policy-makers are pushing the privatization of common goods (such water, health care and education), civil society seems more reluctant about the privatization process in the water sector. In June 2011, in a national referendum on this topic, an overwhelming majority of Italians (95.8%) expressed a negative evaluation of any privatization process in the tap-water management sector.

A further problem that would need to be solved by the legislator is the definition of clear property rights over the land and related forest externalities. The civil or penal code considers the negative externalities rather than the positive ones (Mattei 1995). In the case, for example, of medium-large scale positive externalities such as water quality improvement or soil erosion control, the ES may be achieved at large catchment area, so only the conjoint actions of all the interested landowners may change the water quality parameter or soil stability, while the action of each single actor has a minimal impact. The policy-makers should review the property rights in order to let any ES stakeholders attain their direct or indirect benefits.

The water sector operators need to operate in synergy with land and forest managers at different scales according to the ES extension. Anyhow, technicians have often faced legal constraints, while an economic approach may increase the environmental preservation, stimulating the parties to deal in a more efficient way. The traditional command and control approach has already revealed several weak points, linked to the high cost of monitoring and the failure to follow the dynamic needs and wants of society. The need to build a critical mass of land (suppliers) or ES consumers (buyers) is the first step towards the success of a PES scheme, hence ensuring the provision of ES. The landowner associations may tangibly decrease the transaction costs on the supply side, but the most relevant effort should be spent on increasing ES awareness *de facto*, the real engine of the green economy. It is likely that PES or PES-like schemes may be partly replaced by subsidy-based mechanisms, in order to operate more dynamically than the legislative process, especially in mountain rural areas.

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Notes

1. The Mountain Basin Agency (*Bacini Imbriferi Montani* - BIM) is a consortium of municipalities that charge for the water use in order to reinvest for socio-economic purposes within the managed area, the extra-fee introduced by the Act 959/1953, art. 1 and art. 53 (only for those power plants larger than 220 kWh installed).
2. The extra-fee being 100% (7 €/kWh): 10% is distributed equally among all the municipalities within the Mountain Basin Agency; 20% is linked to the given municipality's population within the Agency; 30% is linked to the surface of a given municipality within the Agency; 40% is linked to the presence of water infrastructure and its impacts.
3. Regional governments implement the fee, so conditions are very different in the 21 Italian regions. The fee is based on the surface that the mineral water plant uses and the water extraction. Both fees vary a lot among regions, for instance the surface based fee is 5.11 €/ha in Molise (Regional Law 33/1977) and 587.27 €/ha in Veneto (Regional Law 40/1989), while the water production fee varies between 0.3 €/m^3 in Campania, Basilicata and Abruzzo (respectively, Regional Laws 8/2008, 43/1996, 15/2002) and 3 €/m^3 in Veneto (Regional Law 40/1989).

10. Paper 5: Estimating values of ecosystem services from the Alpine forests of Veneto: is there willingness to pay for them?

Title: **Estimating values of ecosystem services from the Alpine forests of Veneto: is there willingness to pay for them[1]?**

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Abstract: *Forests produce a large array of market and public goods. The demand for forest services is increasing in many European countries, however data on service values at the regional scale are still scarce for Alpine areas. Forest owners are not compensated for service provision, therefore their forest management regimes are often not targeted at social optimum. A Choice Experiment survey has been conducted in order to explore preferences, uses of and Willingness to pay (WTP) for mountain forest services by the Veneto Region population. The results show that WTP is higher for recreation and C-sequestration and near to zero for landscape and biodiversity conservation. These results seriously question the feasibility of developing market-based mechanisms in Veneto Region in fields like biodiversity conservation and landscape and open a discussion on a revisited role of public institutions in the provision of such types of public goods.*

Keywords: policy tools, marked-based mechanisms, payment for ecosystem services, mountain forests, Veneto Region (Italy).

JEL Classification codes: Q23, Q56

1. Introduction

In Italy the first attempts to evaluate ES, beside the traditional forest goods such as timber, firewood and non-wood forest products, goes back to 40 years ago when Patrone (1970) made some estimates of the soil protection and landscape conservation functions . Today, driven by other and more global stances, the list has widened to include new services like climate mitigation, biodiversity conservation, recreation and effects on water quality and quantity in the Italian Alps (Merlo and Croitoru 2005, Tempesta and Marangon 2005, Goio et al. 2008). Most of these long-established and new services are un-priced goods, enjoyed freely by an increasing number of users. Some of them are provided through mandatory instruments; back in 1923, the Italian legislator decided that soil protection from erosion should have been provided by forests as a public good, and imposed a constrain on all mountain forests without compensation; with a similar approach, a landscape amenity

[1] This paper has been prepared thanks to the funds of the NEWFOREX project (New Ways to Value and Market Forest Externalities - http://www.newforex.org/) supported by the European Commission under the 7th Framework Programme for Research and Technological Development.

conservation was enforced in 1985. Others, like recreation, regulation of water flows and climate mitigation are provided in an unclear property right framework, impeding the full implementation of any market mechanisms.

Lacking compensation, forest owners do not include provision of ES amongst their management objectives, unless constrained by the existence of command-and-control tools. Among the few policy advises to enhance ES provision, the last national Forest Act (the legislative decree 227/2001) addressed only general indications and suggestions, implemented only in limited number of forest management plans. As a result, social optimum has been rarely achieved by the present forest management regimes. Increasing the revenues for the benefit providers and improving forest management in the society's perspective calls for new and appropriate policy tools (Merlo et al. 2000, Gatto et al. 2009). On turn, any policy aiming at internalising externalities or at developing new markets through Payments for Ecosystem Services (PES), needs a thorough assessment of the ES values at stake (MEAB 2005, Wunder 2008). It is essential, in Italy as well in other countries, to understand if and to what extent forest users, or in economic sense "consumers", perceive the value of forest ES, whether a Willingness to pay (WTP) exists, who wants to pay, for what and how much. These questions have inspired and stimulated the progress in the field of evaluation of forest ES: the result is a wide literature – contributing both from the methodological and operational viewpoints – on forest values, on the consumers' characteristics and perceptions and on the determinants of the demand for forest ES (Gómez-Baggethun et al. 2010).

This paper shows the results for the initial phases of the NEWFOREX project, focused on the assessment of WTP for forest ES, in terms of existence and magnitude, in the mountain forest of the Veneto Region (North-eastern Italy). The set of ES under evaluation ranges from aesthetic value to landscape, from carbon sequestration to recreation. The research contributes to fill a gap in the literature on evaluation exercises referred to the Alpine context, being one of the first attempts to estimate the values of different forest ES at the same time and at regional scale. However, the project final goal remains operational, so the evaluation effort is aimed at producing values and indications to support the design of appropriate policy mechanisms to enhance ES provision and to provide inputs to policy makers and forest managers.

The paper is organized as follow: a literature review introduces the ES valuation in the Alps; the section on methodologies presents the process undertaken by the authors to define attributes and econometrics models; a result and discussion session follows, with some conclusions providing some advise for the policy makers.

2. Evaluation of forest ES in the Alps

Since the approval in 1989 of the Alpine Convention[2] and its Mountain Forests and Environmental protection and landscape management Protocols, the attention of scholars towards the Alps and mountain forests has increased, while a fair amount of papers have been published on ES of Alpine forests, like biodiversity, landscape and soil protection. However, the literature assessing economically the values of these services is not equally rich, despite the well-established theoretical and methodological background. Even more scarce are the surveys attempting to measure ES values at

[2] http://www.alpconv.org/

regional or wide scale; usually the studies have considered either one ES – i.e. landscape and scenic beauty, recreation, biodiversity, water – or have attempted at an integrated assessment of the Total Economic Value of Alpine forests, but rarely a bunch of ES at the same time. Among the papers aiming at ES valuation, Croitoru (2007a) assessed several ES generated by mountain forest though Imputed Preference (Holbrook et al. 1988), while Tangerini and Soguel (2004) used Revealed Preference to evaluate the landscape of the Swiss Alps using an Adjusted Hedonic Pricing method and found that the landscape attribute considerably affects the final price of real estate properties. More recently Grêt-Regamey et al. (2008) summarized the ES valuations available on the Alps that used State Preferences Methods such as Contingent Valuation and Choice Experiment; the studies assess the value of landscape, recreation, biodiversity and avalanche protection separately, pointing out the considerable variability among values found, even when the studies deal with similar environmental services Lastly Croitoru (2007b) added a further evaluation based on Benefit transfer: a pillar for the implementation of ES markets. Also meta-analyses as combination of different evaluation methods have been implemented; for instance Goio et al. (2008), in the attempt to estimate the total economic value of the mountain forests in Trento province, found a much higher economic value for the ES compared to traditional forest production functions (timber) A major methodological contribution has been delivered by Scarpa and Thiene (2005) and Scarpa et al. (2007) on recreational assessment, merging Travel cost method and Choice experiment, and in such a way increasing the reliability of recreational service assessment generated by the mountain systems: up to now, the most studied ES in Veneto's mountain forests (Scarpa et al. 2008, Thiene and Scarpa 2008, 2009). Moreover, the valuation methods were based on stratification of users, which allowed a better understanding of the factors influencing personal choices and the direct elicitation of WTP.

On the contrary of recreation service, the studies on biodiversity economic values in the Alpine region are still limited. Among the few works available in literature, Soliva and Hunziker (2009) tried an integrated approach to evaluate biodiversity protection in Switzerland, while Getzner (2000) tested the hypothetical bias of WTP calculation within natural protected areas on specific sites like the Hohe Tauern National Park in Austria. An important contribution has been given by Menzel and Scarpa (2005), who aimed to improve the WTP assessment methodology for promoting new biodiversity protection programs.

Moving to watershed protection in the Alps, the massive presence of steep slopes and unstable soils has been a challenge for the economists assessing the values of this ES. Given the complexity of the cause-effects relationships between forests and downstream water control (FAO 2008), the service has mostly been assessed using Averting behaviour from a change of actual to better ES provision (Bateman et al. 2009), Other authors (Pettenella et al. 2006) applied different operational approaches traditionally used for the evaluation of the costs of ES provision (supply cost). Croitoru (2007a) used the Avoided loss approach making reference to the productivity in nearby agricultural areas and the Avoided costs approach related to building and managing drainages or other erosion control and land consolidation works, while Notaro (2001) used a mixed approach for assessing watershed protection, assuming that the value of water in rivers is linked to the level of fishable water fauna and to fishermen's surplus.

The literature review on values of ES in Alpine areas has pointed out the wide variability in the focus, scale, and values obtained by the studies; some of the works assess the Total Economic Value

of Alpine forests, others the value of single services; the ES considered are mostly landscape and recreation, while biodiversity, carbon sequestration or watershed protection are dealt more rarely. Finally the scale of the studies ranges from local to national, while none of the studies reviewed targeted Alpine region at full scale. In terms of methodology, a clear-cut distinction of approaches is not possible: regional or national studies focused on total economic value have mostly used Benefit Transfer with values estimated by revealed and stated preferences. Only recently, the focus of researchers has shifted towards a better understanding of consumers' behaviour as one root-component of environmental services demand. Methods like Choice experiment have been developed in order to overcome the limits of Contingent evaluation and applied to the Alpine context, but only at a local scale and not to all the most important forest externalities at the same time aim of this paper.

3. Methodology

3.1. Choice Experiment background

The methodologies to assess non-market values have been traditionally divided in two main branches: revealed preference method and state preference methods. The first have been developed to assess single non-market environmental goods based on observed behaviours. Hedonic Pricing and travel cost has been the most common approaches used to estimate the environmental value of the land surrounding a house or village or a touristic value of certain environment. However both of them have not been able to capture non-use value: the reason why state preference methods have been developed. Among the most common state preference methods, contingent valuation methods (CVM) have been adopted to estimate use and non-use values of certain environmental goods and services in which the respondents were asked to declare their WTP (open-ended survey) or more commonly to affirm their WTP a certain amount of money for a given environmental good or service (close-ended survey).

Despite some authors (Hausman 1993, Diamond and Hausman 1994) deeply argued CVM trustfulness, the method have been widely used since Choice experiment (CE) method (McFadden 1974) has been transferred from transportation marketing to environment goods and services assessment (Adamowicz 1995, Hanley et al. 1998). While CVM targets the study of WTP for a specific policy change, CE allows to break up complex goods in different attributes including price, and creates a set of policy scenarios changing the attribute levels according an experimental design that simulate the composition of different policies alternatives. Interviewed persons may compare and choose one of the policy alternatives within one of choice set, usually made up of different scenarios and the *status quo*. Hence, instead to answer to a single question, the respondent has to select a certain number of choice sets (Louviere 1991) changing each time their simulated policy alternatives.

CE models are rooted in the random utility model (RUM) (Lancaster 1966), which stated the utility U_{ijt} of a given an individual *i* gets form the alternative *j* in the choice situation *t* can be divide in a deterministic part V_{ijt} and a stochastic terms ε_{ijt}. Usually, the deterministic part is explained by linear parameters and it may be rewritten as product of vector $\beta' X_{ijt}$ that describe certain topic (1).

$$U_{ijt} = V_{ijt} + \varepsilon_{ijt} = \beta' X_{ijt} + \varepsilon_{ijt} \quad (1)$$

The respondent will maximize its utility choosing the scenario (or alternative) *j* among the other *k* within the choice set C_{it} if the scenario *j* has higher utility of the others. Hence, the probability to choose the alternative *j* over the other *k* may be describe in the (2)

$$Prob(j|C) = Prob\left(U_{ijt} > U_{ikt}\right) = Prob\left\{\left[\left(V_{ijt} - V_{ikt}\right) > \left(\varepsilon_{ikt} - \varepsilon_{ijt}\right)\right];\ j,k \in C;\ j \neq k\right\} \quad (2)$$

To estimate the equation (2) it must be assumed the error distribution, usually Gumbel-distributed and independently and identically distributed (IID), hence the probability to choose *j* is given by

$$P_{ijt} = \frac{e^{\mu\beta' X_{ijt}}}{\sum_{k\in C} e^{\mu\beta' X_{ikt}}} \quad (3)$$

where μ is the scale parameter, commonly used equal to one to keep constant error variance, X_{ijt} is the vector of attributes linked to the individual *i* that chooses the alternative j within the choice situation *t*, while β' is the vector of the betas. V_{ijt} considers, as in our case, individual's characteristics z_i that helps us to find respondent behaviours on particular socio-demographic strata of the sample. The equation (3) may be estimated through a mulit-nomial logit (MNL) regression if only independence for irrelevant alternatives (IIA) holds, which means the ratio of choice probability of a given alternative is not affected by any other alternatives, because the utility is set up systematically with the statistical design (Ben-Akiva and Lerman 1985). Nevertheless, IIA is seldom respect, so other models have to by considered. Finally the average willingness to pay for a given attribute may be calculated with the ratio between the beta parameters of interest β_a and the beta parameters of cost β_c (Train 2003), as follow:

$$WTP = -c\frac{\beta_a}{\beta_c} \quad (4)$$

Only in case of effect coded variable, the (4) have to be multiplied for a constant terms equal two (Bech and Gyrd-Hansen 2005). In this paper we consider also latent class model (LCM) (Boxall and Adamowicz 2002) to overcome to this problem, in which it is considered the presence of a certain number of segment *s* in the population sample that in total has S segments. Thus, the utility function of an individual *i* that belongs to a particular segment s and chooses the alternative *j* within the choice situation *t* can be written as:

$$U_{ijt|s} = V_{ij|s} + \varepsilon_{ijt|s} = \beta_s' X_{ijt} + \varepsilon_{ijt|s} \quad (5)$$

where β_s is the vector that explain the homogeneity within the segment *s* and the heterogeneity among the segments *S*. Assuming the same error distribution as in the (3) the probability that individual *i* belonging to segment *s* chooses the alternative *j* is given by:

$$P_{ijt|s} = \frac{e^{\mu_s\beta_s' X_{ijt}}}{\sum_{k\in C} e^{\mu_s\beta_s' X_{ikt}}} \quad (6)$$

Nevertheless the (6) provides only partial information on the individual choices. The likelihood of an individual *i* to belong to a given segment *s* within a finite number *S* depends to the socio-economic characteristics, personal knowledge and attitude in general *Z*, thus membership likelihood function may represent as:

$$M_{is} = \lambda_s Z_i + \xi_{is} \quad (7)$$

where λ_s is a segment of the vector λ and ξ_{is} is the error terms. Assuming IID of the error term, the probability of the individual *i* to belong to segment *s* is:

$$P_{is} = \frac{e^{\mu_s \lambda_s Z_i}}{\sum_{k \in C} e^{\mu_s \lambda_h Z_i}} \quad (8)$$

where λ_h ($h=1,2,..S$) are the segment-specific parameters that have to be estimated for each individual. The sum of the all segment P_{is} sum up to one, so the *s-esim* P_{is} varies from zero to one.
Whether the (6) and the (8) are put together we obtain the probability of the individual *i* belonging to segment s and choosing alternative *j* within the choice situation *t* and it can be written as:

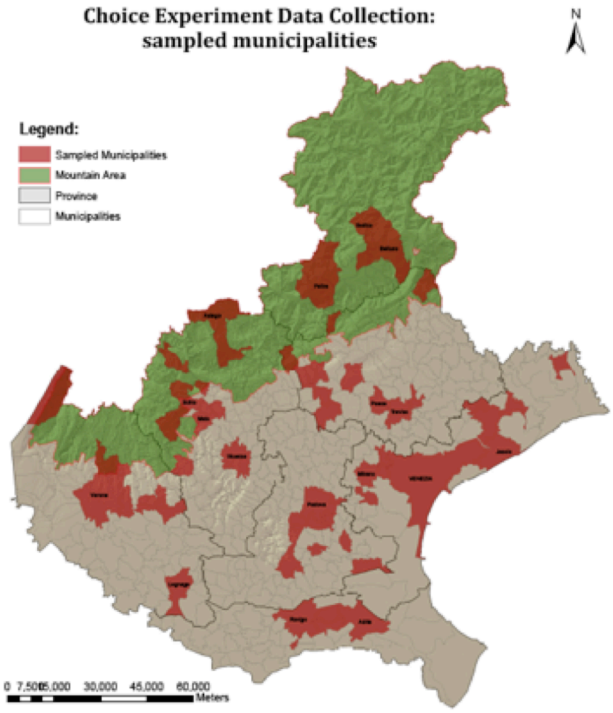
$$P_{ijts} = P_{ijt|s} \cdot P_{is} = \frac{e^{\mu_s \beta_s' X_{ijt}}}{\sum_{k \in C} e^{\mu_s \beta_s' X_{ikt}}} \cdot \frac{e^{\mu_s \lambda_s Z_i}}{\sum_{k \in C} e^{\mu_s \lambda_h Z_i}} \quad (9)$$

In the following paragraph we will describe in the details the target population we selected, the attribute description, and the statistical design with the utility function specification.

3.2. Target and sample population

The target population considered in the CE survey is the resident population of the Veneto Region, by far the main user of forest-related mountain externalities excluding recreational activities already paid by tourists. The target sample was identified as 700 people to be interviewed during July-October 2011 through a face-to-face interview. Two interview sessions were carried out: 74 people were interviewed with a pilot survey and 630 people with the final version of the questionnaire.
The pilot test was mainly run to calculate the priors to calculate the D-optimal design for the final version of the survey (Street et al. 2005). The main survey began just after the summer and ended in the second half of October gathering 637 validated questionnaires; very few people refused to answer (below 2.5%, in the main survey 16 people) and this is partially do to the economic compensation for the time loss we gave to the respondents (~10 €/person).
In order to maximise the representativeness, we designed the survey sample using two main strata, namely the place of residence – whether on the plain or in the mountain areas – and the size of the municipality of residence: for this, we used four strata based on the number of inhabitants: 0-5,000, 5,000-10,000, 10,000-100,000 and the provincial capital.
The geographical distribution (see Figure 1) of the sample covered 63 municipalities that included cities, towns and villages (10.3% of the total number of municipalities in the Region). Chi-squared was run to test the hypothesis of sample-population similitude. The difference between Veneto's population and that sampled did not exceed 5% for gender balance, age classes and size of household; only two parameters – education and income – were not comparable, due to the lack of data to design the real sample.

Figure 1: Sample distribution



Source: our elaboration

Indeed, education was the only socio-demographic parameter that was not considered in the statistical design, therefore one potential bias of the research could be the failure to reach people without education, representing around the 8% of the total voters, even though the expected proportion of persons without formal education in the sample is lower than in the reference population. As regards income, we had to take into consideration that, for a cultural attitude, Italians do not like to disclose information on their earnings and information on this issue is not publicly available, even with a formal request to the regional tax office. Thus we only have information on the income composition of the sample population, where 60.7% were families in which the main income came from employed workers and 34.4% families with self-employed workers (4.8% provided no answer). In the survey, we asked for indications on household monthly income (then transformed into annual income) from the employed workers and on net annual household income from the self-employed. Merging together the two income types we obtained an aggregate distribution in four classes on a single scale: 0-30, 30-60, 60-120 and more than 120 thousand Euros per year. After the survey, a further test was performed with reference to the rurality indicator (OECD 1994, Jonard et al. 2009). A threshold of 150 inhabitants per square kilometre was used to divide rural municipalities from non-rural municipalities. The sample distribution generally fits Veneto's rurality distribution despite mountain remote areas being considered inappropriate because more linked to the ES supply instead ES demand.

The questionnaire was prepared to serve as a guide during the face-to-face interviews. It is organized in four main parts: the first asks attitudes and frequency of the use of mountain goods and services, the second part introduces the attributes and attribute levels and ends with six choice tasks of the CE, the third part is a debriefing aimed at understanding the respondent's impressions of the questionnaire and the last part is on socio-demographic variables. It is worth mentioning that the attributes and attribute levels were thoroughly explained before the CE, to fill the knowledge gap on forest externalities of the ordinary residents of the Veneto Region[3].

3.3. Attribute selection

Forests in Veneto are mostly located in the Northern part of the region, in the mountainous areas of the Alpine range. Here, together with pastures and meadows, they are the two main components of the landscape. At the same time, they contribute towards biodiversity conservation – as many as 240,984 hectares of forests are within the Natura 2000 network accounting for the 64% of mountain forest surface – they are destinations for recreational activities. On average they are able to attract over 5.3 million daily stays per year (Regione Veneto 2011). Moreover, forests play an essential role in protecting soils from erosion in steep slopes and they represent an important carbon sink accumulating every year 2.2 $MtCO_2$.

Based on the physical, ecological and economic characteristics of forest ES in Veneto, a preliminary selection of the forest attributes to insert in the CE has been made. The initial list comprised: i) landscape beauty; ii) biodiversity conservation; iii) carbon sequestration; iv) recreation; v) effect of the forest on soil erosion and landslide prevention. Effects on the forests on water quality, quantity

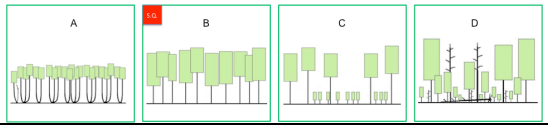
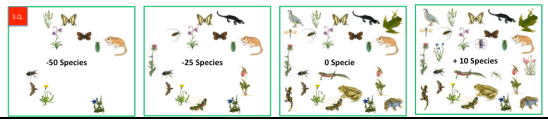
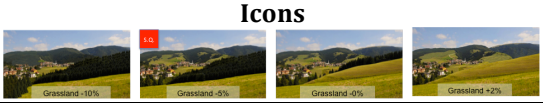
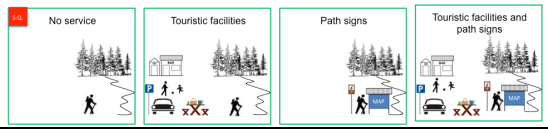
[3] This also helped to filter respondents who did not understand the CE and gave illogical answers. For instance, we asked them to identify the best level for one specific attribute without any reference to its cost and, in this way, we understood whether they grasped the meaning of the question. These answers have been used to weight their answers or to identify strategic or protest answers.

and regimes, although relevant, have been deliberately excluded from the analysis since the beginning, due to the difficulties of identify clear cause-effect relationships between forest management practices and effects on water on which to build the proposed CE scenario. Moreover, the conspicuous number of regulations is limiting forest owners to manage freely their land with the results of land abandonment and forest re-naturalization that, as a matter of fact, are unintentional good practices which improve water quality (Bagnaresi et al. 1999).

In order to show forest attributes in the most effective way to the respondents three focus group sessions with sectoral experts were organized: the first group included mostly forest ecologists and silviculturalists, the second group included naturalists and landscape experts, the third group mostly economists, each one consisting of 8-12 professionals. At first, the experts were interviewed singularly while afterwards they were invited to participate to an open debate in a focus group in order to see whether or not they confirm their previous suggestions. As a result of the three focus groups, a set of attributes and attributes levels have been drafted as reported in Table 1.

Forest structure view has been the first and the most debated attribute. Originally it was draft to describe the soil erosion effects according to different forest management techniques, however due to the river floods occurred in the region the year before the survey, respondents had a very high grudge on their answers leading strategic answers. Though it was not the same, we convert it in a recreational attribute to capture at least the respondents' connection with forest in terms of aesthetic appreciation, so far the main visible output of the forest management people may see along roads or paths. An attribute on carbon sequestration was developed using the information gathered in a regional program for marketing carbon credits generated by the regional forests (www.carbomark.org). Biodiversity was another difficult attribute to describe due to the scale of biodiversity representativeness, very often site specific. Despite regional dwellers are not so familiar with biodiversity, the attribute was considered for the increasing demand for nature-based experiences (flora and fauna watching). Finally we draft the biodiversity attribute with reference to the number of Alpine threaten species,. Landscape view, as mosaic of forest and grassland, was the second last attribute; we add it to check and update findings of previous studies (Tempesta and Thiene 2004) on this topic, considering also the growing interest to maintain a balanced relationship between the mountain farmland under a process of abandonment and an expanding forest cover. Recreation facilities in the forest (picnic and barbecue areas, mountain paths, car parks, ...) were the last attribute considered in the survey, being such infrastructures extensively requested by forest users. An annual regional income tax has been assumed as the most suitable and concrete payment vehicle for the majority of the respondents and it logically associated to the proposed policy scenarios implementation. The wide range of cost levels has been defined according to the economists' suggestions in the focus groups and it allows respondent to have fewer attribute repetition between the alternatives, keeping at the same time the low number of choice sets.

Table 1: Attributes of the CE survey

Attribute	Attribute level		Reference
Forest structure view along paths and roads	**Icons** 		(Nielsen et al. 2007) modif.
	Description	**Model code**	
	A=thick stand forest (coppice);	view A	
	B=even aged forest (*Status quo* – S.Q.);		
	C=uneven aged forest;	view C	
	D=uneven aged forest with dead tree	view D	
Carbon sequestration in forest stocks as % of the Veneto's dweller in a carbon neutral condition	**Icons** 		(Mogas et al. 2006) modif.
	Description	**Model Code**	
	Level 1= 5.5% (or 280.000 people) of Veneto's dwellers (S.Q.);		
	Level 2=7%;	CO_2 7%	
	Level 3=8.5%;	CO_2 8.5%	
	Level 4=10% (the maximum percentage whether all the forest will leave in natural evolution)	CO_2 10%	
Number of threatened species lost/protected	**Icons** 		(Lehtonen et al. 2003, Christie et al. 2006, Jacobsen et al. 2007) modif.
	Description	**Model Code**	
	Level 1=-50 species (S.Q.);		
	Level 2= -25 species;	BIO -25	
	Level 3= 0 species lost;	BIO 0	
	Level 4=+2species gain from surrounding regions.	BIO +2	
Landscape aesthetic view	**Icons** 		(Tempesta and Thiene 2004, Tempesta and Marangon 2005, Grêt-Regamey et al. 2008) modif.
	Description	**Model Code**	
	Level 1=-10% of grassland;	LAND-10	
	Level 2=-5% of grassland (S.Q.);		
	Level 3= 0% of grassland;	LAND 0	
	Level 4=+2% of grassland	LAND +2	
Recreation in forest	**Icons** 		(Christie et al. 2007) modif.
	Description	**Model Code**	
	Level 1= No service (S.Q.);		
	Level 2=Touristic facilities;	recrST	
	Level 3= Path signs;	recrS	
	Level 4=Touristic facilities and path signs	recrSST	
Cost	Levels= 0(S.Q.) 25, 50, 75, 100, 125, 150, 175, 200€/household/year		

Note: picture source: our elaboration; red boxes in the attribute level are referred to *status quo* situation.

3.4. Choice experiment statistical design

The statistical design is a fundamental step of the Choice experiment method. We proceeded in two phases according the procedure suggested by Bliemer and Rose (2009) after we defined the utility function as:

$$U_{ijt} = b0 + b1_j viewA_{it} + b2_j viewC_{it} + b3_j viewD_{it} + b4_j CO2_{it} + b5_j bio_{it} + b6_j land_{it} + b7_j recrST_{it} + b8_j recrS_{it} + b9_j recrSST_{it} + b10_j cost_{it} + \varepsilon_{ijt} \quad (10)$$

where the single variables are explained in the table 1. Firstly, we created the statistical design for the pilot survey in order to estimate some preliminary betas, also called priors. The priors, estimated with Multi-Nominal Logit (MNL), have been used to develop the final statistical design for the main survey. In the pilot, we estimated a Dz-efficient design with Ngene software ®©, using priors equal to zero (Bliemer and Rose 2005), rather than an orthogonal design. The benefit of this procedure is the possibility to combine dummy coded and continue variables in the same design, as well

Table 2: Alternative choice frequency: difference between estimated and real choices

	Estimated			Real			Differences		
Choice set	Alt 1	Alt 2	S.Q.	Alt 1	Alt 2	S.Q.	Δ alt 1	Δ alt 2	Δ S.Q.
1	33.67	30.94	35.39	34.91	22.01	43.08	1.24	-8.93	7.69
2	59.93	15.34	24.72	65.20	19.44	15.36	5.27	4.09	-9.36
3	37.88	26.71	35.41	60.69	16.67	22.64	22.81	-10.04	-12.77
4	16.53	51.29	32.18	14.15	47.17	38.68	-2.38	-4.12	6.49
5	43.75	23.66	32.59	22.64	27.36	50.00	-21.11	3.69	17.41
6	23.32	31.58	45.10	16.30	44.83	38.87	-7.02	13.25	-6.23
7	24.68	38.99	36.34	21.00	52.98	26.02	-3.67	13.99	-10.32
8	33.49	35.30	31.21	23.51	26.65	49.84	-9.98	-8.65	18.63
9	24.07	44.83	31.10	22.33	53.14	24.53	-1.74	8.32	-6.58
10	18.45	47.67	33.88	15.67	28.53	55.80	-2.78	-19.14	21.92
11	31.94	17.33	50.73	37.30	17.87	44.83	5.36	0.54	-5.90
12	33.50	20.44	46.06	16.04	30.19	53.77	-17.46	9.75	7.71

Note: the choice set of block 2 are reported in grey shading; S.Q. = *status quo* alternative.
Source: our elaboration

to weight the maximum and minimum values of continue variables[4]. Based on the CE answers we estimated the MNL model betas used as priors in the final statistical design using the utility function (10) (the statistical design of the full survey is presented in Appendix 1). Due to serial non participant or protesters (von Haefen et al. 2005, Meyerho and Liebe 2008) during the pilot questionnaire,

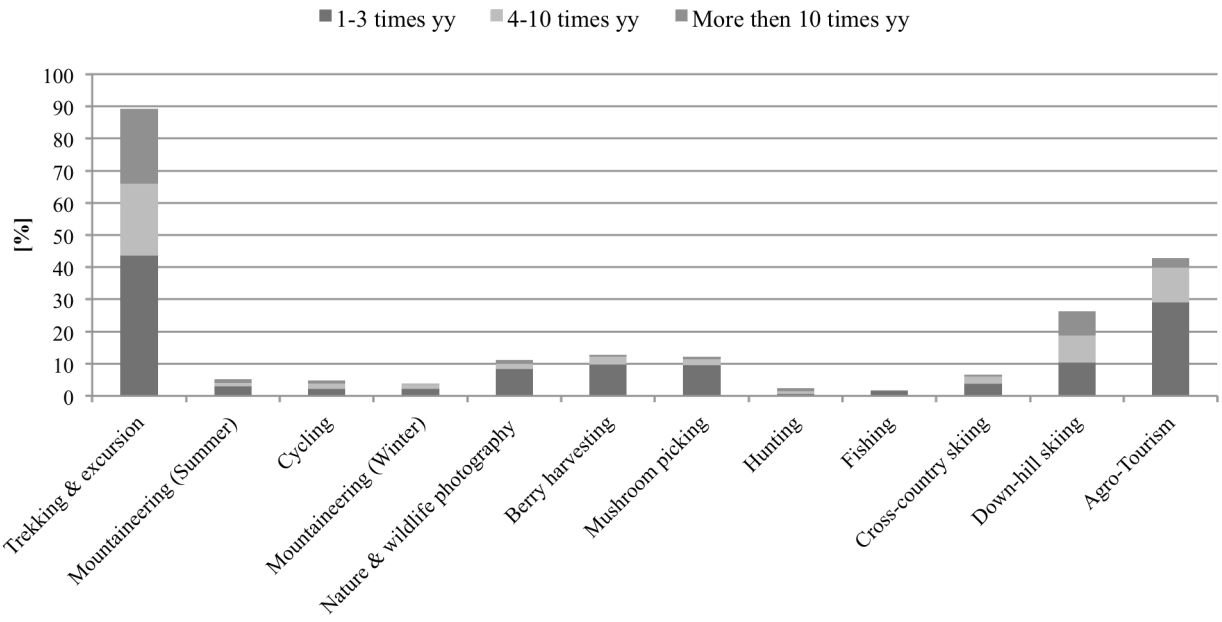
[4] For instance, in the case of linear attributes such as carbon sequestration, biodiversity and cost, the higher levels, linked to the effort required to implement them, are less representative than the lower levels: this is in accordance with the theory that maintaining or increasing provision of forest externalities requires a great deal of effort.

more than 20% of the observations had to be dropped from the analysis, and the priors have been estimated with the remaining answers, then used to estimate the statistical design (see Appendix 1). Finally we checked the presence of dominant alternatives (Table 2). We found limited dominant effect in the estimated design, while the choice frequencies from the questionnaire showed a similar distribution with higher ratio in the ones having higher probability to be chosen in the estimated design. During the CE session, respondents were asked to answer six choice tasks out of the twelve contained in the CE statistical design. In order to split the choice tasks homogeneously, the block column has been used. The block column is a further attribute that is introduced in the statistical design and it is balanced to the other attributes. This helped us to split the design in different parts (the same number as the number of blocks) to reduce the amount of choice tasks for the respondent.

4. Results and discussions

The results of our survey show the 57.9% of the Veneto population goes in mountain at least once a year, nevertheless only 29.4% of the respondents stated they visit Veneto's mountain while another 28.7% prefer mountains in the neighbouring Regions such as Trentino-Alto-Adige and Friuli-

Figure 2: Use of mountains for tourism and recreation: frequency graph



Note: Percentage of the sample. Source: our elaboration

Venezia-Giulia. Considering that 97.5% of this 29.4% undertake only daytrips, which are not recorded by official statistics, and assuming 4.9 million of Veneto's dwellers, the total number of user in the mountain areas could be at least 1.4 million (considering also the ratio of refuse answers). This number is surely underestimated, because it does not consider tourist coming from neighbour regions and other countries, but it may indicate a dimension mountain users populantion.

One purpose of the questionnaire was also to survey the several activities done in mountain areas by visitors and the frequency of the use. We identified twelve main categories as reported in Figure 2. The results show that trekking and visiting agro-tourism facilities are the only activities for the ma-

jority of people (mostly in the summer), while down-hill skiing is the most preferred activity in the winter season. Mushroom and truffle picking are also quite frequent recreational activities among the mountain users, as well as nature and wildlife photography. The categories on the left-side of berry picking (included) in the graph are regulated but free of charge, while on the right-side (berry picking excluded) the activities are payment based. It is worth mentioning the lobbying effect of hunters, a small group compared to other users' groups (e.g. hiking and climbing associations like the *Club Alpino Italiano*, mushroom pickers or birdwatchers associations, etc.), but with high influence and effective power on public decision-makers.

4.1. Results of the CE survey

Since the pilot phase of the CE we have found a huge knowledge gaps on the majority of the respondents, thus we decided to ask within each attribute explanation what level they would have preferred in absence of green taxation, in order to study the interest the respondent had for every externality (Table 3, "Before CE" column). On the contrary we expected not all the respondents chose

Table 3: Attribute level choice before and during CE: frequency table

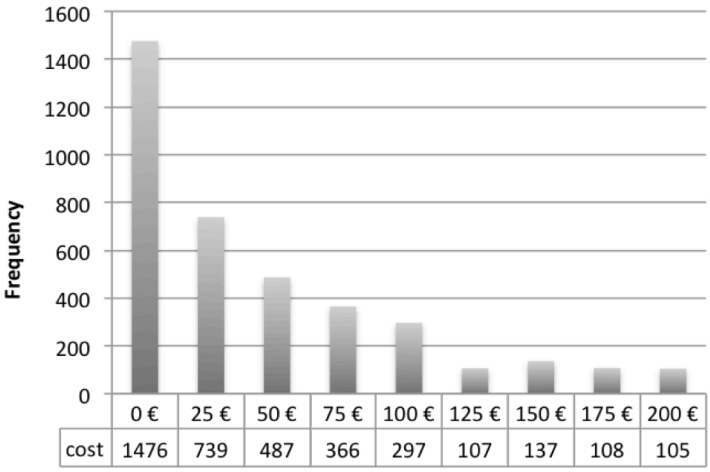
	Before CE				CE choices				Differences				
Attribute	L 1	L 2	L 3	L 4	L 1	L 2	L 3	L 4	Δ L 1	Δ L 2	Δ L 3	Δ L 4	Chi-test
view	9.1	33.0	34.4	23.5	16.6	50.7	15.5	17.2	7.5	17.7	-18.8	-6.4	4.1E-06
CO2	22.5	19.4	18.2	39.9	44.8	13.8	16.3	25.1	22.3	-5.6	-1.9	-14.7	1.8E-06
bio	14.8	11.0	33.2	41.1	54.3	16.5	13.8	15.4	39.5	5.5	-19.4	-25.6	3.3E-29
land	31.8	26.5	26.3	15.5	17.7	45.8	19.4	17.1	-14.1	19.3	-6.8	1.6	5.6E-05
recreation	17.4	14.6	27.0	41.1	47.5	15.8	19.5	17.2	30.2	1.1	-7.5	-23.8	1.1E-14

Note: The table is based on respondents who gave acceptable answers: protesters have not been considered. The column before CE was compiled directly using the answer frequency, while CE choices were calculated summing up the frequency of the chosen alternative that contains the specific attribute level. In grey shadow the S.Q. levels. L = Level (followed by a number). The level from L1 to L4 has the same order as the attribute levels reported in section 3.2). Source: our elaboration.

the higher levels (L4) on biodiversity maintenance, carbon sequestration and touristic infrastructure, thought they followed the design patterns. Moreover, landscape view attribute has been chosen in the opposite trend to what we designed with the priors, so landscapes with more forest area was preferred instead of open areas and meadows. Open areas are consider more desirable than forest areas (Tempesta and Thiene 2004) in the mountain environment, nevertheless, if the landscape aesthetic view is evaluated within a larger variety of mountain forest externalities, is less appreciated. It is worth mentioning the weak environmental sensitivity of the population. Once the cost attribute was introduced (see "CE choices" columns), the choice of *status quo* dramatically increased in terms of frequency. This behaviour strongly affected the model output, especially in terms of attribute significance. Among the attributes costs have been the most important attributes; looking at the choice frequency of the cost attribute (Figure 3) (sum of all cost levels selected in the choice sets), we can see the negative slope distribution confirming the marginal utility theory (more it cost less you are willing to pay), while from the table 5 we can see more irregular attribute trends either before and after CE, though the 88% of the people interviewed declared to have understood the questionnaire and only the remaining 12 affirmed CE was difficult.

Protest answers on CE, accounting for 8.9% of all respondents, have been an additional constraint on the model estimation. We identified them as those persons always opting for the *status quo* or even refusing to answer some questions; these respondents were subjected to an additional set of control questions as reported in Table 6: if they answered positively to at least one out of the first four options in Table 4, they were considered as definitely protesters and hence rejected from the model estimation. The total number of protest respondents was 61.

Figure 3: Cost attribute: frequency distribution



Note: Values reported under x-axis represent the choice frequency contained in the chosen alternatives, excluding protesters. Source: our elaboration

The estimation of a general model for the Veneto Region population has been the first step in data elaboration using Nlogit software©®. Applying basic MNL model (McFadden 1974), we initially obtained quite weak results (see Table 5) at the aggregated level. This can be explained partially by the answers' heterogeneity; in fact, Model 1.1 (all respondents) shows a general "unwillingness" to pay for the majority of the attributes, except for recreation facilities ("recrSST" variable). Slight improvements of the model outputs have been obtained by introducing some dummy variables such us "non-protesters", "mountain users" and "mountain non-users". Once the vector of the attributes was multiply by the dummy for the non-protesters better outputs were obtained. Model 2.1 fits better parameters, showing a general willingness to change from the present situation (ASC < 0) and good fit of the model with the majority of the attributes significant at 5%; only the "LAND" variable shows unexpected negative sign, pointing out a general careless about open areas in mountain areas. So, moving from Model 1.1 to Model 2.1 protesters play an critical role adding important bias on the model fit as observed by Holbrook et al. (1988). Following the idea of use and non-use values, we tested the differences between "mountain users" (Model 3.1) and "mountain non-users" (Model 4.1) (Adamowicz et al. 1998). As expected people having a direct interest on a given good have also higher propensity to spend for it; in Model 1.1 we may see an increasing interest on biodiversity maintenance and even-aged managed forest, though their main attention is addressed on touristic

Table 4: Frequency table of protesters answers

	Number of respondents	[%] of the sample
It is too costly	55	8.6
I do not have enough money	58	9.1
I already pay enough taxes	61	9.6
I prefer to spend my money on other things	56	8.8
The programme is not important	35	5.5
I don't believe the programme will be implemented	38	6.0
Other programmes could be better	29	4.6
I want things left as they are now	31	4.9

Source: our elaboration

facilities; in fact, trekking and excursions are the main recreational activities in the Veneto's mountains (see Figure 2). Nevertheless, the present state of the environment does not push the mountain users to have a high willingness to change as the ASC is positive and significant.

Non-use value is another crucial information for the policy maker targeting ES provision at regional scale. Model 4.1 shows the presence of reduced WTP stated by mountain non-users, though it is limited to touristic infrastructure and carbon sequestration. Here it is worth to mention the negative sign of "recrS" (see variable explanation in table 1), activities linked to active mountain users, so, as option-value, they are more attracted to touristic infrastructure ("recrST"). WTP for Carbon sequestration could be regarded as the effect of mass media advertise on climatic change, affecting people that have lost direct links with the forest (see negative coefficients for outdoor recreation in Model

Table 5: MNL Model outputs

	MNL				
Variables	Model 1.1 (all respondent)	Model 2.1 (dummy for non protest)	Model 3.1 (dummy for non protest & users)	Model 4.1 (dummy for non protest & non-users)	Model 5.1 (interaction with edu & dummy for non protest)
ASC	0.045	-0.684***	0.457***	0.307***	-0.065
viewA	-0.003	0.106**	0.103*	-0.200**	0.008**
viewC	0.030	0.130**	0.145**	-0.105	0.014***
viewD	-0.005	0.086*	-0.034	-0.001	2e-5
CO2	0.052	0.112**	-0.143***	0.297***	-0.001
BIO	0.003	0.006**	0.019***	-0.015***	0.001***
LAND	-0.005	-0.010*	0.001	-0.013	-0.823
recrST	0.048	0.119**	-0.050	0.204**	0.004
recrS	0.011	0.065	0.291***	-0.400***	0.011**
recrSST	0.223***	0.441***	0.211***	0.270***	0.025***
COST	-0.009***	-0.010***	-0.013***	-0.006***	-0.012***
Obs.	3822	3822	3822	3822	3822
Log-L	-4172.47	-4172.47	-4172.47	-4172.47	-4172.47
R-sqrd	0.05928	0.09962	0.08795	0.06130	0.09186
Adj. R-sqrd	0.05792	0.09833	0.08694	0.06003	0.09055

Note: starred values represent the p-value : * = 0.10, ** = 0.05, *** = 0.001. The variables codes are reported in table 1. ASC = Alternative Specific Constant, usually equal in the un-labelled CE. Source: our elaboration.

3.1). Finally, the interaction with education (years of education) has been tested to verify the role of knowledge in the CE (see Model 5.1); basically the differences with Model 1.1 are minimal, though education enhances the parameters of costs.

Moreover, the models in Table 5 have been re-estimated after recoding "CO_2", "BIO" and "LAND" in dummy coded variables according to the levels reported in Table 1. We took as reference level the *status quo* for each variable (5.5% for carbon sequestration, -50% species for biodiversity and -5% for landscape). The results show a non-linear pattern (see Table 6) explaining average responded behaviour on the single level. For instance, "CO_2" at 8.5% has been the less meaningful attribute level; people preferred to choose the lower and the higher "CO_2" levels. Model 2.2 adds information about attribute "LAND", in which people preferred to keep the grassland surfaces as such, while in Model 2.1 people choice referred to a forest surface increment. Further information are

provide by Model 4.2 where biodiversity is significant at "-25 species" level (in Model 4.1 is negative).

Table 6: MNL model outputs for recoded variables

	MNL				
	Model 1.2 (all resp.)	Model 2.2 (dummy for protest)	Model 3.2 (dummies for non-prot. & user)	Model 4.2 (dummies for non-prot. & non-user)	Model 5.2 (interaction with edu & dummy for non protest)
VIEWA	0.042	0.239***	0.201**	-0.228**	0.015**
VIEWC	0.159**	0.175**	0.032	0.194*	0.013**
VIEWD	-0.167**	-0.098	-0.076	-0.351***	-0.010**
CO2 +7%	0.294***	0.417***	0.176	0.464***	0.030***
CO2 +8.5%	-0.317***	-0.502***	-0.383***	-0.203*	-0.035***
CO2 +10%	0.263***	-0.074	0.109	1.014***	0.004
BIO -25	0.007	0.094	-2e4	0.302**	0.007
BIO 0	0.151**	0.508***	0.451***	-0.465***	0.034***
BIO +10	-0.055	0.267**	0.182*	-0.734***	0.014**
LAND -10%	-0.090	-0.252***	-0.021	-0.083	-0.016***
LAND 0%	0.085	0.434***	0.369**	-0.266*	0.029***
LAND +2%	-0.103	-0.156**	-0.171*	-0.062	-0.011**
RECRST	0.013	-0.174**	-0.190*	0.271**	-0.011*
RECRS	0.048	0.240***	0.169**	-0.285**	0.015**
RECRSST	0.289***	0.417***	0.302***	0.452***	0.030***
COST	-0.009***	-0.017***	-0.010***	-0.004***	-0.014***
Obs.	3822	3822	3822	3822	3822
Log-L	-4172.47	-4172.47	-4172.47	-4172.47	-4172.47
R-sqrd	0.06599	0.10818	0.08756	0.10277	0.10139
Adj. R-sqrd	0.06403	0.10631	0.08564	0.10077	0.09950

Note: starred values represent the p-value : * = 0.10, ** = 0.05, *** = 0.001. Source: our elaboration.

Despite the use of continue variables, the recoding has highlighted the respondent' propensity to have higher attention on the extreme levels of attributes.

Lastly, LCM has been estimated (see Table 7). The results provide interesting information, confirming partially the major findings of the previous models. Actually the model delivered two groups of people differing from their willingness to support the changes. The Group 1 is characterised by people willing to have forest left to its natural evolution ("viewD") as well willing to support carbon sequestration policies and an abundant demand for recreation infrastructures, while on the contrary considering biodiversity maintenance, policy for keeping grassland and the investment on path signs, rather superfluous. Group 2 has a total different behaviour, with a willingness to have more path signs and landscape maintenance, with the conversion of coppice forest. Nevertheless, the idea to pay for something does not hold, as ASC is positive and significant. The fact can be understood looking at the λ values: Group 2 gathers mountain users with and people with high education, while the opposite is in the Group 1. This holds also with the previous findings reported in Table 5.

Table 7: Latent Class model

	LCM	
	Group 1 (prob. 53.3%)	Group 2 (prob. 46.7%)
ASC	-1.114***	1.489***
viewA	-0.112	-0.111**
viewC	-0.050	0.018
viewD	0.722***	0.061
CO2	0.785***	-0.052
BIO	-0.026***	0.007*
LAND	-0.065***	0.013**
recrST	0.030	-0.063
recrS	-0.677***	0.244***
recrSST	1.777***	0.035
COST	-0.051***	-0.004**
Prob. model	λ_1	λ_2 (reference)
Constant	1.142***	0
Protest	32.032	0
Mount. User	-1.014***	0
Education	-0.050**	0
Obs.	3822	
Log-L	-2968.79	
R-sqrd	0.29296	
Adj. R-sqrd	0.29045	

Note: starred values represent the p-value: * = 0.10, ** = 0.05, *** = 0.001
Source: our elaboration.

Table 8: Characteristics of LCM groups

				Group 1	Group 2	G1 [%]	G2 [%]
Non protesters				284	298	48.8	51.2
	Non Users			152	84	64.4	35.6
		edu. [year]	5	11	9		
			8	70	29		
			11	6	4		
			13	51	34		
			18	14	8		
	Users			132	214	38.2	61.8
		edu. [year]	5	4	9		
			8	55	67		
			11	7	12		
			13	55	84		
			18	11	42		
Protesters				55		100.0	0.0
	Non Users			32			
		edu. [year]	5	1			
			8	18			
			11	4			
			13	8			
			18	1			
	Users			23			
		edu. [year]	8	11			
			11	4			
			13	7			
			18	1			
Total				339	298	53.2	46.8

Source: our elaboration.

A general finding of the paper is the presence of option and existence values for some ES, hence showing a potential perceived scarcity among Veneto's dwellers for the 83% living in the plain areas. On the contrary of target specific valuation (Scarpa and Thiene 2005), where the sample was selected among the good or service users, on large scale policy, all the population has to be considered because directly or indirectly they may use a given ES.. As stated in several other papers (Scarpa and Thiene 2005, Scarpa et al. 2007), LCM helps to define homogenous choices within a certain strata of the population. Nevertheless, the outputs are not straightforward applicable in the real policy because there is no clear distinction of the groups by variables (see Table 8), due to the difficulty to cluster up people belonging to the same socio-demographic strata. Surely the models can be improved and they can be used to indicate choice behaviour on ES demand, adding information that are generally difficult to generate with traditional models (Boxall and Adamowicz 2002).

After the MNL model estimations, we calculated the WTP marginal values (see Table 9) as ration between the coefficient attribute and the opposite coefficient of price as reported above. Only for Model 5.1 different approach was needed, due to the education interaction effect. Basically, educa-

tion is not the same through the sample so we needed to weight the attribute coefficient with the sample frequency (Hidrue et al. 2011, Martinez-Cruz 2012) (see Table 9 and Table 10).

Table 9: WTP marginal values [€/ES unit change]

	MNL				
Variables	Model 1.1 (all respondent)	Model 2.1 (dummy for non protest)	Model 3.1 (dummy for non protest & users)	Model 4.1 (dummy for non protest & non-users)	Model 5.1 (interaction with edu & dummy for non protest)
ASC					
viewA	0	21.28	0	-62.22	14.46
viewC	0	25.98	20.91	0	24.18
viewD	0	0	0	0	0
CO2	0	11.21	-10.30	46.20	0
BIO	0	0.62	1.37	-2.41	0.87
LAND	0	0	0	0	0
recrST	0	23.69	0	63.33	0
recrS	0	0	41.96	-124.62	19.68
recrSST	48.43	88.00	30.33	84.05	44.35

Table 10: WTP marginal values for effect coded variables [€/ES unit change]

	MNL				
	Model 1.2 (all resp.)	Model 2.2 (dummy for protest)	Model 3.2 (dummies for non-prot. & user)	Model 4.2 (dummies for non-prot. & non-user)	Model 5.2 (interaction with edu & dummy for non protest)
VIEWA	0	27.74	38.71	-104.46	23.30
VIEWC	32.71	20.29	0	0	20.79
VIEWD	-34.44	0	0	-160.17	-16.39
CO2 +7%	60.48	48.46	0	211.95	46.27
CO2 +8.5%	-65.39	-58.31	-73.86	0	-55.76
CO2 +10%	54.07	0	0	462.49	0
BIO -25	0	0	0	137.81	0
BIO 0	31.02	58.96	86.77	-212.40	52.75
BIO +10	0	31.05	0	-334.87	21.28
LAND -10%	0	-29.27	0	0	-24.96
LAND 0%	0	50.37	71.08	0	45.55
LAND +2%	0	-18.18	0	0	-18.18
RECRST	0	-20.25	0	123.48	0
RECRS	0	27.87	32.57	-130.27	24.22
RECRSST	59.52	48.38	58.22	206.27	46.96

Source: our elaboration.

The overall WTP for the ES provision in Veneto may be calculated as a positive marginal variation of each attributes within the given model; the values wave between the 48 (Model 1.1 in Table 9) to 313 €/household/year (Model 2.2 in Table 10). Hence, the creation of a hypothetical environmental fund may generate approximately 51 to 338 M€/year (considering the 8% of the families under the minimal income threshold). These values might be considered in line with the results of similar studies (Tempesta and Marangon 2005, Goio et al. 2008) for the assessment of the Italian forest landscape by asking to respondent whether they were willing to abrogate a law for forest fires pre-

vention thus reducing the tax load. The results estimated a total economic value of 722.6 €/ha, with a non-use value component of 665 €/ha, which correspond to 220 M€/year applying our socio-demographic parameters. The results may also compare with the actual annual household payment for Common Agriculture Policy. According to OECD (2010), the average European household expenditure account for 1200 €/household/year, and nearly one third is used to subsidies the agro-forestry measure (mainly in the second pillar of Common Agriculture Policy) for approximately 360 M€ in Veneto Region.

5. Conclusions

CE is an innovative econometric approach to estimate non market values. The direct utility ES user has on the forest service model plays an important role in our models. Higher WTP has been recorded on mountain-users especially on those ES frequently experienced, like path signs, aesthetic view along path or roads. On the contrary, non mountain-users react according to the media inputs. It is not a case the higher WTP on carbons sequestration has been recorded within this group of respondent, mainly informed by television advertises more and more addressing to climatic change issue. The absence of forests in Veneto plains plays an important role for non-users of mountain resources that stated a general positive existence values for some environmental services like biodiversity, as well option values for recreational facilities as they used to have along seaside. Unexpected outputs may rise as well; for instance several people decided to avoid choosing due to the high complexity of choice tasks request to the respondent.

Small WTP for certain mountain forest services is linked also to the deficiency of respondent's knowledge, opening a field of policy action. The improvement of environment education and the citizens' awareness could be a preliminary step to increase the perceived value of mountain forests services. Environmental education is surely a strategic tool to be considered in the future but it is also a hot and challenging issue raising some ethical questions: who decides the right level of awareness and information? Is it ethically acceptable to invest in education and information with the aim of increasing the WTP and hence introducing new market-based mechanisms? Not easy answers. However, only fair awareness on forest-related environmental services could support the introduction of market-based mechanisms to improve forest ES, even though on the perspective of household economic account it represent an additional cost.

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Appendix 1: Survey statistical design

	Alternative 1						Alternative 2						
Choice situation	Forest structure	Carbon sequestration	Extinction rate	Grassland open areas	Recreation	Cost	Forest structure	Carbon sequestration	Extinction rate	Grassland open areas	Recreation	Cost	Block
1	D	5.5%	-50 species	-10%	Tourist facilities & path signs	75€	C	8.5%	10 species	0%	Tourist facilities	150€	1
2	B	10%	10 species	2%	Tourist facilities & path signs	25€	C	5.5%	-25 species	-10%	Path signs	125€	2
3	C	10%	-50 species	0%	Path signs	25€	A	7%	10 species	-5%	Tourist facilities & path signs	200€	1
4	A	7%	0 species	2%	No service	125€	B	10%	0 species	-10%	Path signs	50€	1
5	D	10%	10 species	-5%	No service	75€	B	5.5%	-50 species	0%	Tourist facilities & path signs	75€	1
6	C	5.5%	-25 species	-5%	Tourist facilities & path signs	200€	A	8.5%	-50 species	0%	Tourist facilities	50€	2
7	D	7%	0 species	0%	Tourist facilities	150€	A	10%	-25 species	-5%	No service	25€	2
8	C	8.5%	-25 species	-10%	No service	50€	D	10%	10 species	2%	Path signs	100€	2
9	B	8.5%	0 species	2%	Path signs	100€	D	7%	-25 species	-10%	Tourist facilities	25€	1
10	B	5.5%	-25 species	-5%	Tourist facilities	100€	C	8.5%	0 species	2%	Tourist facilities & path signs	100€	2
11	A	8.5%	-50 species	0%	Path signs	50€	B	5.5%	0 species	-5%	No service	175€	2
12	A	7%	10 species	-10%	Tourist facilities	175€	D	7%	-50 species	2%	No service	75€	1

11. Conclusions

In Italy, in the last three decades, the forest sector has been characterised by a negative trend, in term of wood production and capability to generate income from wood harvesting operations: sectorial GDP, employment and added value have been constantly decreasing. Nevertheless, it covers a strategic importance for the public services it generates. In the five papers we reported in the present work, forest was the core environment we targeted our attention, due its capacity to be at the same time generator of traditional forest goods for the market (i.e. timber, firewood, etc.) as well for the offer of forest-based ES (i.e. recreation, biodiversity conservation, water quality enhancement, etc.). Not considering wood production, forests are a source of NWFP and services directly or indirectly used by a wide range of ES users or simply left aside for future uses. The papers describe the actual and potential forest outputs from the most known to the less notorious ES as well the factors that let us understand the main driving forces and constrains for PES implementation in the Veneto's mountain areas.

Recreational wild mushroom picking (RWMP) has been among the first paid forest services widely diffused in Italy since harvesting conflicts among land owners and pickers created the ground for introducing property rights regulations. RWMP represents an emblematic case where the demand of a single forest externality has become a new ES and furthermore an income source for the forest manager. Implementing a cardinal principle of environmental economics (Coase 1960), it was possible to create a source of income regulating the WM harvesting rights thanks to the approval and refinement of national, regional and local regulations.

The use of forest ES, such as forest games or edible NWFP, has been generally based on fee implementation regardless the efforts of the ES manager in improving or reducing their provision. This behaviour usually led into resource depletion (Marangon et al. 2001, Thiene 2001). Also RWMP permits have been implemented with the same general approach, but different scenarios occurred. In fact, being the public or private forest mangers free to decide how to manage WM resources, they have been also free to set up specific governance structures to enhance WM revenues. The better performances occurred where forest managers spend a lot of efforts to keep active forest management higher or targeting WM silviculture, as well where good coordination with control system and local tourist offer is ensued. RWMP demand is generally very high and forest manager may benefit only for the WM picking permit selling. However, on the long run, income may become marginal. In fact, the creation of new income opportunities from forest sector requires today more complex approach (Secco et al. 2009) rather than the mere application of a norm. The involvement of different stakeholders, ranging form public authorities to private enterprises to form a "*net-system*" does not only improve the commercialization forest-based services, like RWMP, but also increases the economic resilience of the local economy. Borgotaro Consortium is a case where a simple forest service became the economic driver of the area, but, more importantly, it represents the ability of the stakeholder network to create a lively local economy, based on a shared culture of WM use, connecting different operators (restaurant, hotel and B&B managers, small-scale processing industries, shop keepers selling local typical products), at the end enriching and stabilising the WP-related economy.

For more business-oriented activity, culture creation was also the successful factor of the Dalla Valle Company, Finnish WM exporter able to fulfil the huge demand of WM in Veneto Region. The massive investment on the local Finnish WM pickers training was the first step the company undertook to organise a stable supply of WM that locals have scarcely used before. This investment allowed to transform a public good like ceps in a new forest commodity sold in the market, which meant an additional income source both for the company and more importantly for Finnish rural dwellers. Other factors that allowed the company to succeed has been the completely tax exemption for WM picking and furthermore information asymmetry

to fetch up better price in the Italian market. In this was Dalla Valle Company was able to get a competitive advantage on competitors.
RWMP highlights all the key points a potential PES implementation (*paper 2*) or MES creation (*paper 3*) have to be considered once a policy maker or a private agent want to step into the ES market. The clear and effective regulation of property rights, the implementation of regulations through the development of proper contractual agreements for organizing ES provision among different agents, the presence of a real rather then fictitious or built demand, the institutional condition that allows to operate economically are all factors that should be added to the five principle of PES theory (see *paper 1*) (Wunder 2005) to accomplish ES contract requirement. Moreover, the diffusion of similar PES schemes, trading the same ES, may stimulate the formation of a market for environmental services (MES), even though among the main problems the ES user's utility transfer from one area to another can result impossible. An example is the ES related to water quality maintenance and improvement (*paper 4*). Despite the efforts to underpin by central government water quality enhancement through national act, water related PES remain limited at few case studies where the financial efficiency hold, but no information where collected about consumers' demand. The reasons of this limited result might be searched on the lack of real demand or demand information the water resource manager holds. Surely the accumulation of norms and customary rights, the incapability of landowners to cluster up and ask for water service compensation, or the high transaction costs to built ES contract have been other huge constraints, but more importantly is the scarce knowledge people have about the complexity of water cycle and the role of forests in water filtering.
Knowledge plays also a key role to mature the society, usually unprepared to drastic change on public good use. This statement was one of the most interesting outcome described in the last paper (*paper 5*), where the average respondent declared to have a relatively low WTP to compensate any additional provision of ES like biodiversity conservation, carbon storage and non-structured mountain recreation services. Nevertheless, whether the respondents had knowledge about of a given resource, their WTP resulted higher. The analysis of the demand helps us to understand consumers' behaviours about their preferred ES and it highlights also the effect of education on WTP. The survey results may advise decision makers on the potentiality to implement a regional PES scheme, but at the present, knowledge on ES can undermine the success of any PES implementation exercise. Utility, is the *de facto* the engine of MES, strictly "interrelated" to consumers' knowledge, without which, the creation of the ES demand results impossible.

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