

Report of the WG “Mountain Forests” 2015-2016

Introduction

The 2013-2014 report of the WG described and discussed Ecosystem Services in general and those of mountain forests in particular. In this second report (2015-2016), the focus is on examples and good practices on Ecosystem Services perception, valorisation and approaches for organizing payment schemes. Information and data presented are based on the Workshop “**Ecosystem services of the Alpine forests: approaches, good practices and examples**” (Trento – IT, 8th June 2016).

Two major projects described are:

1. an ongoing project by the Austrian Federal Forests (the agency managing about 10% of forests and natural land owned by the Austrian state), very comprehensive and considering a wide range of ES;
2. an Italian project focused on payment for Ecosystem Services, that has started some innovative approaches in Italy's mountain forests.

In addition, some experiences are reported that indirectly deal on ecosystem services of forests in the Alpine area, improving the perception of the multifunction management and experimenting new approaches for an economic valorisation of the services:

1. Opportunity for forest owners in the context of tourism development (Poschiavo, Switzerland; and Trentino, Italy);
2. Mushrooms permits (Trentino and Italy);
3. Cooperation with social services, training and certification for farmers (Austria);
4. Landscape projects and nature protection (Italy and Switzerland);
5. An overview of the state of the voluntary market for carbon storage and sequestration.

The perception of forest functions

In October 2015, the EU conducted a Eurobarometer on the Common Agriculture Policy that encompassed a question on forests functions. The survey is regularly carried out in all 28 EU countries with 1000 interviews in the same period, to sample the views of European citizens. Results were published in January 2016.

People were asked to indicate the most important benefits provided by forests, up to 3 answers:

- providing healthy leisure activities
- providing wood to produce furniture, paper or construction material
- providing animals natural habitats, preserving the different types of animals and plants and conserving nature
- providing renewable energy using wood as fuel
- protecting people from natural disasters such as floods and avalanches
- contributing to jobs and rural development
- absorbing carbon dioxide, contributing to fight climate change and its detrimental effects

The most important benefit is absorbing CO² to fight climate change (66% and first in 16 countries). The second named benefit is providing natural habitats and conserving nature (63% and first in 11 countries). These two are dominant, prevailing in 27 countries and with a clear advantage over the other indications. Third one is protection against natural disasters (40% and first in 1 country), with considerable differences between Mediterranean (high) and northern (low) countries.

Productive benefits are well behind the protective ones: energy (24%, first in 1 country at the same level with CO²) and industrial wood (22%). Higher values are registered in northern and in eastern (less evident) countries. Healthy outdoor recreation is indicated 20%. The least named benefit is the creation of jobs and rural development (16%).

Grouping countries per macro areas Mediterranean (PT, ES, IT, MT, EL, CY), West Central (FR, BE, LU, DE, AT), Eastern (SI, SK, CZ, PL, HU, HR, RO, BG, Northern (SE, FI, EE, LV, LT), North Sea (UK, IR, NL, DK) some differences appear, as shown in the following Figure 1.

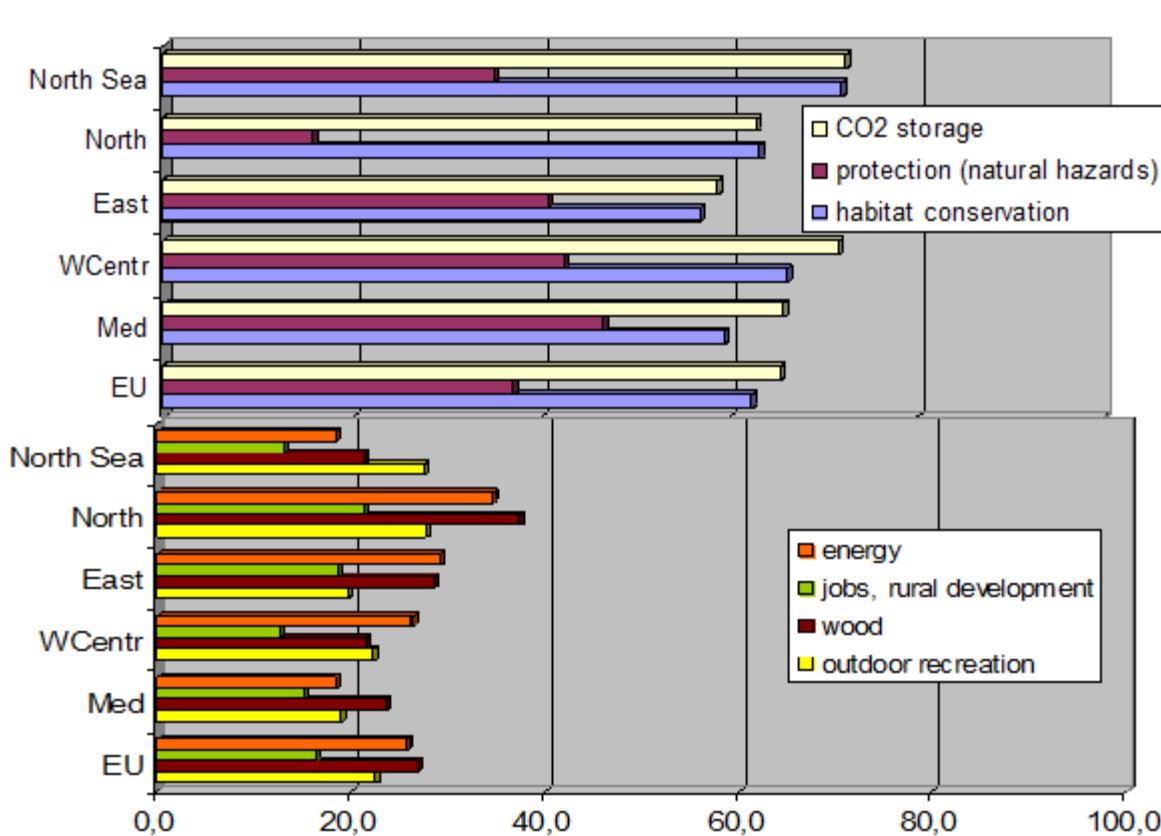


Fig. 1: Most important benefits from forest by European regions.

The survey is stratified by age, social position, political view, rural/city dwellers.

Younger respondents are more likely to think that the most important benefit is providing natural habitats (67% of respondents aged 15-39 in comparison to 59% of respondents aged 55 or over). Older respondents are more likely to think one of the most important benefit is to protect people from natural disasters (43% of respondents aged 55 or over for 34% of those aged 15-24).

Managers value habitat function higher than house persons (managers, 70% compared with house persons, 57%) and absorbing carbon dioxide (managers 76% compared with house persons, 58%). The self-employed (45%) are more likely than manual workers (37%) and students (35%) to mention that forests protect people from natural disasters.

Respondents with a strong political view consider more important CO₂ (75%) and habitat (68%) compared to low (66% and 64%) and not at all (54% for both). Quite surprisingly, there are no significant differences between respondents in large cities, small/med-size towns and rural villages: small differences emerge only for recreation (23%, 19%, and 18%); energy (20%, 24%, and 25%) and protection (42%, 40%, and 38%).

1. Values of Nature: The Economics of Ecosystem Services and Biodiversity – a pioneering Project from the Austrian Federal Forests

What is the value of pure air or of the diversity of plants and animals? These services provided from nature do not have any market price – and that may be the problem. Our current economic models do not consider any natural resources for which no monetary value is defined. Particularly, this refers to those natural resources that are often invisible in the economic choices we make. Thus, we have steadily been drawing down our natural capital – without understanding either what it really costs to replace services provided free by nature, or that anthropic alternative solutions are sometimes far too expensive for these services to be replaced or substituted. Thus, the study on “The Economics of Ecosystems and Biodiversity” (TEEB – Kumar, 2010) recommends to determine economic values for natural resources and goods to underline their importance.

Accordingly, the Austrian Federal Forests (AFF) was the first company in Austria that initiated a project to determine a socio-economic value on landscape sites influenced by nature and cultivation across its total territory, encompassing 10% of the total area of Austria. Together with the Consultant Company ECO and the Technical University of Vienna (TU), this project should be coherent with the EU-Biodiversity Strategy that should stop the biodiversity loss and the degradation of ecosystem-services until 2020. The EU member states are thus requested to survey the status of their ecosystems and their ecosystem-services until 2014 and to determine their monetary value in a standardized reporting scheme until 2020 (EC, 2011).

Yet, the AFF are translating their attempts concretely at forest site levels to make its stakeholders more familiar and aware of nature's benefits and its limits of usage. Besides, they try to illustrate the externalisation of behaviour that is harmful to the environment and resulting environment costs. That approach, focusing on five eco-system services – Water Supply, Erosion Prevention, Regulation of Local Climate, Recreational Benefits and Biodiversity - enhances the understanding for environmental and natural resource policies and for designing applicable and better tailored target-measures. This project applies a sustainable and multi-functional forest management that promotes a supplementary concept in which the creation of markets for individual ecosystem services like health, protection or biological diversity that replace traditional business fields are excluded. Moreover, the determined results are never considered to be included in the cost/profit calculation of the company's balance sheet (Plattner, 2016a).

The calculation of the qualitative and socio-economic value of biodiversity for the total AFF area was conducted in relation to a hypothetical reference scenario of purely economically orientated forest management systems. According to the applied "relative biodiversity index" an additional human well-being benefit per year of approximately 60 Mio. € was derived (Plattner, 2016a).

Methodology

In a pre-study on behalf of AFF, which was finished in 2014, WWF Austria and the Federal Environment Agency selected 50 indicators that are appropriate for valuating ecosystem-services. The main study initiated in 2014 will last until 2019. It should survey these indicators quantitatively and import the findings in a GIS system (Geographical Information System). Thereof the direct and indirect impacts of 17 different ecosystem-services and their increasing human well-being effects in the four sectors - economy, health, protection and biodiversity - are evaluated (NRM, 2014, Fig. 2).

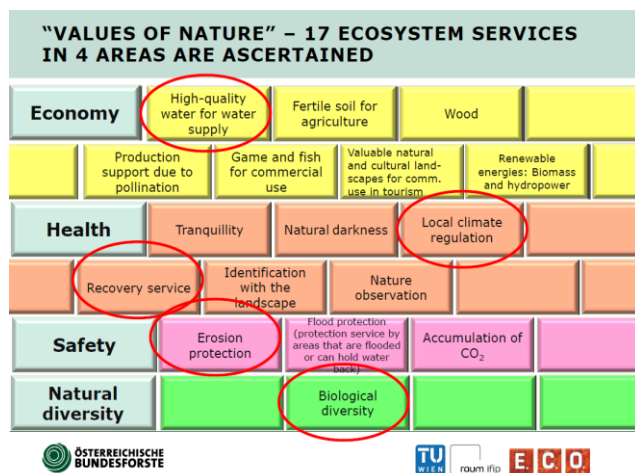


Fig. 2: The 17 evaluated Ecosystem Services from four thematic areas (Plattner, 2016b).

The calculation approach for determining economic values by means of criteria from all three dimensions of sustainability considers two simple perspectives:

First, the protection of nature guarantees a broad amount of ecosystem services, which create an additional benefit for human well-being by covering various different peoples' needs, to which a monetary value can be distributed.

Second, when our economic interests require production factors, then on the opposite the protection of nature also needs natural resources as an input factor.

Due to the restricted availability of natural resources, trade-offs for not using them economically is an appropriate economic surrogate for prioritising the protection function. As it is hardly possible and mostly not reasonable to assign an absolute value to nature, this approach has applied hypothetical reference scenarios for systematizing the economic dimension of the "Value of Nature". Due to the difficulties in determining an economic value for a bird-species, a tree or a wetland, the study approach is just evaluating the differences concerning the environmental quality of current ecosystem services (status quo) in

comparison to a baseline scenario of intensive forest management (Gretzner, 2016). Hence, the resulting economic losses are surrogates for the higher environmental quality attained, concerning water quality, local climate, erosion protection or biodiversity.

The virtual assumptions of this purely economic orientated forest management base line scenario consider the following aspects:	
<ul style="list-style-type: none"> ▪ more dense forest road networks and faster growing monocultures, ▪ less mixed woodland, more stands of the same age from economically important tree types, ▪ greater sampling on larger, extensive applications (clear cut), faster removal of trees (shortening the felling cycle from 100 to 80 years to achieve a higher forest net income); ▪ increase in the management of protected forests, where this does not significantly impair the protective function, but technical conservation measures would have to be taken as a precaution; ▪ Decline in the forests' biodiversity index and proximity. 	

Table1: Description of the base line scenario (Plattner, 2016b).

Results

The preliminary results from this project approach refer to five ecosystem services. All these five ecosystem services together – water supply, erosion prevention, regulation of local climate, recreational benefits, and biodiversity - achieve an annual monetary value of 92 to 114 M € (109 – 135 €/ha and year).

Water supply is estimated to be between 1.4 and 7.6 M € per year across the total AFF areas. Due to the inexistent scarcity of high quality drinking water, this value - calculated from costs for technical treatment or alternative water supply networks, if the currently used water sources were polluted – is rather low (Fig. 3).

Ecosystem service following the concept of the Austrian Federal Forests (AFF)	Brief description of the ecosystem service	Value of the ecosystem service (in Mio. € p.a.)	Assumptions of the evaluation (change) and evaluation methods
High-quality water for water supply	Protection and provision of spring water for the drinking water supply	1,381	Cost-based approach: Saving in alternative quality assurance costs (UV plants) with a small decline in cleaning services due to intensification of forest management
		7,569	Cost-based approach: Saving in alternative costs of new feed lines to the upcoming distribution network in the event of source failure (quality, quantity)
Erosion prevention	Preservation and improvement of the forests' protective function (protection against gravitational mass movements)	14,672	Cost-based approach: Saving in alternative safeguarding costs (technical barrier construction) if the object-protecting forests can no longer fulfil their protective function on AFF areas.
		2,875	Market price method: Discount on real estate prices for cases where the properties protected by the object-protecting forests on AFF areas lose value due to additional risk.

Fig. 3: Economic estimation for evaluating "Water Quality" and "Erosion Protection" (Plattner, 2016b).

Concerning the **prevention from erosion**, landslides, rock falls or avalanches, the structure and texture of AFFs' forest stands save 14.7 M € as investments in technical facilities are not required to compensate the reduced protective function of purely economic managed forest concerning natural hazards (NRM, 2016). Besides, economic losses for immovable real estate properties, if they are endangered from natural hazards, could also be considered. When assuming shrinking market prices between 2 and 5% due to the latent present risk, this would amount to 2.9 M € for those buildings, allocated in the catchment area of AFF (NRM, 2016; Fig. 3).

Currently 427,000 Austrians living closer than 300 meters to AFF forests benefit from the cooling effects of the particular forest microclimate in summer time. Up to now, only few studies have taken concern of these local climate effects, although they influence the quality of life. In relation to alternative cooling costs, the 1.1 Mio. € calculated for all AFF forests is rather low. Nevertheless, the allocation of forests and green areas around metropolitan areas, become continuously important due to their effects on climate change and their impact on regulating the local climate (NRM, 2016; Fig. 4).

EcoS	Brief description	Value	Assumptions of the evaluation (change) and evaluation methods
Local climate regulation	Forests' cooling output for settlement areas near forests	4.861	Evaluation of statistical deaths (Value of Statistical Life) when assuming that the cooling output of forests near settlements is lost due to intensification of forest management (e.g. clear-cut)
		0.573	Evaluation of statistical, heat-related illnesses (hospital stay) due to "cost of illness" approach in the event of decline in cooling output of forests near settlements
		1.115	Cost-based approach: Saving in alternative replacement measures due to air conditioning and cooling devices (cooling costs) in residential buildings

Fig. 4: Economic estimation for evaluating "Local Climate Regulation" (Plattner, 2016b).

Interestingly, the study "Values of Nature" notes that for Austrians the recreational activities are "emotionally" the outmost important ones. This encompasses mainly hiking trails and walking paths, trails for mountain and normal biking, but also trails for riding, thematic trails as well as forest bathing areas. These results are essential for a target-orientated visitor management to avoid time- or spatial-driven conflicts with harvesting, hunting or even among recreational activities. According to a qualitative study done with 1,500 people, an economic trade-off in relation to a pure wood-management orientated scenario was calculated from the stated leisure-time behaviour and the currently at AFF applied management measures. Due to the raising importance of the recreational forest function, this figure is expected to increase in the upcoming years (Fig. 5). In the societies' view, the maintenance of biodiversity creates relevant welfare effects. In a conservative estimation, the "willingness-to-pay" procedure to access territories with a significant biodiversity value was applied for three scenarios preferring nature conservation and pure forestry. Only for this field an approximate economic value of 60.5 M € was derived. Although biodiversity is one of the non-marketable ecosystem services, it could attain the highest economic rating among the five examined services. Besides the "willingness to pay" approach, the study also analysed the "relative biodiversity value" to express the significance of forest stands to protect biodiversity. While none of the areas could attain a "very high" relative biodiversity value, 18% were assigned to the "high" category (particular the so-called secondary areas, like wetlands, rivers and lakes as well as many alpine areas). Furthermore, for 43% of the territory the relative biodiversity value was recorded as "medium", 34% was evaluated as "low" and 5% just received the evaluation "very low". Despite that judgement, no change in the currently applied management procedure to sustain biodiversity was proposed (NRM, 2016; Fig. 5).

Ecosystem service based on concept of Austrian Federal Forests (AFF)	Brief description of ecosystem service	Value of ecosystem service (in EUR million per year)	Assumptions of the evaluation (change) and evaluation methods
Recreational service	Recreational and leisure use on AFF areas	25.749	Evaluation of the current recreational and leisure use on ÖBf areas due to a 7.72% improvement in proximity to nature compared with intense commercial forest management
Biological diversity	Protection of biodiversity through nature conservation (including conservation areas)	60.505	Aggregate willingness to pay for nature conservation assuming that the biodiversity index is 0.2 index points higher than the hypothetical reference scenario (intense commercial forest management)
(Average) value of ecosystem services that are assured by the current management methods		Low estimate: EUR 91.725 million per year Higher estimate: EUR 113.929 million per year	

Fig. 5: Source: Own surveys and calculations, 2016

Outlook and conclusion

The study “Values of Nature” did not only concentrate its evaluation on the status quo but it also considered scenarios forecasting the changes of ecosystem services (concerning: land use change, climate change, insertion of nutrients, biodiversity or the demographic, social or technical development) until 2050. Thereof, it is assumed that the environmental threat-potential as well as the potential of infrastructure-damages will steadily rise between 2015 and 2050. An increase in extreme weather events due to the climate change is anticipated. Thus, due to the expansion of settlements and traffic areas, more people and infrastructure-objects with protection needs will be allocated in catchment areas endangered from natural hazards (NRW, 2016). For both reasons the importance of protective and sustainable managed forests and a raising sensitivity towards the importance of the whole range of forest-ecosystem services needs to grow in the future. Due to climate change, air pollution, noise exposure or urban sprawl, the comprehensive protection and conscious care is crucial for preventing natural hazards or environmental damages on water supply or biodiversity. Just as relevant are the effects on regulating the local microclimate as well as creating recreational benefits. Thus, this approach targets to raise general awareness and responsibility on the importance that forest ecosystem services have, to guarantee our society and future generations these assets of our Alpine forests.

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2. Ecosystem Services of Mountain Forests in Italy

A recent project LIFE (LIFE + Making Good Natura - www.ligemgn-serviziecosistemicie.eu) introduced in several Italian mountain areas the function of the payment of ecosystem services (PES). The process has been developed according to the following steps:

- Identification and evaluation of more important Ecosystem Services for different Natura 2000 sites across the national territory;
- Quantification of the value of the ES provided for each site and each service;
- Involvement of local stakeholders to validate the selected ES, organization and implementation PES; Activation of the PES.



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	RL			ERSAF									RS			PNCVD			PNP		PNSSS
	IT2040401	IT2040402	IT2080501	IT2020301	IT2020002	IT2070022	IT2070021	IT2070303	IT2040601	IT2040019	IT2040020	IT2070402	ITAO20007	ITAO20008	ITAO60006	IT8050055	IT8050025	IT8050006	IT9310014	IT9310008	IT4090006
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F1=agriculture F2=fodder F3=game F4= raw materials F5=mushrooms F6=medicinal plants
 F7=genetic resources F8=dinking water R1=carbon sequestration R2=local climate egulation/air purification R3=water cycle regulation R4=air purification R5=erosion/hydrogeological protection R7=impollination R8=biological control R9=biodiversity, habitat C1=esthetic value C2=resrecreation C3=arts, cultural, spiritual values

Fig. 6 - Main ES (F: Provisioning; R: Regulation; C: Cultural heritage) for Natura 2000 site.

In some Natura 2000 sites of the Alps, different types of PES have been enhanced:

Valtellina Orobie Park

Provisioning ES: wildlife and fishery resource

It is a contract between the Park, responsible for territory management, the hunters, beneficiaries of service of wildlife provisioning, and Sondrio Province, responsible for the hunting sector.

The contract expects the correspondence by each hunter of 2 workdays /year to carry out measures of game habitat improvement (clearings, plantation of fruit species), as foreseen in the Provincial Wild Animal Plan.

The overall value of the works is nearly 50.000 €/year.

Forests of Lombardy

Cultural ES: Recreation

It is a contract with a phone company that provides a number for paying 1 € by SMS for visitors of a thematic equipped path to contribute to site management.

It was started since summer time 2016, the first data will be available at end the year.

Provisioning ES: raw materials (wood)

Timber sales contracts in which the value of the product as eco systemic services is explained, whose amount is then reinvested in the improvement of structural conditions of the forest.

Regulation ES: carbon sequestration.

It provides for the signing of a contract with a company tasked with collecting carbon credits from sustainable management of forests and finalized in order of their location on the voluntary market.

Sold credit's value is estimated with market quotation.

Provisioning ES: non wood products

Contract with an association of gatherers to collect (foraging) buds and herbaceous species to create new dishes for catering with wild ingredients from the local spruce and larch forest.

The value, normally identified in 5-10 €/kg depending on the species, is paid by activities of training, information and communication.

Along with these experiences, there are checks and processes for the subscription of other PES for the supply of drinking water with private companies in the sector, the protection service against hydrogeological instability with hydroelectric companies, the establishing of contracts between farms and transport companies to provide access to facilities to hikers. It is just the beginning of a process on PES, whose results will be evaluated over time.

In the discussions and verification process with stakeholders, at the time, the most relevant points seem to be the following:

- Difficulties in identifying the correct contractual subjects (private entities,) since there is a significant public ownership of forests in the Italian Alps, with local customs and practices as well as a long tradition of enhancing the public interest in the forest management;
- Difficulties in identifying correctly the market value, real and possible, of the services, except those of provisioning;
- Difficulty to acceptance the idea of a new payment to those who have always benefited from the services without paying;
- Opportunities to increase awareness about the importance and value of ecosystem services provided by forests.

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Collection of experiences from Alpine Countries

1. Opportunity for forest owners in the context of tourism development

1.1 Switzerland: tourism and forest in Poschiavo

Project	Organic Smart Valley -Tourism, Forest and Mountain in Switzerland
Funding	Founded by Valposchiavo Region and European programming Developed in 2009
Country, region	Switzerland Valposchiavo Region
Objectives	<p>The project proposes a multi-level governance approach for the management of the UNESCO World Heritage site in Valposchiavo.</p> <p>The project also starts from the appointment of the territory as UNESCO Heritage site in 2008. The goal was to bring the "smart city" approach in a mountain valley, to create the conditions to enable young people to stay in the mountains offering an urban lifestyle, according to the idea that a protected area is a liveable territory!</p> <p>Through the various activities planned and carried out through the cooperation programmes, it aims also to achieve the certification of "100 % Bio Valley".</p> <p>In forestry, it aimed at diversifying the municipality's forestry activities, integrating tourism, timber production for the building sector and wood chips for energy production.</p>
Actions, measures	<p>Elements of the project:</p> <p>Spatial planning: landscape / forest and new buildings (use of local materials and resources)</p> <p>Training / skills development: recovery of traditional crafts and food processing</p> <p>Use of energy resources: hydropower as a historical tradition of the valley, biomass (with production of wood chips by the Municipal Forestry company)</p> <p>Improvement of mobility: trains and road transport</p> <p>Tourism: investment in the network of mountain bike trails and cross-border interconnection with the Italian paths</p> <p>Human resource development: projects for vocational training as part of the wood chain management</p>
Years	2009 still, ongoing
Contact	<p>Cassiano Luminati</p> <p>Polo Poschiavo - Switzerland</p> <p>mail: cassiano.luminati@polo-poschiavo.ch</p>



1.2. Mountain tourism and forest ownership: the Regole Spinale Manez in Campiglio

The Regole are a common ownership of the inhabitants of the villages Ragoli, Preore and Montagne (1462 inhabitants, with 922 members by being resident for more than 25 years): 4640 ha (1400 forest, 550 grazing land).

The ownership extend to Madonna di Campiglio, a leading mountain resort for climbing and skiing in the Brenta Dolomites: first alpine huts have been built at the end of the XIX century, first ski lift 1936. The Regole decided almost from the beginning to maintain the ownership of the total area and to have a fair share of the touristic development: they rented the area where infrastructures and buildings were to be built (concession up to 70 years) becoming owners of them and receiving an adequate payment.

Today 100 ha of the Regole are rented to the Campiglio Development Agency for tracks, facilities, infrastructures (60% of total) and produce an annual revenue 220.000 EU (10% of total).

The Regole are also owner of 3 large restaurants in the ski area (with over 900 seats combined) and a family holiday home, that are rented as companies and produce an income of 1.200.000 € (50% of the total). These structures require high maintenance costs (200-300.000 €) and investments, but they have been able to activate important investment (the Regole will cover with own reserves 2/3 of an important renovation going to start soon).

The Regole own also some buildings in Madonna di Campiglio because of the expansion of the resort on the land owned by the Regole): 31 flat units, 6 shops, 2 markets (rented as companies). 2015 They produce an income of 380.000 € (16% of the total).

The traditional land management (forest, alp farms, game, the own diary) produce an income of 350,000 (16% of total) and benefits from the well-equipped administration (1 director, 4 employees, 1 seasonal worker, 1 game warden) and from the investment capacity (2015 turnover: 2.4 M€).

The Regole do spend for their members 220.000 fuel costs (500 € per family as the account unit) in form of delivered firewood or fuel voucher, as envisioned in the old statutes.

In addition; they invest in social activities and study subsidies (2015: 137,000 €) and pay 275.000 € taxes and insurance, which is considerable for a municipality of 1400 inhabitants. However, even more important is the social capital: the Regole are a strong and recognized institution, produce a high participation feeling and pride in the local population. Trying to maintain this positive relationship they invest also in information and participation through a periodical newsletter, studies and publications, the permanent exhibition.

This very positive situation is in part due to the exceptional quality of the area of Madonna di Campiglio and is not easily replicable. However, it is probably not by chance that the valorisation has been produced by an independent institution, with a strong will (and capacity) to grant a fair share of the touristic development to the institution and its members. When the administrative municipality holds the ownership it is easier that roles and interests are mixed up and as a result land ownership is not adequately valorised.



2. Mushrooms picking regulations in Italy

Mushroom production in the forest is a relevant socio-economic activity: though recreational pickers mainly generate its value, it may be an interesting additional income for some local dwellers. Wild mushrooms collected from local forests are mainly self-consumed or directly sold to local restaurants and small retailers though informal supply in which traceability of the product is almost impossible. Nonetheless, despite the informal supply, the link to local gastronomy and the perceived higher quality of local wild mushrooms is an important aspect that could be strengthened by the policy makers.

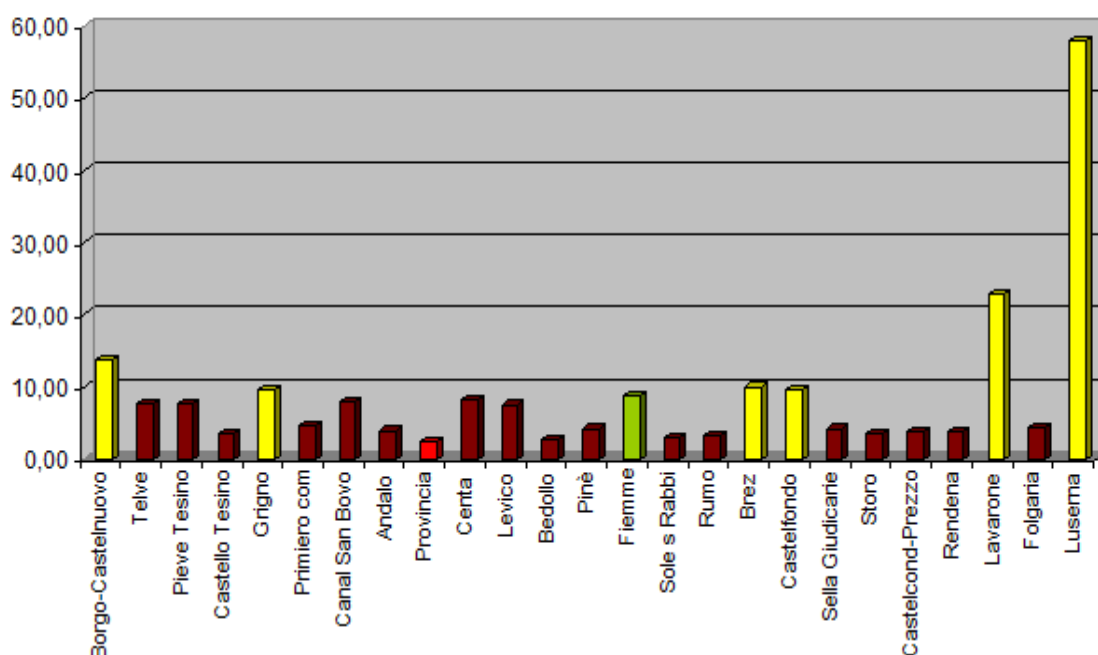
In the Trento province several municipalities obtain important revenues selling wild mushroom picking permits and the regulation is quite accepted both by recreational pickers outside the province as well by local dwellers. One problem related to the use of the picking permits revenues is that private forest owners do not receive any compensation; and revenues are not bound to investments in silviculture or the provision of services or infrastructures.

The valorisation of wild products is interesting to allow additional income in rural and mountain areas: it should be based on the possibility to certify the wild origin of the local harvest, while guarantee the highest health and quality standards along all the phases of the production as well as harvest sustainability. Crucial economic actors will be the non-professional pickers (economic activities under tax exemption regime). A key legal constrain that must to be solved is to promote a transparent traceability process of the product and a modification of the fiscal norms and procedure that allows a product to be transferred from a private producer to a company.

Trentino (F. Dellagiacoma, report on mushroom picking in Trentino, Trento 8.6.16)

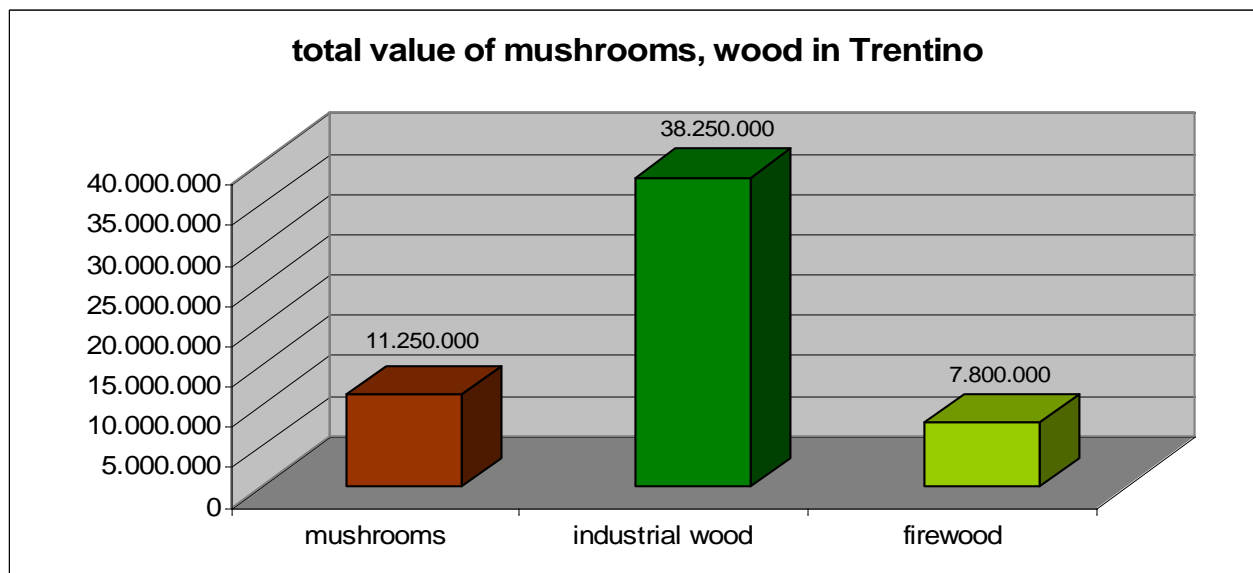
The regulation for mushroom picking in the Autonomous Province of Trento was introduced 1973 as one of the first in Italy. The regulation set a harvesting limitation of 2 kg per day for everyone willing to pick; the harvesting limitation was set up in order to increase the availability of mushroom for the wider number of pickers, rather than for ecological reasons. The regulation contains also some specific rules regarding the best harvesting practice that a picker must follow like the use of rigid and open containers, or the cleaning of the mushrooms in forest. Moreover, people with a legal residence outside of the province need to buy a picking permit, whose cost is decided by each municipality or association of municipalities. There are different picking permit types: the cost for 1 day (the most purchased permit) varies from 5 to 12 € according to the municipalities rules, 10-20 € for three days, 30-40 € for a week or 40-60€ for a month. Municipalities tend to enhance tourists staying longer over daily visitors.

mushroom revenue per ha of forest area - some municipalities/associations



Only the total revenue for all the types of permits in the last 3-5 years is known: 900,000 € (related to the total forest area it is 2.4 €/ha). The lack of data does not allow a detail accountability hence estimations are need to assess the economic value generated by the recreational wild mushroom picking: assuming an average permit cost of 6 €/day it corresponds to 150,000 days of permit. The revenue variability among municipalities is very high as shown in the graph: small, touristic areas with good mushroom production can sell high numbers of permits with revenue up to 58 €/ha like in the case of Luserna. A case worth to be mentioned is Fiemme (see the green column in the graph), with an area of over 20,000 ha, and a total revenue of 175,000 € per year, that are used to hire four special wild mushroom guards during the mushroom season to control mushroom harvesting both as recreational activity as well as commercial.

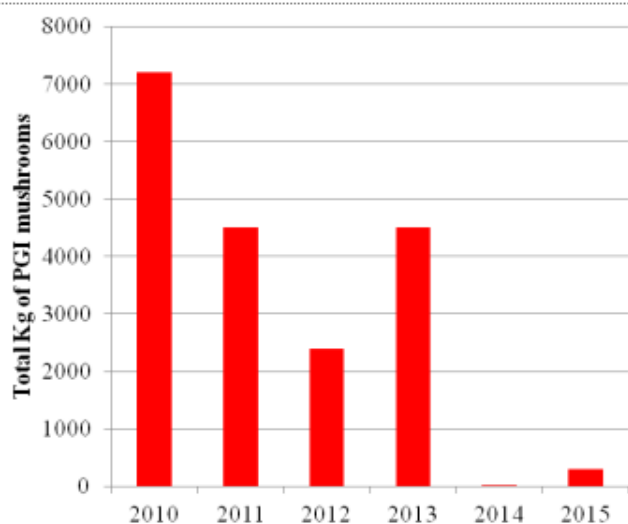
Trying an estimation of the total value of wild mushroom harvest, we consider the 150,000 picking days and for each day 2 kg/day of mushroom collected, it means a potential of 300,000 kg of wild mushroom harvested on average, which can worth around at 4.5 M€ with an average consumer price of 15 €/kg. Basically five times higher than the direct revenues generated with the permit selling by municipalities. If we add the harvest of province dwellers that do not need a permit, assuming that it may be 1,5 times the total amount of the pick of permits buyers we may estimate a total wild mushroom harvest of 750,000 kg per year on average, with a total value over 11 M€, or in other term of comparisons, approximately 1/3 of the value of the industrial wood.



There is an essential difference: the total value of wild mushroom (as well as fire wood, with the exception of coppice) does not consider harvesting costs (self-production, informal market; for firewood a recognized right of dwellers in public forests) and the forest's owner does not receive almost any money, while round wood is collected by professional companies (collection costs: 30-50% of the final value). While roundwood is the only direct income for forest owners, wild mushroom harvest may contribute to differentiate and enhance the forest benefit for local communities.

Consorzio Comunalie Parmensi (CCP)

The CCP was founded in 1993 grouping up several community forest and other private forest owner with an area of approximately 33.000 ha. The CCP was also the promoter of the Consortium of Borgotaro Mushroom so far the only area with Protected Geographic Indication for Wild Mushrooms. Production, processing and marketing is economically very relevant for the area, as Borgotaro is known globally for the use of "porcini" in the gastronomy and forest tourism based on wild mushroom harvesting for recreational purpose.



The valorisation of wild mushroom was based on a complex system of local norms that allow to differentiate the typology of pickers and the limitation they need to follow. The system was created to guarantee high qualitative standards of the wild mushroom collected for supply the market under the PGI certification of origin. Hence, the two main typology of pickers are the:

- * Local dwellers with customary right on the wild mushroom harvest that can pick mushrooms without limitations during the daytime;
- * All other picker without customary rights that can pick 3 kg per day paying a permit that is different in each harvesting area. The picking permit prices depends on area and type of picker and it varies from 6-20 € for a daily permit or up to 75-250 € for a seasonal permit.

The total revenue from permits gained by the forest manager ranges between the 600,000 and 1.2 € per year with an average gross income per hectare between the 18-36 €/ha that can reach the 64€/ha if direct and indirect income are sum up together. A local supply chain for Boletus has been created with certification of geographic origin where the picker can gain 6-23 €/kg while consumer have to pay 20-45 €/kg due to the high cost of delivery the wild mushroom in the main Italian markets. As it may be seen from the graph above, there are dramatic seasonal changes that explain the relatively high prices of the mushrooms. Indeed, the total turnover of the companies dealing with the PGI mushrooms varies very much (with weather conditions) from 150.000 to 1.000.000 € with an annual production of PGI varying from 7.000 kg (2010) to 100 kg (2014).

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3. Austria: forest's positive effects on health and sociality

Project	Green Care Forest – The forest's healing effects
Funding	Funded by the Rural Development Program 2014-2020 (Measure 16.9.1) and the Austrian Chamber of Agriculture. Developed in 2014
Country, region	Austria. Promoters: Austrian Research Centre on forests , Austrian Chamber of Agriculture
Objectives	<p>The main purpose of the project is to strengthen the social functions of forests.</p> <p>The Green Care strategy is to facilitate forms of collaboration between forest owners and the social system, education and health to provide users with services and educational and therapeutic products</p> <p>Green Care is designed to promote horizontal and vertical cooperation between agricultural and forestry actors and social services to develop ideas derived from agriculture and forestry.</p>
Actions, measures	<ul style="list-style-type: none"> • Development and implementation of "Green Care" products and services offered by agricultural and forestry farms, in collaboration with social services. For example: handicapped people, unemployed, disadvantaged young people, migrants; • Creation and implementation of the certification criteria for products and services; • Development of a " Green Care" platform to inform and update all the private partners; • Presentation of existing funding models and creating new models; • Development and promotion of training programs for those who want to engage with "Green Care" in the agriculture and forestry sectors; • Support of interdisciplinary research in order to demonstrate the effects and use of the "Green Care" products; • To promote collaboration at European level.
Contact	Petra Isabella Schwarz Austrian Research Centre for Forests http://www.greencare-oe.at/ www.bfw.ac.at/greencareforest



4. Landscape projects and nature protection

4.1 Italy: the value of old growth forests

Forest represents the most important earth biome in terms of natural extension and complexity (stratification, succession); in cultural terms many myths, legends and art's work are linked to forest.

Truly virgin forests are virtually absent in the Alps and in most Europe; swaths of old forests, often small areas smaller than 10 ha, naturally developed over many decades without human direct influence, can be found and have a very high ecological, scientific, cultural, aesthetic and spiritual importance. Characteristic parameter for old growth forest are presence of dead wood (both standing and lying), of large diameters and a complex structure with more vertical strata and dimension classes.

The real value of old growth depends heavily on being recognized, maintained, monitored and being part of a net extending on a geographical and elevation area to sample (all) forest type of the area, including the most important and productive and not only in inaccessible and remote areas. Like monumental trees, generally accepted and protected by society, the very old growth forest swaths are of very high value and forestry must be able to preserve them as a contribution to science, society and inspiration. Most important threats are direct human intervention (wood withdrawal) but also indirect effects (high game density, making the natural regeneration difficult). Visitor's paths, carefully designed to avoid disturbance but allow enjoyment, will help to create acceptance and pride about these important natural monuments and promote ecological understanding.

4.2 Southern Switzerland forest landscape

The lower valley area is 15% of the Canton Ticino but hosts 85% of the total population and 90% of the workplaces. All over the canton forest cover is 51% but between 500 m and 1700 m asl it is constantly over 70% and between 600 m and 1400 it is over 80% (Fig. 1)).

In Fig. 2 forest area 1979 and 2009 are compared: in the lower part (elevation under 800 m asl) changes from non-forest to forest and from forest to non-forest are almost balanced; that changes totally for elevations over 800 m, where forest expansion is 3 to 20 times higher than deforestation.

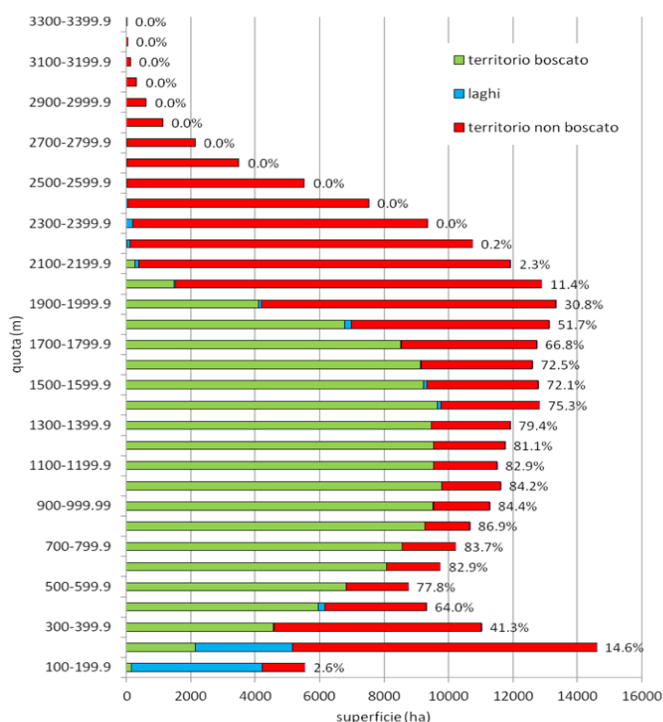


Fig. 1

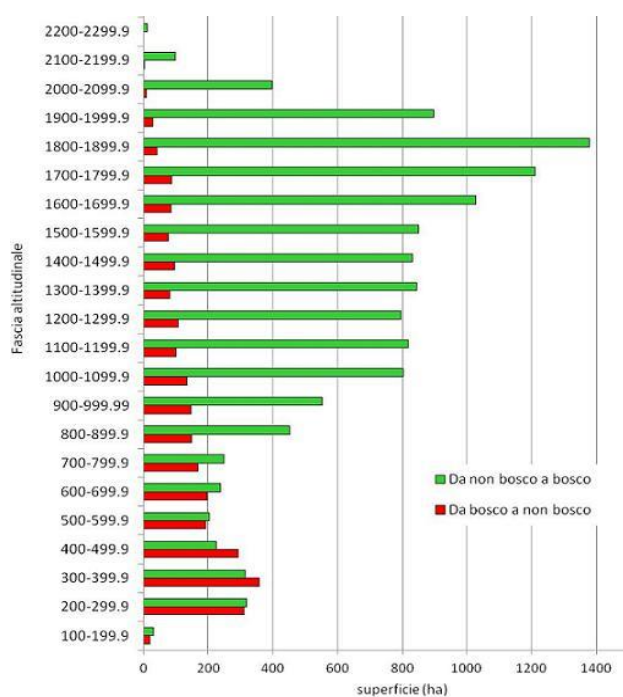


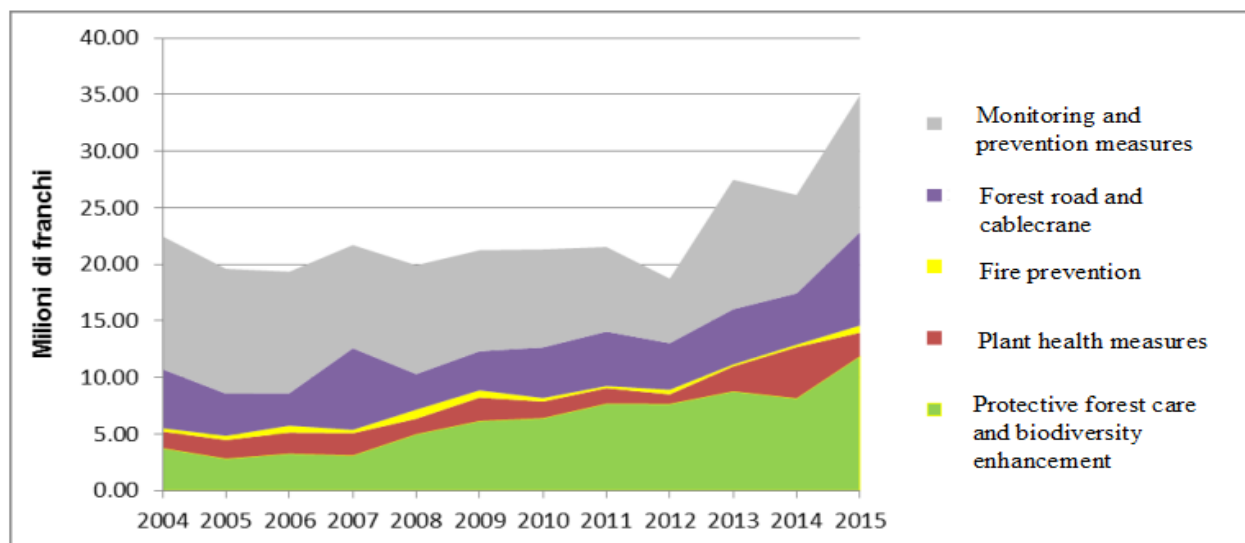
Fig. 2

Ecosystem services like protection against natural risks, biodiversity and landscape are very important for the population and for the institutions, predominantly located in the lower area. Financial support is given to monitor and maintain forests and enhance ecosystem services (protection, biodiversity, landscape). Regarding biodiversity and landscape, two are the main objectives of the forest policy creation of forest reserves maintaining a significant part of the cultural landscape (in particular chestnut forest).



The goal is to create a net of forest reserves with an extension of 25,000 ha (17% of the forest area), covering all type of forests and all elevation zones. The reserves are instituted by long term contracts (usually 50 years) with forest owners, who pledge to maintain paths, to carry out some actions but no traditional logging and allow monitoring and access. The cultural landscape was disappearing because the traditional agriculture had been abandoned: people went working in the lower valley and abandoned meadows, cattle raising and chestnut cultivation, which caused a rapid expansion of the forest. Landscape and an important part of biodiversity (linked to extensive and high natural value agriculture like meadows, hedges, single trees and small groups) were threatened in the process. Projects were started to finance the recreation and maintenance - through agricultural use - of traditional landscapes, involving farmers, municipalities, citizens and associations through mid-term contracts. Investment have been significant, but results are visible and appreciated by citizens and tourists

Swiss Forest management: public subsidies



5. Voluntary Carbon market and forests

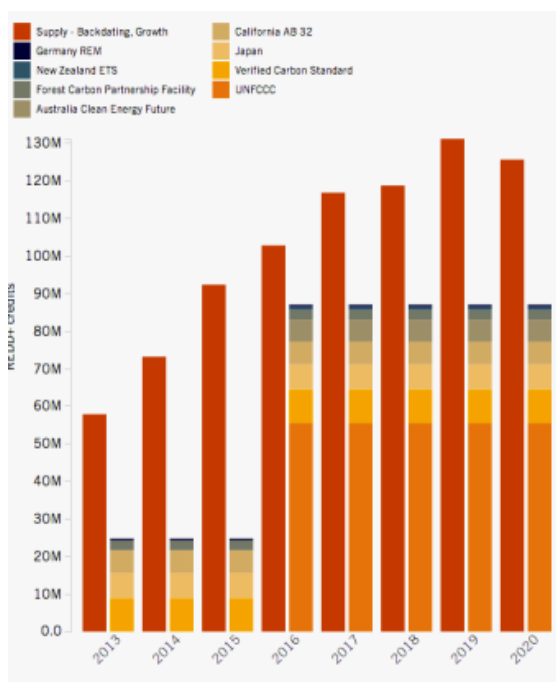


In the field of Carbon emission and climate protection states agreed at UNO level national emission reductions/compensations (Kyoto protocol, Paris agreement), which created an official market for emission trading (notably Europe, some areas and states in USA). The forest sector could be accounted for in the 1st period of the Kyoto protocol (afforestation, forest management) and is mandatory in the 2nd (from 2012). The Clean Development Mechanism (CDM) allows emission-reduction projects to earn certified emission reduction (CER) credits, to be sold to industrialized countries to meet a part of their emission reduction targets.

In addition to this official market many corporations, company, organisations and event organisers decided to act directly and compensate their emission financing projects that store atmospheric CO₂, mostly forest projects. A considerable market has arisen from these voluntary actions: in Europe, the total value is 28 M€, with most projects in UK and Germany.

Forest projects consider agroforestry, afforestation, forest management and avoiding deforestation (Reducing Emissions from Deforestation and forest Degradation, REDD+). Average cost per t of avoided emission is lower in the REDD+ projects.

In these years, the price per CO₂ t stored has fallen due to a reduced demand and growing projects offer. The situation is going to change 2106 with official starting of REDD+ projects, but offer is foreseen to stay higher than demand.



Situation of voluntary market in some alpine countries

Austria: 2013 started a monitoring project (VCM-AT). Biomass projects have been developed since 2007 (Climate Austria).

France: projects since 2006, and then brought into ETS. There is now a debate on small-scale projects and methodology for agriculture is in preparation.

Germany: it is an important European market (2012 3.3 Mt CO₂) with 10% generated in Germany. Interesting project on peat lands (Moor Futures)

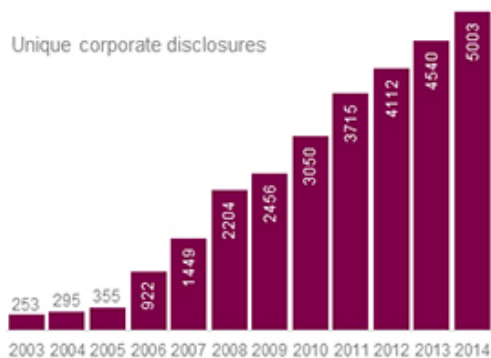
Switzerland: domestic market with projects based on CDM methodologies (e.g. Biofuels) with Swiss Attestations paid by fossil fuel importers.

Italy: small market, with 57 mostly micro (less than 5.000 tCO₂/y) projects and NGOs leading the sector: 2014: 46,720 tCO₂ and 560,000 €. Due to the small projects and the role of NGOs the average price is very high (12 €/tCO₂). Impacted forest area: 16,000 ha.

A supply chain approach to climate change

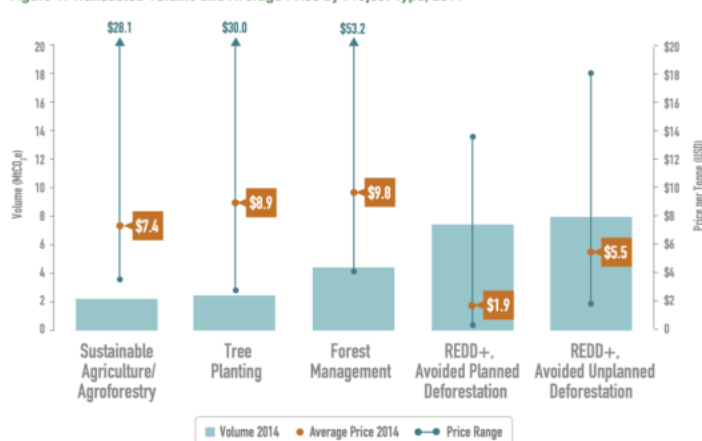
An innovative approach has been launched by the initiative Carbon Disclosure Project (UK based): working with companies and institutional investors they look for the climate impact of the entire supply chain, in order to reduce negative impacts on deforestation, water misuse and community rights. Many global companies are part of the project as well as over 800 institutional investors.

Unique corporate disclosures



This chart measures the total public and private responses from companies to CDP's climate change, water, forests and supply chain programs.

Figure 4: Transacted Volume and Average Price by Project Type, 2014



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The protective function of Alpine mountain forests

Mountain areas in general are strongly affected by natural hazards: avalanches, landslides, rockfall, erosion, torrent activity, floods. Compared to other mountain areas the Alps are characterized by a high population density and by important infrastructures (transport, tourism, production) and therefore hazards constitute a major risk for human activities.

At the same time, the Alps have a very long history of human settlements and are inhabited by a rich society. This has brought to the development of a solid concept of risk management in the alpine countries, based on the recognition of the natural hazards, and on the actions to improve resilience and defence against them (risk avoidance, technical and biological measures, alert and civil protection) in an INTEGRATED RISK MANAGEMENT.

In this comprehensive approach, mountain forests play an important role: because they actively protect against avalanche detachment, can stop rockfall, prevent erosion and form deep soils that reduce runoff; and because of their large extent in the steep slopes around human settlements and infrastructures.

In the past the focus was on a general protection of mountain forests, which was strengthened after major flood and torrent catastrophes in the second part of the 19th century (France, Austria, beginning of the 20th century Italy), leading to the constitution of special agencies for technical measures and to forest laws to protect and improve forest cover. Currently, the attention has turned to identifying and modelling of natural hazards and considering the relation to damage objectives.

Studies have been conducted to assess the effectiveness of the protective function of forests: obviously, the protection that forests grant has natural limits and in some conditions must be integrated by technical measures. Forest planning is called to verify forest functions and forest management to develop strategy to maintain and improve the protective function. These strategies usually imply higher costs for the owners so forest policy has the task to provide adequate funding to assure that protective forests are maintained in a healthy and stable condition and in case of heavy damages are quickly rebuilt.

PROTECTION FUNCTION AND WOOD PRODUCTION

The protective function does not exclude tree felling and wood production. More than this: the protection forests must be tended and maintained in a healthy and balanced condition to optimize their protective functions. The protective function is maximised by mixed tree composition, vertical structure with 3 layers, formed by trees of different ages in a dynamic balance, with continuous soil cover in time and with sufficient natural regeneration of the trees. To create/maintain such conditions human intervention in form of tree felling and wood harvest are necessary: the tending requires professional knowledge and attention to guide the evolution of the forest. Usually this implies less intensive cutting with higher costs: wood harvest must be carried out avoiding damages to soil and forest (often it implies cable crane, which is more expensive). Often natural evolution of the forest goes toward mature structures with larger proportion of old (less vital and stable) trees, possibly with structure simplification over longer periods. Unstable trees can cause damages to infrastructures and in case of floods activate debris flow and torrent activity. In protective forests, management and monitoring are necessary; wood production is usually compatible but more expensive: in some cases, trees are felled to regenerate the forest but not harvested to maintain a temporal protection through the roughness of the terrain: these very particular measures are financed by the state or by the beneficiaries of the protection.

There is no common definition of protective forests in the alpine countries and regions: each one applies different regulations and definitions and therefore the area identified with protective functions differs meaningfully from country to country. Nevertheless, in every country and region there is a general recognition of the essential importance of the protective function of forests.

In between, few projects have dealt with the protection function of forests:

- Interreg III A 2000-2006 “Gestion durable des forêts de montagne”
- Alcotra 2007-2013 “Forêts de protection : techniques de gestion et innovation dans les Alpes occidentales ”
- Progetto Interreg IIIC “Network mountain forest”
- NESBA - Progetto Interreg Italia – Austria: malghe Schutzwald / boschi di protezione
- In 2009 the Arge-Alp project dealt with the “Ecology and Economy in Protective Forests”

An additional difficulty is that the area where mountain Alpine forests are defined and considered does not coincide with the area of the Alpine convention: consequently, there is no accurate data available specifically for the area of the Alpine Convention: national delegations provided data making some adjustments and estimates from existing data.

The task of the WG is to collect information and data on definition, mapping, management objectives, projects and subsidies to improve the protection function of mountain forests in the Alpine area.

In many countries and regions there is a trend to define protective forests linked to different natural hazards: rock- and stone-fall; avalanche; landslide; torrent activity and debris flow. Therefore, many/some countries/regions define two types of protective functions

- **Object protection forest:** directly interlinked with the existence of objects (housing, buildings, infrastructures) to be protected from natural hazards damages;
- **Site-protection forests:** designated for forest stands with ecological sensitive soil conditions at the upper and lower timberline, where the regeneration is problematic, where the economic exploitation is difficult/impossible and only allowed under specific requirements.

Italy

In Italy, there is a very broad conservation issue of forests linked to their protective function (**hydrogeological protection**, going back to a 1923 national forest decree): 89% of the forest area in the Alpine regions is under this kind of protection that implies that land use change must be authorized, regeneration guaranteed and management controlled (Fig. 1). The rationale of this regulation is that all forests in the hydrological protection area have a protective function (priority) while only a part of them has also a productive (economic) function.

<i>forest area subject to hydrogeological protection</i>	
Piemonte	83,90%
Valle d'Aosta	80,80%
Lombardia	82,90%
Alto Adige	98,10%
Trentino	98,70%
Veneto	95,30%
Friuli V.G.	85,70%
Total	88,60%

Fig. 1: Italian Alpine Forests: Hydrogeological protection area.

There are no specific data available for forests in the alpine area: the national delegation used data of the seven Alpine regions where most of the forests are in the mountain (Alpine) area (Fig. 2).

Percentage of forest area subject to hydrogeological protection is between 81% and 99%.

Italy has not identified forests with direct protection function but the National Forest Inventory has data on slope, elevation and presence of instability phenomena that are indications of protection function.

	<i>slope >60%</i>	<i>elevation > 1500</i>	<i>instability</i>
Piemonte	26,41%	11,90%	19,40%
Valle d'Aosta	32,34%	59,40%	24,80%
Lombardia	37,49%	13,00%	14,60%
Alto Adige	39,53%		21,90%
Trentino	37,70%	42,90%	14,10%
Veneto	27,54%	16,60%	19,50%
Friuli V.G.	29,84%	6,00%	15,90%
Total	28,97%	21,00%	17,90%

Fig. 2: Italian Alpine forests: slope over 60%, elevation over 1500 m asl and area with instability.

Lombardy, Veneto and Friuli Venezia Giulia have a definition of protective forests:

- forests on cliffs or costal dunes
- forests on natural risk prone terrain (high inclination, areas subject to erosion, avalanches, rockfall)

Valle d'Aosta, Lombardy and the autonomous provinces of Bolzano and Trento have tools to identify protective forests (in planning).

Austria

Austria has defined in his forest development plan (Waldentwicklungsplan - WEP) four main functions for its forests: economic, protective, welfare, recreation. The WEP is anchored in § 9 of the forest law 1975. Its target is the delineation and a foresighted planning of the forest functions and has to be elaborated by considering any public relevant interests according to forest spatial planning. For each functional area, any of these four function is indicated (Fig. 3). The economic function is thereby interpreted as the precondition for any of the other three functions. Only in the case that any of those three functions “protective, welfare or recreational function” is highly dominating, the economic function changes. According to this approach, the protective function is prevailing on 30% of the forested area in Austria. These areas are mainly located in the Alpine arc.

The Forest Act identifies 2 functions

- site protection: forests on sand and drift soils, threaten by erosion or landslides, on sites where regeneration is very difficult (forests towards timberline, poor soils)
- object protection: humans, settlement, facilities, cultivated soils against natural hazards

Both of them grant a more stringent regulation to enhance the protective function.

20,5% of the Austrian forests other than OeBF (state forests) have a protective function; approximately half of them have a direct protection function (9.7% of the non OeBF forest area).

The protective status does not prohibit any economic usage in Austria. The average Growing stock of protective forests in Austria with 283 m³/ha does not differ much from the average for all forests: 286 m³/ha). Only the amount of timber harvested averagely in protective forests per year differs with 3.8 m³/ha significantly from the average for all forests: 5,0 m³/ha.

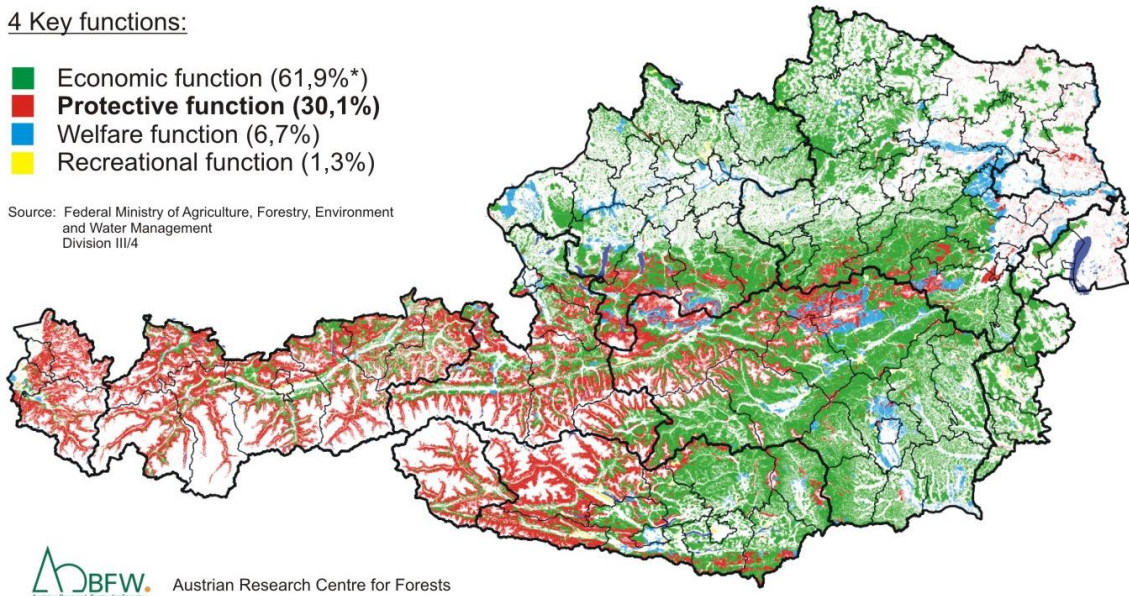
There are specific subsidies foreseen to maintain/enhance the protective functions of forests:

- a) National project Protection through forests initiative (ISDW) since 2007
- b) Rural Development Program's measure for Object Protecting Forests, based on silvicultural actions, knowledge and networking promotion (6 Mill €/year)

4 Key functions:

- Economic function (61,9%*)
- **Protective function (30,1%)**
- Welfare function (6,7%)
- Recreational function (1,3%)

Source: Federal Ministry of Agriculture, Forestry, Environment and Water Management
Division III/4



 Austrian Research Centre for Forests

Fig. 3: Austrian Alpine forests: key functions of forests.

Germany

Germany has only a small part of the area of the alpine convention. It is situated only in the federal state Bavaria. Bavaria has defined a geographical Alpine area that is considerably smaller than the area of the Alpine Convention. Data on mountain forest are referred to the Bavarian Alpine area. The forested area in the German Alpine area is 50%.

Mountain forests in Bavaria are 250 000 ha (approximately 10% of the total forested area of Bavaria); protection forests are 58% of the Mountain Forests (approx. 150.000 ha).

In the composition conifers prevail (70%) with spruce representing 61% of total volume (Fig. 4).

Public ownership is 66%, with 57% represented by state forests (Fig. 5).

The Bavarian Forest Act states, that mountain forests should as possible fulfil all functions over the entire area, in particular production functions (e.g. wood production), protection functions (protection against natural hazards, protection of water, biodiversity) and recreational functions.

Legal definition of protective forests (Bavarian Forest Act):

- Located at higher elevation or mountain ranges or
- Site with erosion risk or
- Preventing natural hazards as avalanches, rockfall, floods etc.

The Bavarian Forest Act also provides special regulations for protection forests, for example against land use change (clearing) and regulation of management (no clear-cuts).

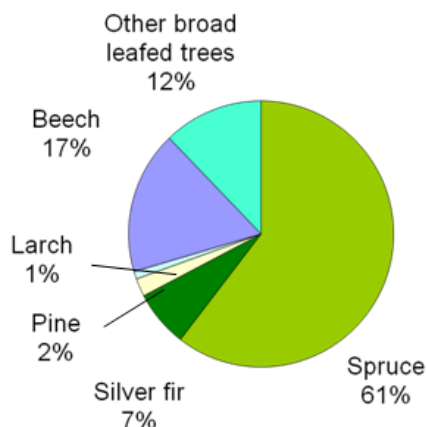


Fig. 4: German Alpine forests: Composition.

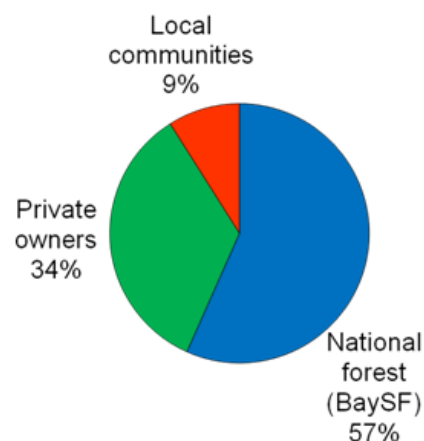


Fig. 5: Ownership of German Alpine forests.

There is a **financial support** for private and communal owners of mountain forests with a special focus on for maintaining the protective functions. Annual subsidies are about 2.9 Mio € per year. It includes special measures as

- road-construction
- logging with cable cranes
- planting of deciduous and mixed stands
- established natural regeneration
- tending in young stands
- prevention of bark beetles

Since 2005, the national forests can benefit of subsidies for special measures in protection forests (road building, prevention of bark beetles, planting, tending in young stands) too. This regulation was also integrated in the Bavarian forest law. The annual subsidies are about 1,8 Mill €/year.

Protection forests that are endangered to lose their protective functions or have lost it yet are maintained with a special **program for restoration of the protection forests**. The program is under direct responsibility of the Bavarian Forest administration. The annual investment is about 2,8 Mill. €/year.

Scientific research in order to improve the protection function of the forests is also important for Bavaria. For example, the INTERREG co-financed projects SICCALP and STRATALP dealt with the effects of loss of humus in succession of wind throws in the Northern Limestone Alps and developed strategies to prevent negative effects.

The projects were performed together with partners in Austria

(<http://www.hswt.de/forschung/forschungsprojekte/wald-und-forstwirtschaft/stratalp.html>).

Switzerland

Switzerland has important projects on protective forests

- silvaProtect.ch (<http://www.bafu.admin.ch/naturgefahren>)
- NAIS (Sustainability in Protective Forests)

The protection function is related to natural hazards (rock fall, avalanches, landslides, torrential processes).



Fig. 6: Switzerland Alpine forests: the Silva Project web site.

Based on national criteria the area relevant for each hazard's source has been defined for whole Switzerland: the percentage of this area for each canton is protective forests index. This is higher in the Alpine core area (Graubunden, Ticino, Valais, Berner) as shown in the graph of Fig. 7. The index is the base for provision of subsidies for protective forest management to the cantons (60 Mill CHF/year).

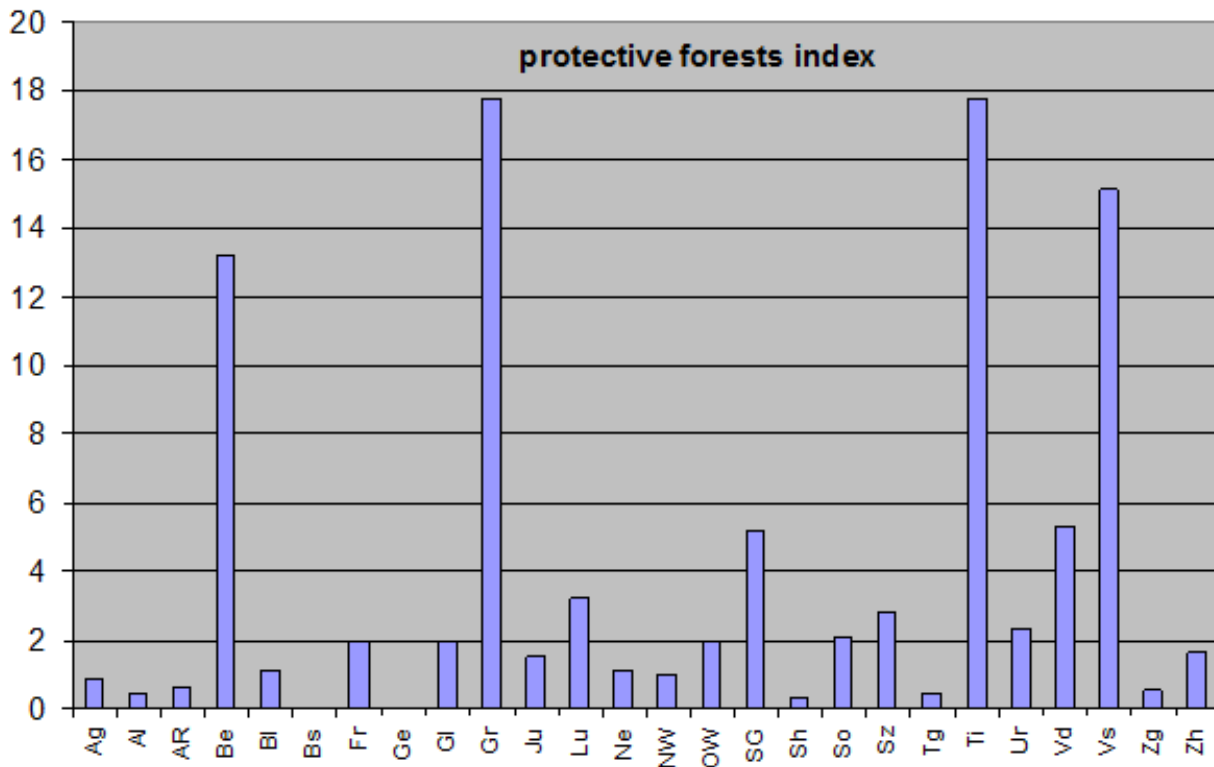


Fig. 7: Switzerland Alpine forests: Percentage of cantons' territories under the protective forests' index.

Additional 40 Mill CHF are provided for technical protective measures based on risk potential and needs.

Forest with a direct protection function has been defined in the whole Switzerland and is 49%.

The percentage of forest related to each cause is

- 8% rock fall
- 21% avalanches
- 27% landslides
- 80% torrential processes

Sum is bigger than 100% because areas related to different phenomena overlap.

Subsidies are given to owners to improve the protection function, according to specific criteria for each kind, and the condition of the forests (composition, age structure, regeneration).

The percentage of protective forests is very different in the cantons, up 90% in Ticino and Valais. As expected Alpine cantons have a higher percentage of protective forests (Fig. 8).

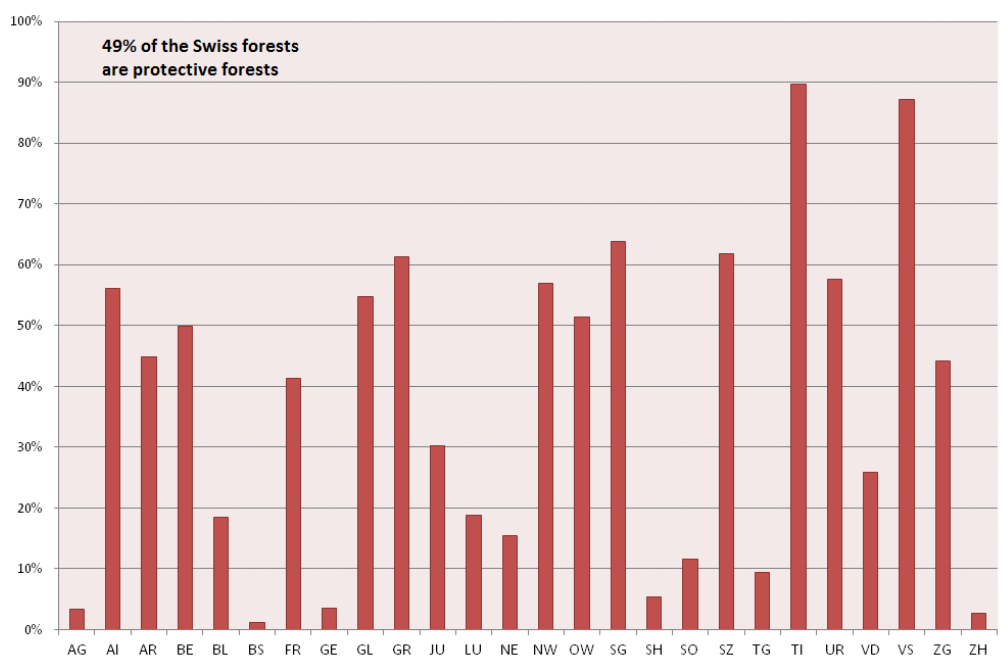


Fig. 8: Switzerland Alpine forests: Percentage of protective forests in each cantons' territories.

France

Most protective forests are **site protection** forests against erosion and landslides. Protection areas are identified on the most risk-prone areas.

At national level

Protection areas: 1.238.000 ha (2,3% of the land area). Mostly mountains (Alps and Pyrenees); and costal dunes

964.000 ha are forested (78% of protection areas).

Forests in protection areas are 6,3% of the total forest area.

Management of protection areas

On 404.000 ha (33%) the only object is protection; on the rest protection and production.

258.000 ha (63%) of the only protective areas are forested.

Since 1860 a program to buy, restore and develop degraded areas in mountain areas has been in place: **Restauration des Terrains en Montagne (RTM)**

RTM manages 205.000 ha in the French Alps and has a yearly budget of 5 Mill €.

50% is forested

25% with non-forest vegetation

25% bare land

The areas are in the upper Alpine zone and access is usually a problem. Management is focused on maintaining/improving protection.

Water quality protection

200.000 ha forest are in drinking water reservoir protection zones (within landscapes with special conservation regulations) (1,3% of the forest area);

600.000 ha within mineral water spring protection zones (where no special forestry requirements are in place) (3,9% of the forest area).

Direct protection

Protective forests against rockfall, avalanche, landslides and debris flow have been designed.

Under the forest law, they have to be conserved and management and logging are subject to special regulations.

In the French Alps (total forest area: 1.446.000 ha) direct protective forests are 136.100 ha (9,4%). A study in 3 small alpine catchments showed that the direct protection area varies between 20 and 47% of the forest area.

Liechtenstein

Due to amended claims on forests within the society, the forest function mapping has been revised in 1993. Besides the pure timber production, a number of additional forms of usage have been defined. Passive usages as protective function, welfare function or protection of nature and territories were equally considered as active ones such as recreational function. In these days, forests need to cover a wide range of tasks. Therefore every of the more than 3,800 forest stands in Liechtenstein have been linked to a priority function, setting the main direction for future treatments.

The function mapping resulted in the following spatial and proportional distribution of functions:

Very Important Protective Function:	10%
Important Protective Function:	17%
<u>Common Protective Function:</u>	<u>29%</u>
Timber Production:	25%
Protection of Nature and Territories:	18%
Recreation and Welfare Function:	1%

The topography of Liechtenstein leads to a high share of forests with a protective function against natural hazards (56%). Regulated by law, the state covers all the expenses for management interventions to maintain and enhance protective forests (Fig. 9).

Only a quarter of all stands are focused on timber production and 18% are determined as special forest reserves and protected by regulation.

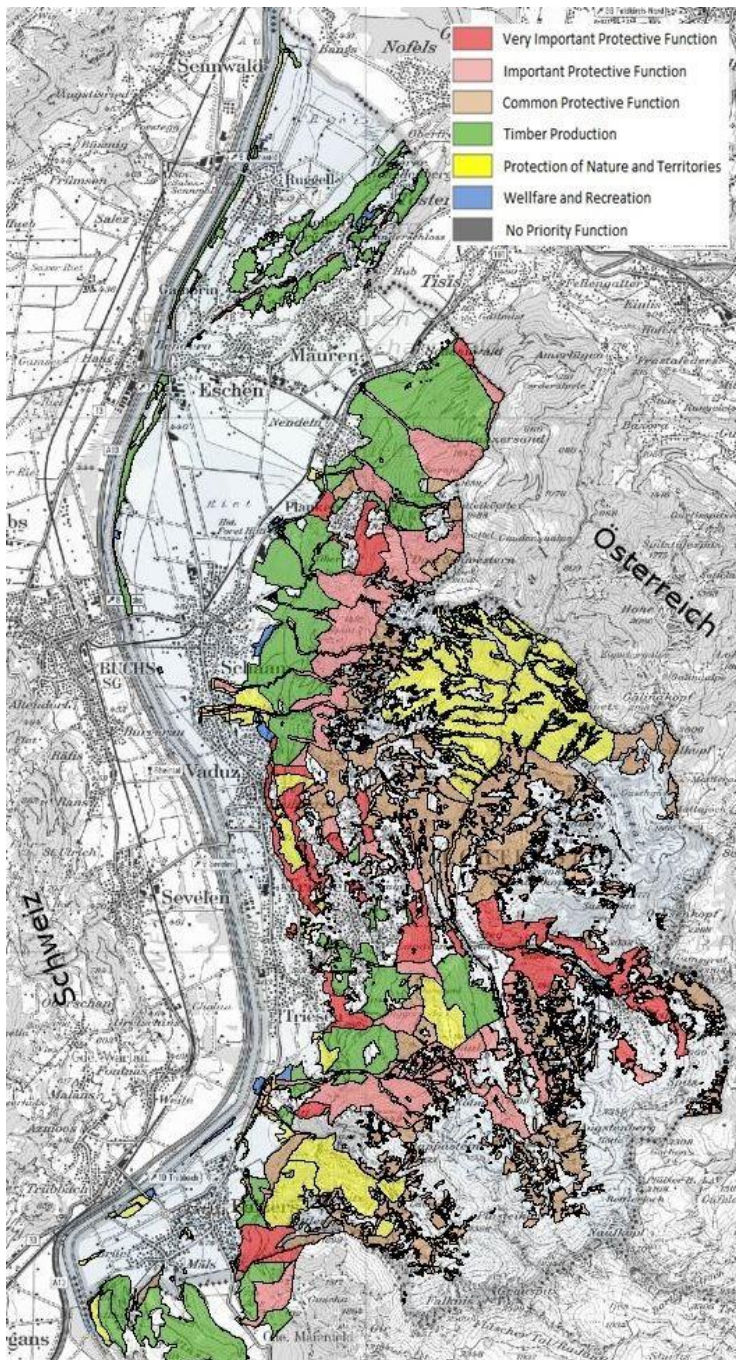


Fig. 9: Different protection function of Liechtenstein forests.

GOOD PRACTICES

Germany: Project Mountain Forest Offensive (BWO)

Almost 60 percent of Bavaria's mountain forests in the Alps are protection forests. These forests are increasingly endangered by the global climate change. With a broad measure package, Bavaria has increased its efforts for the preservation of multifunctional mountain- and protection forests. According to the mountain forest protocol of the alpine convention the implementation of the BWO is put forward together with concerned stakeholders.

The Mountain Forest Offensive ("Bergwaldoffensive" – BWO) is a part of a widespread program of the Bavarian state government against the global climate change. Since 2008, the Bavarian state government is financing the BWO with about 2.5 million euro per year. The measures of the BWO are specially designed for private and communal mountain forests, where the size of the single properties is usually very small.

The central part of the BWO are the so-called "BWO-projects". These are specially identified areas with an elevated risk for degradation as a function of climate change. In those areas together with different forest owners measures for maintenance and adaption of the forests are set into work. Examples for the measures are planting of adapted tree species, tending with the special aim of supporting adapted tree species, natural regeneration, logging with cable crane or building of new forest roads (Fig. 10).



Fig.10: Schematic picture of a BWO-Project in the Bavarian Alps.

The local forest authorities are planning the single measures, setting them into action together with the forest owners. Putting together different owners is increasing the efficiency and reducing the costs. A project manager of the local forest authority is taking care of the BWO-projekt from the planning until the completion and is a contact person for forest owners and stakeholders.

Besides the process of integral planning participation is an important part of the programme. Therefor all concerned persons get the possibility to bring in their ideas from the beginning of the selection of project region, the planning process until the implementation of the single measures. In

general, a so-called “BWO-advisory board” is founded for the BWO-projects. The members of the advisory board are differing in each project area. In general, they are consisting of politicians, deputies of the forest owners, local authorities and other organisations (for example hunters, farmers, conservationists). We regard the BWO-advisory board the central factor of the success of the BWO (Fig. 11).



Fig. 11: The BWO-advisory board is discussing the regeneration of protection forests in a BWO-project.

Beside the BWO-projects, several other actions are part of the BWO as a program for the adaption of mountain forests to the climate change:

- **Adapted seed sources:** Forest regeneration, whether natural or artificial, is based on the utilization of forest genetic resources (i.e. seeds). The selection of suitable forest reproductive material has assumed a new importance both because trees are long-lived species and because rapid climate change will have an impact on the environmental conditions of the trees as they grow and mature. This counts especially for the Alps, because global warming will affect mountain areas in a particularly severe way, posing a very serious threat to Alpine forests. Adaptation to these novel environmental conditions is nearly impossible without genetic diversity. Therefore, the Bavarian Office for Forest Seeding and Planting (ASP) established a project to identify site adapted seed stands in the Bavarian Alps and to improve an adequate supply with seeds of high genetic quality.
- **Information on mountain forest sites:** whereas for the lowlands of Bavaria there are existing detailed forest site maps, no such maps were existing for the alpine region for a long time. As part of the BWO together with partners in Austria the project WINALP - ‘Forest Information System for the Northern Alps’ (www.winalp.info) developed intermediate-scale maps of the potential natural forest vegetation for the Northern Calcareous Alps, which are based on the ecological gradients temperature, soil reaction, and soil moisture. The project was financially supported by the European Fund for Regional Development (EFRE) within the ‘INTERREG Bayern – Österreich 2007–2013’ program.
- **Research:** although research findings show, that the alpine region will be increasingly affected by the global climate change, there are many questions on the effects of climate change on forests. Therefore in the frame of the BWO Bavaria also intensified research on the effects of climate change on forests (see projects SICCALP and STRATALP cited in the German part of the paper on protective forests)

With the BWO Bavaria is increasing its efforts for the preservation of multifunctional forests in the Alpine region. We hope that it will help to save the mountain forests as areas for recreation, biodiversity, wood supply and other ecosystem services for the coming generations.

Italy, Autonomous Province of Bolzano/Bozen: identification of protective forest in South Tyrol, Italy

In 2008 the Autonomous Province of Bolzano conducted a study to identify the protective function of forests against natural risks: avalanches, rockfall, debris flow, floods (Provincia Autonoma Bolzano: Schutzwald Hinweiskarte Suedtirol (Redaktion: A. Zischg, A. Largiader, ABENIS AG).

The province is an entirely mountainous area (100 % within the Alpine Convention), has a forest cover of 50% (National Forest Inventory 2005) that protect villages and essential infrastructures (transportation, tourism, production). Object of the study was mapping of the protective forests.

The study was based on an automatic GIS proceeding for each danger's source (first tested in some basins than extended on the whole area). The results were then checked on local conditions; in the final stage the actual protection of buildings and important infrastructures (using the categories of the flood risk plan) were defined (**object protection forest**) in order to receive the priority attention in the planning and management process; all forest with protection function (including object protective) were defined as **site protection**. The total area to be protected is 318,5 km² (4,5% of the province).

Avalanche protection: the model calculated potential avalanches in absence of forest (based on the digital terrain model: slope, elevation, morphology; and meteorological data); for the detachment area trajectories have been calculated, testing results with real avalanches' data. For all avalanches trajectory a deposition area has been simulated. The potential avalanche area was overlapped with the forest map and with the damage potential map, defining the object protection and the site protection forest (Fig. 12).

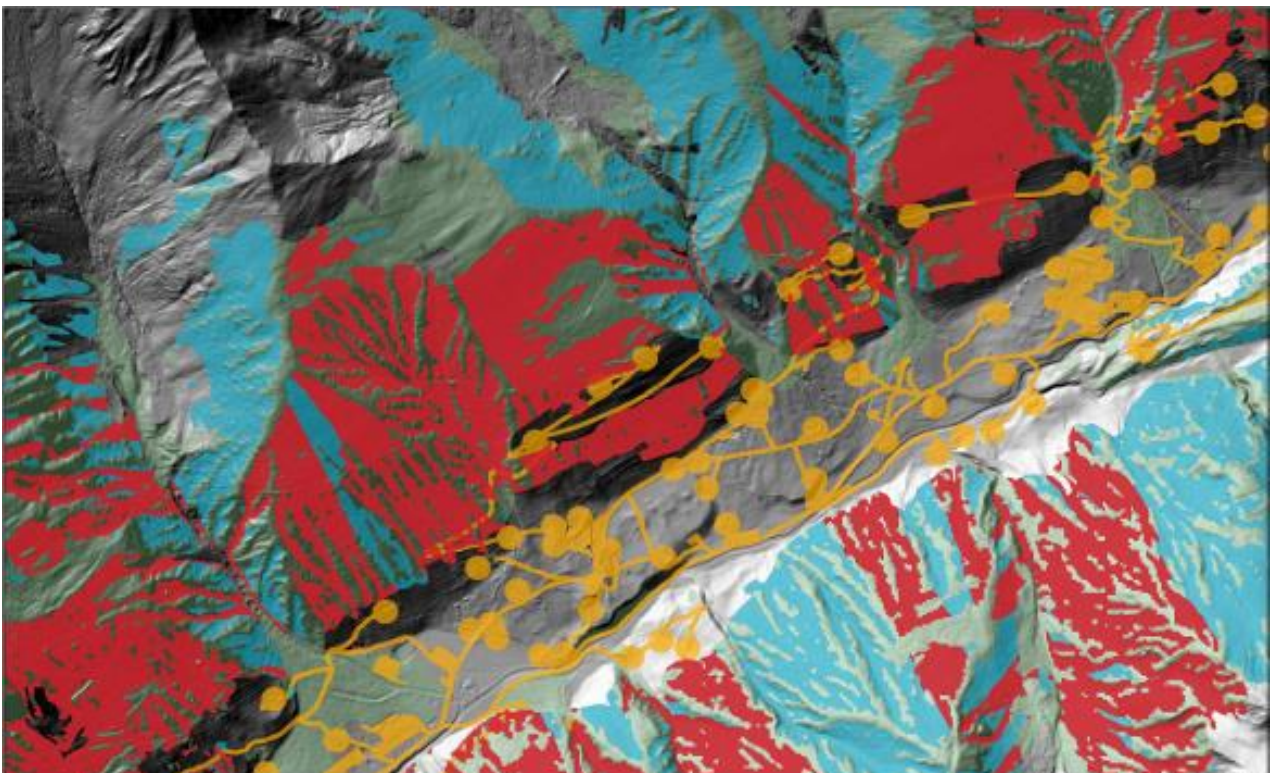


Fig. 12: Avalanche protective forests.
In orange - risk potential, in red - object protection, in blue - site protection forests.

In the whole province site protection forests have an extension of 1131 km² (33% of the forest area; 560 km² of these are object protection forests (16% of forest area).

Rock fall protection: rock fall risk was simulated with the BUWAL method (1988) within the INTERREG IIIA project I-CH *Informationssystem Hydrogeologische Risiken*, based on geological information and the digital terrain model. Trajectories and deposition areas had already been mapped and has been transformed into a vector perimeter in order to be intersected with forest area and damage potential area (Fig. 13).

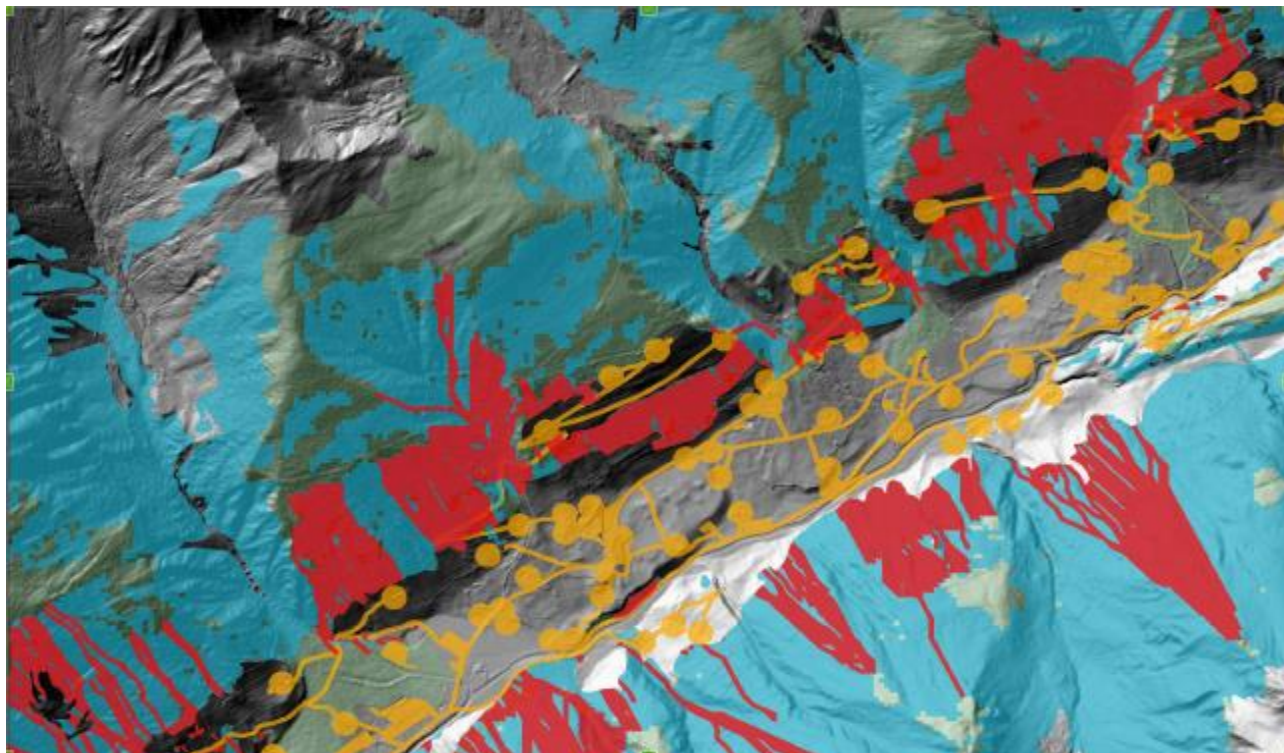


Fig. 13: Rockfall protection: colors as in Fig. 12.

In the province, rock fall site protection forests cover an area of 1772 km² (51% of the forest area); object protection forest in 451 km² (13% of the forest area).

Debris flow protection: in the above-mentioned INTERREG project a risk map for geomorphological and hydrogeological risks had been devised. For any basin the maximum solid transport load, maximum water discharge and debris flow potential (small/large) were estimated and the most critical areas were determined. Risk zones and the forest cover of the critical areas were used to define protective forests (Fig. 14).

In the province debris flow site protection forests cover an area of 227 km² (7% of the forest area); object protection forest in 133 km² (4% of the forest area).

Due to quality of available data and structured information (risk zone for rockfall and torrent processes) the cost of the mapping has been quite low (3,4 €/km²), providing forest and land institutions a useful instrument to guide forestry policy and maintain/improve the protective function.

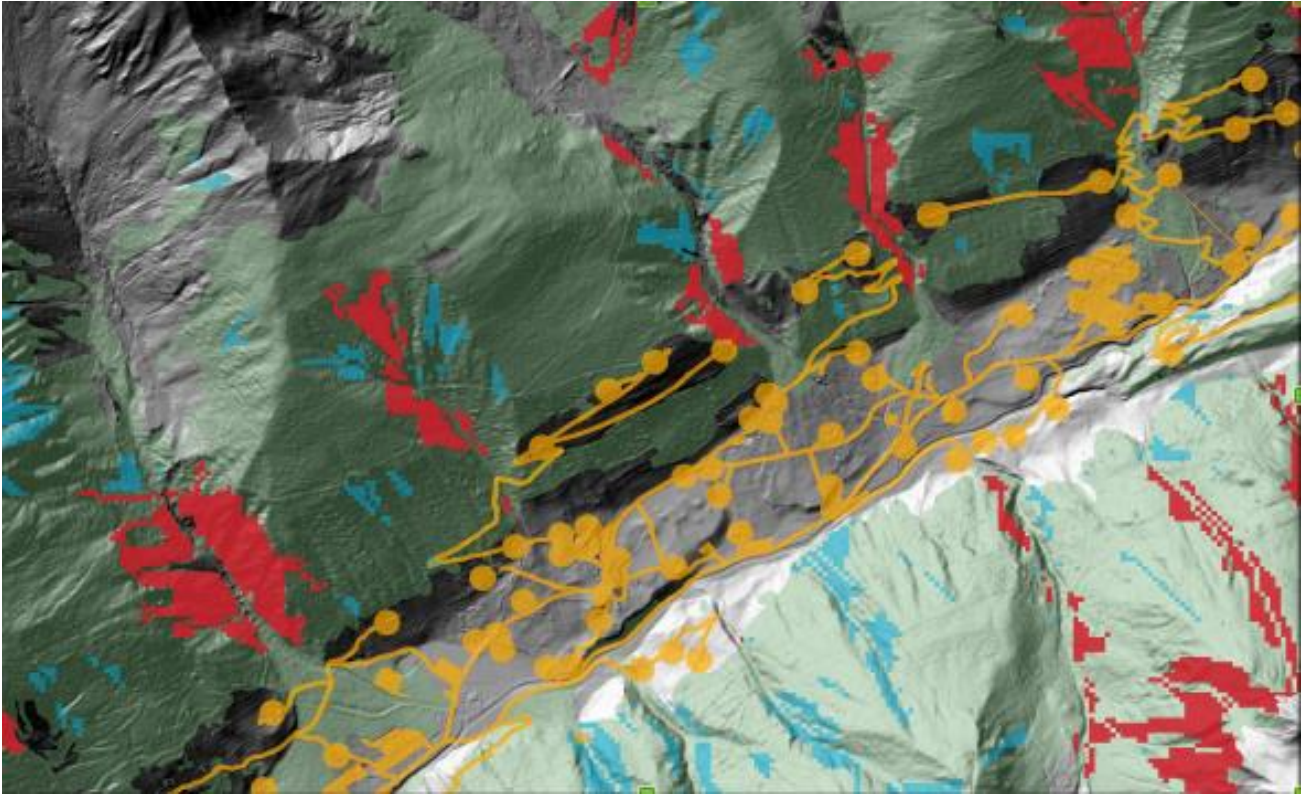


Fig. 14: Debris flow protection forest: colors as in Fig. 12 and 13.

Italy, France, Switzerland: Creation of a network of operators on multifunctional forest management

Project	Creation of a network of operators on multifunctional forest management
Funding	<p>Interreg IIIA Italy-France 2003-2006 “Sustainable management of mountain forests with protective function”</p> <p>Interreg Alcotra 2007-2013 “Protection forests: management techniques and innovation in the Italian Alps”</p> <p>Interreg IFP FR-CH 2007-2013 “Interreg Protection forests”</p>
Countries Regions	<p>Paese/regioni: Italy (Piemonte and Valle d’Aosta), France (Savoie, Haute-Savoie, Isère) and Switzerland (Valais, Vaud, Fribourg)</p> <p>Promoter / coordinator entity: OF Savoie</p> <p>agencies involved:</p> <p>France: Cemagref, Alpes-Maritimes, Centre régional de la propriété forestière Rhône-Alpes, Rhône, ENGREF (Ecole national du génie rural des eaux et des forets), Lycée agricole de Poisy, SIVOM du Haut-Chablais, Commune de Chamonix-Mont-Blanc, Syndicat mixte ARLYSERE, Communauté d'agglomération de Grenoble</p> <p>Italy: Forestry Services of Val d'Aoste / Regione autonoma Valle d'Aosta, Aosta; Forestry Services of Piedmont Region; University of Turin /</p> <p>Switzerland: Forestry Services of Fribourg, Forestry Services of Vaud, Ecole des gardes forestiers de Lyss, Antenne romande du WSL (Recherche sur les forêts, la neige et le paysage), Gisalp (Groupe international des sylviculteurs alpins)</p>
Objectives	<p>The mountain forests provide a wide variety of goods and services for society. Much more than the production of wood, these forests play an important protective role. Management of these forests is therefore essential, although their economic balance is deteriorating. The public and private forest managers of the border regions of France (Savoie, Haute-Savoie, Isère), Switzerland (Valais, Vaud, Fribourg) and Italian (Val d'Aosta, Piedmont) have joined forces to:</p> <ul style="list-style-type: none"> • Strengthening relations, exchanges and joint training in relevant management of mountain forests at high ecological value, protectors of people and goods, but also economic value • Create a network of contacts at the local level • Achieving a state of cross-border knowledge • Develop technical reference documents to better define the actions to be implemented in protective forests • Improve dissemination of information and technical reference documents • Evaluate the effectiveness of the measures implemented in mountain forests • • To raise awareness among owners, public administrators and stakeholders
Actions, measures	Creation of an international network of forest operators to exchange experiences and know-how (dissemination of Swiss technical and

	<p>harmonization of national savoir-faire) and the definition of a standard form for the implementation of training sessions. Establishment of a stable network of cross-border contacts at the local level on the issue of forestry in mountain forests with protective function, as well as a group of Italian-Swiss-French employment. Implementation of pilot training sites</p> <p>Development of technical reference documents:</p> <ul style="list-style-type: none"> • Forestry in protection forests: addresses the structural stability characteristics that must have the wooded formations to exercise the function of protection, in relation to the hazard types and the forest types, with an evaluation form of the protective role of forests; - Natural and stability in the western Alps: reviews disorders and major natural disturbances and gives useful indications for the prevention and mitigation; • Forestry and economic assessments in the Western Alps: numerous operational cases, real scale to be role models, are presented and the effectiveness of silvicultural measures and the cost-benefit economic discussed
Years	2003-2013
Costs	About 4.462.000 €.
Contacts, further information	<p>www.risknet-alcotra.org</p> <p>The handbooks are downloadable from the websites: http://www.regione.piemonte.it/foreste/it/pubblicazioni/89-pubblicazioni/manualistica/744-selvicultura-nelle-foreste-di-protezione.html http://www.regione.piemonte.it/foreste/it/pubblicazioni/89-pubblicazioni/manualistica/837-foreste-di-protezione-diretta.html http://www.interreg-alcotra.org/public/projects-docs/66/Guide%20des%20sylv%20de%20montagne%20-%20FR.pdf</p>

Switzerland: Training trails for protection forests

Project	Training trails for protection forests
Funding	<p>The project was financially supported by a group of private insurance, related to the Association of Insurance ASA Switzerland, an alliance concluded by 22 Swiss insurance companies to cover the damage caused by natural elements</p> <p>GIBP: Information group “Forests and natural hazards”</p> <p>SILVIVA: organization for environmental education</p>
Country Regions	<p>Switzerland</p> <p>Promoter/Coordinator Entity: Information group “Forests and natural hazards” (GIBP)</p> <p>Implementing agency: SILVIVA, organization for environmental education</p>
Objective	Provide the public with basic information with respect to the meaning and value of protective forests through an interactive and emotional activity.

Actions

9 educational trails (Fig. 15) have been realized presenting in depth the theme "natural hazards and protection forest", through installations and interactive themed tables. For each path a special guide containing the description of the observation places is then set up, additional information as well as additional elements to deepen the experiences along the educational trail.

The nature trails are addressed to the entire population: children, teens and adults of all ages. They are particularly suitable for teachers, those responsible for tourism, tourist operators, forest operators and representatives of alpine organizations, nature conservation associations and the establishment of training.

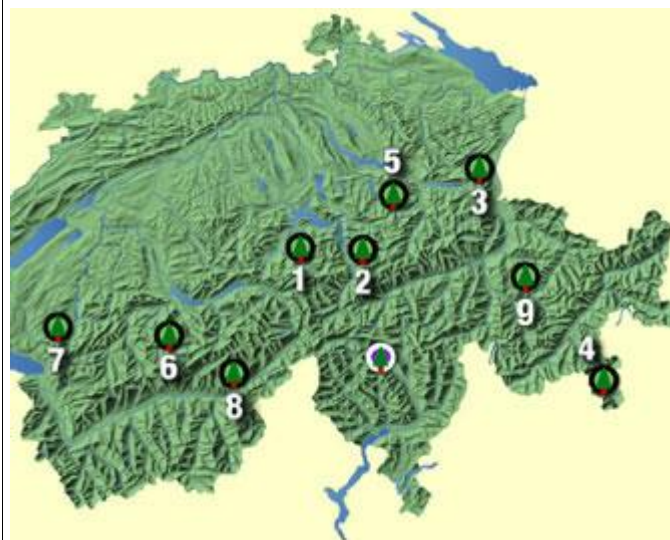


Fig. 15: Educational trails for protective forests.

Years

2002-2006

Contact, further information

www.foret-protection-population.ch

<http://www.svv.ch/it>

<mailto:wald-landschaft@ow.ch>

<http://www.silviva.ch/>