

National barriers identification and policy needs for improving forest ecosystem-based risk-management in the Alpine Space
D.T5.2.1 Report on 'Survey/comparison of national barriers for application of ecosystem-based natural hazard risk mitigation concept'
D.T5.1.1 Report on 'Policy needs for a sustainable strategy for ecosystem-based risk-management'

GREEN RISK 4 ALPS



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1

GreenRisk4ALPs Partnership

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Table of Contents

Table des matières

GreenRisk4ALPs Partnership	2
Table of Contents	3
Introduction.....	7
SWOT ANALYSIS – BARRIERS AND POLICY NEEDS FOR APPLICATION OF FOREST AS NATURE-BASED HAZARD RISK MITIGATION IN AUSTRIA	9
Overview (with a focus on protection forest) on the forestry law of Austria	9
Summary of the regulation about protection forests in the national forestry law	13
Principles.....	13
Consequences	13
Areas of application.....	16
Objectives.....	16
Reference documents.....	16
Legal act of establishment	16
Procedure.....	16
Updating / Evaluation	17
Legal effects	17
Figures.....	18
The different actors and their involvement	19
Summary of other regulations about risk prevention including forests items	19
Name of the regulation	20
Principles.....	20
Consequences for forestry actions.....	21
Areas of application.....	21
Objectives.....	22
Reference documents.....	22
Barriers and policy needs for application of ecosystem-based natural risk mitigation concept/sustainable management.....	23
References:.....	27
SWOT ANALYSIS – BARRIERS AND POLICY NEEDS FOR APPLICATION OF FOREST AS NATURE-BASED HAZARD RISK MITIGATION IN BAVARIA	28
Overview (with a focus on protection forest) on the forestry law of Bavaria	28
Summary of the regulation about protection forests in the national forestry law	32
Principles.....	32
Consequences	32

Areas of application.....	33
Objectives.....	33
Reference documents.....	33
Legal act of establishment	33
Procedure.....	33
Updating / Evaluation	34
Legal effects	35
Figures.....	35
The different actors and their involvement	36
Summary of other regulations about risk prevention including forests items	36
In Bavaria, hazard zone planning is a state competence and organized by various administrative competences and procedures.....	36
Name of the regulation	36
Principles.....	37
Consequences for forestry actions.....	37
Areas of application.....	37
Objectives.....	38
Reference documents.....	38
Other legislative texts usable for regulating protection forest management.....	38
Principles for the forest management in the high mountains at the Bavarian State Forest enterprise.....	38
Principles.....	38
Consequences for FORESTRY actions	39
Barriers and policy needs for application of ecosystem-based natural risk mitigation concept/sustainable management.....	39
References:.....	43
SWOT ANALYSIS – BARRIERS AND POLICY NEEDS FOR APPLICATION OF FOREST AS NATURE-BASED HAZARD RISK MITIGATION IN FRANCE	44
Overview (with a focus on protection forest) on the forestry law of France	44
The forest, a national asset in France.....	44
Summary of the regulation about protection forests in the national forestry law	45
Principles.....	45
Consequences	45
Areas of application.....	46
Objectives.....	46
Reference documents.....	46
Legal act of establishment	46
Procedure.....	46

Updating / Evaluation	47
Legal effects	47
Figures.....	49
The different actors and their involvement	49
Summary of other regulations about risk prevention including forests items	49
Environmental CODE: Natural Risk Prevention Plans	49
Town planning code: wooded areas to be preserved, protected or created	52
Other legislative texts usable for regulating protection forest management	53
Barriers and policy needs for application of ecosystem-based natural risk mitigation concept/sustainable management.....	53
References:.....	56
SWOT ANALYSIS – BARRIERS AND POLICY NEEDS FOR APPLICATION OF FOREST AS NATURE-BASED HAZARD RISK MITIGATION IN ITALY.....	57
Overview (with a focus on protection forest) on the forestry law of Italy	57
“TUFF” in details (birth, principles, objectives).....	58
Process that led to the TUFF.....	59
Principles and Purposes	59
Ministerial Implementing Decrees	62
Focus on protection forest.....	63
National types of protection forests.....	63
Management methods and practices	64
Responsibilities and consequences.....	64
Example of good practices.....	65
Summary of the regulation about protection forests in the Italian forestry law.....	65
Principles.....	65
Consequences	65
Areas of application.....	65
Objectives.....	65
Reference documents.....	65
Legal act of establishment	65
Procedure.....	66
Summary of other regulations about risk prevention including forests items.....	66
Name of the regulation.....	66
Principles	66
Areas of application	66
Objectives	66
References.....	66

Barriers and policy needs for application of ecosystem-based natural risk mitigation concept/sustainable management.....	67
References:.....	68
SWOT ANALYSIS – BARRIERS AND POLICY NEEDS FOR APPLICATION OF FOREST AS NATURE-BASED HAZARD RISK MITIGATION IN SLOVENIA.....	70
Overview (with a focus on protection forest) on the forestry law of Slovenia.....	70
Summary of the regulation about protection forests in the national forestry law	71
Principles.....	71
Consequences	71
Areas of application.....	72
Objectives.....	72
Reference documents.....	72
Legal act of establishment	73
• The Slovenian Forest Act	73
○ Protection functions are defined in the process of the adoption of forest management plans.....	73
○ Protective forests are designated as such by government regulation.....	73
Procedure.....	73
Updating / Evaluation	75
Legal effects	75
Figures.....	75
The different actors and their involvement	77
Summary of other regulations about risk prevention including forests items	77
Name of the regulation	77
Principles.....	77
Consequences for forestry actions.....	78
Reference documents.....	78
Name of the regulation.....	78
Principles	78
Consequences for forestry actions	79
Reference documents.....	79
Barriers and policy needs for application of ecosystem-based natural risk mitigation concept/sustainable management.....	79
References:.....	81
SWOT ANALYSIS – KEY BARRIERS AND POLICY NEEDS FOR APPLICATION OF FOREST AS NATURE-BASED HAZARD RISK MITIGATION IN THE ALPINE SPACE	82

Introduction

In mountains, the forests present on the slopes make it possible to prevent and protect the population and its goods locally against various natural hazards (avalanches, landslides, rock falls, torrential floods) but also, and this on a larger scale, to minimize soil erosion and flooding

Since man has inhabited and used the mountain territories, he has known and used this ecosystem service to protect his interests. Thus, the common ancestors of all the natural risk prevention policies of the countries of the Alpine space are the forestry policy and the foresters in charge of their implementation.

The middle of the 19th century, and in particular the 1840s, marked an important turning point in the evolution of ideas concerning deforestation and the fight against erosion. This evolution began in France with the realization that it was necessary to re-establish a protective service that had been damaged by centuries of overgrazing and overexploitation of forests. The absence of specific legislation for the mountains was strongly felt by the politicians and managers of the time. Proof of this is the declaration of Ludovic Beaussire, special editor and contributor to the first edition of the French forestry annals of 1842: "The considerations, which make the reforestation of the mountains a necessity, impose on the government, as one of its most pressing and sacred duties, the obligation to provide for it. The catastrophic floods of 1855, 1856 and especially of 1859 reminded us once again of these problems. It should be noted that at that time, the interest of the political authorities was focused on the safety of issues that indirectly benefited from the protective effect of the forest areas, namely the valleys and towns downstream of the watersheds.

In March 1860, the French government of the Second Empire established the first law on the reforestation of the mountains. Within the framework of this law, reforestation was carried out to the detriment of pastures. The pastoral activities, necessary at the time for the life of the mountain populations, were threatened. This law has been thus very badly perceived by the populations and generates their animosity towards the State and its forestry service. In order to calm the opposition of the mountain populations, the law of April 4, 1882 on the restoration and conservation of mountainous lands completes and modifies the existing regulations. The mission entrusted to the foresters was no longer to work on the extension of forest areas but to "restore mountain land by correcting torrents, by regulating pastures and by planting eroded watersheds". This law, which is the basis of the French legislation dedicated to the sustainable management of the ecosystem service of protection against natural hazards of mountain forests, has served as a model for many foreign legislations and in particular for those of the countries of the Alpine space.

It is important to note that while foresters initially used forest engineering techniques and concepts to work on slope afforestation, they complemented their forestry approaches with the development of civil engineering techniques. The first developments of natural hazard civil engineering were aimed at reproducing the positive effects of forest stands: anchoring of the snowpack, soil stabilization, obstacles to the propagation of moving masses. The evolution of the terms used is representative of that of the techniques and philosophies of intervention: forest engineering, biological engineering, civil engineering, ecological engineering, nature-based solutions. This evolution also reflects the passage from the management of a "simple" role/function to that of sustainable management of an ecosystem service in relation to land use planning and the multifunctionality of forest ecosystems.

Obviously, any policy, any legislation, can be improved and must take into account the evolution of knowledge and philosophies of action. If the French law of 1882 lays the foundations of the policy of mountain land restoration, it was not until 1922 and the Chauveau law that the legal status of protection was created in France, recognizing the predominant role of certain forests in preventing natural risks.

This principle of regulatory classification of these forests, which has been widely used in the Alpine region, is translated into the legal term "protection forest". If it allows the recognition of the protective effect of forest stands, it is very often not exhaustive due to the lack of an exhaustive cartography of forests offering this service of protection of goods and persons.

Consequently, due to the lack of identification and display of many mountain forests with a protective effect and thus offering a service of prevention and protection against natural risks, they do not benefit from this legal status. Often, these forests are not taken into consideration by the different legislations in force in the Alpine area. It is therefore very important to distinguish between protection forests with legal status and forests with a protective effect not recognized by this status. Furthermore, the legal protection status is very broad and covers forests that protect against natural hazards as well as forests that have to be protected for the quality of life of the population or for environmental reasons.

The 1990s marked a turning point in the development of this ecosystem service of protection against natural hazards. Indeed, the development of geographic information systems, the acquisition and availability of high resolution, accurate and reliable geographic data, as well as the formalization of knowledge of tree/forest stands/natural hazard interactions within simulation models, allowed the first large-scale mapping (land, canton, department, region). Furthermore, the EU ministerial conferences on forest protection in Europe held since 1990 have all stressed 1) the need for a common and harmonized approach to value the ecosystem services of forests as a basis for the development of sustainable forest management, and 2) that the prioritization of these services must be done based on society's needs.

This will of harmonization at the European level has been the basis of many applied research projects, among which the interreg Alpine Space projects ROCKtheALPS and GREENRISKS4ALPS. One of the objectives of the GREENRISK4ALPS project is to propose ways to improve the forestry policies in force in the Alpine Space. Based on the analysis of the current forestry and risk prevention policies in use in the Alpine regions, on one hand the national barriers for application of ecosystem-based natural hazard risk mitigation concept have been identified (D.T5.2.1). On the other hand, a SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats) of these policies has been carried out (integrating the feedbacks from the project's pilot action regions -PARs) and used for proposing recommendations to enhance forest-based solutions in natural hazard prevention policies (D.T5.1.1).

The reading grid of the tables presenting the different national SWOT is as follows:

- **Strengths:** The elements that contribute to the realization of success stories based on forest ecosystem-based risk management.
- **Weaknesses:** These are in fact the pitfalls that hinder the deployment of forest ecosystem-based risk management. Consequently, these weaknesses identify the main national barriers.
- **Opportunities:** Elements of the current context that favour the improvement of policies and the development of innovative ones where appropriate.
- **Threats:** Constraints that may limit the optimization of policies and their implementation.

This document present the results of the investigations conducted on these topics. The presentation of these results is done according to the alphabetical order of the countries of the Alpine space in which PARs have been implemented.

SWOT ANALYSIS – BARRIERS AND POLICY NEEDS FOR APPLICATION OF FOREST AS NATURE-BASED HAZARD RISK MITIGATION IN AUSTRIA

[Overview \(with a focus on protection forest\) on the forestry law of Austria](#)

Austria is a federal republic (federation) with an ownership constitution and legislative competences of the nine federal states (Burgenland, Kärnten, Niederösterreich, Oberösterreich, Salzburg, Steiermark, Tirol, Vorarlberg, Wien). A federal state is divided into administrative districts without legal competences. A district groups together the smallest public administrative units, the municipalities.

Concerning forestry regulations, it is important to consider that 82 % of the forest in Austria is of private ownership. The ownership structure is often complex. The average size of a forest property unit is 9.2 ha. 54 % of the property units are smaller than 200 ha (ÖWI 2009). The forest property units are spatially fragmented to a high extent.

The regulations concerning the definition and protection of forests, the forest management, and the role of forests in (natural) hazard risk mitigation is mainly a legislative federal competence but allocated to the monitoring and implementation by the authorities of the nine federal provinces and their districts via their forestry administrations (LFD and BFI) and by the federal agency of avalanche and torrent control (WLV). The BFI is the public forestry administration on district level (district offices), the LFD on the level of the federal state with different supervisory and coordination tasks depending on the state. The main source of legal regulations is the federal 1975 forest act (ForstG 1975), which replaced the 1852 forest act called "Reichsforstgesetz".

Another important legal provision considering the protective effects of forests is the 1884 act regulating the implementation of engineered constructions and afforestation to mitigate damage due to snow avalanche or torrential hazards (Wildbachverbauungsgesetz 1884). This law may also be counted as forestry law.

Some legal provisions of forest management in detail are legislative competences of the federal states due to authorization by the federal constitution act or the federal forest act (ForstG 1975). These regional regulations (called "Waldordnung", "Landesforstgesetz", or "Forstausführungsgesetz" LFG) are of minor importance for risk mitigation. However, some of them implement the obligation of forest owners to announce intended cuttings and/or to apply them for approval and to tree marking by BFI as well as limitations of pasture especially in protection forests following stricter criteria than the federal forest act. A special item of (protection) forest management, the removal of logs or snags from torrents, is influenced by regulations in LFG and in the federal water rights act 1959 (WRG 1959).

The WLV is a planning and advisory service of the Austrian federal ministry for agriculture and forests (the current acronym of this ministry is BMLRT) with special tasks on order of the federal forest act (ForstG 1975) such as the hazard zone planning (ForstG-GZP) and the implementation of defence constructions or other measures mainly in relation to snow avalanches and torrential hazards, but the WLV is not a public forestry authority. In relation to rivers of high-stream order, these tasks are assigned to the federal water engineering administration (BWV) of the BMLRT. The area of responsibility of both services extends beyond the forest area, while the competence of BFI (LFD) is limited to forests. However, the BFI (LFD) as an administrative unit of the public authority is also mandated to determine the necessity of measures against torrent and avalanche hazards outside of the forest in the torrent and snow avalanche catchments (ForstG 1975 idF 2002, § 101). The implementation of these measures is allocated to the WLV (ForstG 1975 idF 2002, § 102).

In Austria, game browsing is a major cause of insufficient regeneration of protection forests (Schodterer 2011). Hunting matters are legal competences of the federal states. There is no direct competence of the federation concerning the wild animal and hunting management except in relation to animal diseases (Animal disease law 1909). Ownership in hunting is addicted to a certain extent of land property. Therefore, most forest owners do not hold the hunting right. Small properties are grouped into hunting cooperatives and hunting is leased out.

In Austria, the (forest) law is based on two types of legal provisions: 1) the (forest) law enacted by parliament (the forest act) and 2) the ordinances. An ordinance is a more detailed regulation of matters by the responsible minister within the legal mandate and authorization by the forest act.

The implementation of an ordinance takes place via administrative (technical) directives (guidelines), which are not documents of law. However, in fact, the directives concretize the way in which the law is interpreted and implemented by administration, right down to the formulation of (informal) targets.

A special type of legislation is international convention adopted without reservation by the national legislative. Austria agreed to the "Mountain forest" and to the "Soil conservation" protocols of the Alpine convention considering functions and effects of (protection) forests. Formally, these protocols are not part of the (national) forestry law. However, the protocols define objectives and principles of the forest policy according to international commitment, but no operational rules for their implementation and management. This analysis is limited to laws, conventions, ordinances, and directives related to hazard risk mitigation by forest management.

Notice, that the Austrian forest act (as well as many other national and international regulations) do not clearly differ the meanings of the terms "protective function" and "protective effect" of forest as described by Brang et al. (2001) but refers to the societal functions of forest in terms of forest effects (Perzl 2014). Wording is changing between the regulations such as laws, ordinances, and guidelines and their versions due to historical traditions in legislation and administration and no common concept in terms, neither in (international) science nor in (national) legal and administrative practice.

A forest function is a demand for forest effects that is posed to a forest by society because of the situation, e.g., a hazard and damage potential to assets, and without consideration of the (current) effects of the forest (Brang et al. 2001, Riegert & Bader 2010, Perzl 2014).

A protection forest is a forest with a protective function as its primary function (Brang et al. 2001), or, in other words, a forest which shall protect something of value from damage by natural or cultural hazards (Perzl & Huber 2014, Perzl 2019). This societal task designated to the effects of the forest vegetation in interaction with abiotic site conditions is called the protective function of forest. Forest functions define the public interests and objectives in forest management.

Protection forests are also named "protective forests" in the literature (e.g., in Miura et al. (2015), FAO (2021)), although the second term may refer to forests with a (sufficient) protective effect and can be refused with this. Both terms can be found for forests with protection purposes (e.g., in FAO (1981, 2000)), but be aware that a "protective forest" (a forest with a protective function) does not necessarily provide a (sufficient) protective effect. This analysis follows the scientific approach of keeping terms as they were (first) introduced based on clear concepts in terminology and uses the term "protection forest" according to Brang et al. (2001). However, it is important not to confuse protection forests with the term "protected forests" since protected forests may also be legally protected to prevent deforestation because of other forest functions than hazard mitigation. The Austrian forest law shows some peculiarities in relation to the simple and common view of a protective function and a protection forest cited above.

Date and reference document of the current federal Austrian forestry law:

- 1884-06-30 in the version of 2018, current date of amendments 2021-04-19: Act on torrent control (Wildbachverbauungsgesetz 1884): Gesetz vom 30. Juni 1884, betreffend Vorkehrungen zur unschädlichen Ableitung von Gebirgswässern. RGBl. Nr. 117/1884.
- 1975-07-03 in the version of 2002, current date of amendments 2021-04-19: Forest act 1975 (ForstG 1975 idF 2002): Bundesgesetz vom 3. Juli 1975, mit dem das Forstwesen geregelt wird (Forstgesetz 1975). BGBl. Nr. 440/1975.
- 1977-11-18: Ordinance on the forest development (forest function) plan (WEP-V 1977): Verordnung des Bundesministers für Land- und Forstwirtschaft vom 19. November 1977 über den Waldentwicklungsplan. BGBl. Nr. 582/1977.
- 2012-06, current version 2012: Guideline on content and design of the forest development plan (WEP-R 2012): Waldentwicklungsplan - Richtlinie über Inhalt und Ausgestaltung. GZ.BMLFUW-LE.3.1.10/0003-IV/4a/2012.
- 2021-03-21: Ordinance on the hazard zone planning according to the forest act 1975 (ForstG-GZPV 1975 idF 2021): 132. Verordnung der Bundesministerin für Landwirtschaft, Regionen und Tourismus über die Gefahrenzonenpläne nach dem Forstgesetz 1975 (ForstG-GZPV). BGBl. II Nr. 132/2021.
- 2002-10-29 in the version of 2005: Mountain forests protocol (BWaldP): Protokoll zur Durchführung der Alpenkonvention von 1991 im Bereich Bergwald (Protokoll "Bergwald"). BGBl. III Nr. 233/2002.
- 2002-10-29 in the version of 2005: Soil Conservation protocol (BodP): Protokoll zur Durchführung der Alpenkonvention von 1991 im Bereich Bodenschutz (Protokoll "Bodenschutz"). BGBl. III Nr. 235/2002.

The main objectives of the Austrian forestry policy are (ForstG, BWaldP, BodP):

- ForstG 1975 idF 2002, § 1 (2), § 6 (2): Ensuring the effects ("functions") of forests: production of timber, protection against natural hazards and other damaging environmental impacts (note of author: "*cultural hazards*") including soil erosion, balance of climate and water budget, and recreation of forest visitors. According to ForstG 1975 idF 2002 the effects (and subsequently the functions) of forests are of the same value for the society. In fact, the administrative directive WEP-V 1977 (and the BWaldP, Article 6) implemented a higher relevance and priority of the protective functions of forests against natural hazards and damaging environmental impacts in relation to all other functions.
- Mountain forest protocol, Article 1 (1): The preservation of mountain forests as a near-natural habitat and, whenever necessary, to develop them or increase their extent and improve their stability as they provide protection against natural hazards, influence climate, are a source of renewable materials, are important habitats of plants and animals, and have recreational functions.
- Soil conservation protocol, Article 1 (2): The preservation of Alpine soils in a sustainable manner to allow them to deliver their functions.
- The Austrian forest law does not explicitly refer to objectives of rural development. However, the forest policy shall contribute to the rural development, as the legal provisions do not provide for resettlement and there is agreement to the objectives of the Mountain forest

protocol. Risk-based approaches are implemented only cautiously in terms of protection targets, as they could favour urban or economically strong regions, enhance economic and social discrepancies and disadvantage rural regions. This policy is indicated by the definition and the classification of assets to be protected by forest according to the forest act (ForstG 1975 idF 2002) and the guideline for forest function mapping (WEP-R 2012) as well as by the expropriation policy. Although the 1884 act allows for expropriation to install measures and to ensure their effects, expropriation for this purpose has been and still is rare. The relocation of elements-at-risk is possible but not generally provided for in Austrian laws and statutory planning procedures (*Schindelegger 2019*). Austria's natural hazard risk policy always aimed at preserving settlement in rural (mountain) areas.

- Forests are valuable habitats for plants and animals. Forest management shall provide sustainability and biodiversity (ForstG 1975 idF 2002, § 1).

The fundamental principles of the Austrian forestry policy are:

- ForstG 1975 idF 2002, § 6 (2): The presence of forest shall be pursued to such an extent and in such a condition that the effects of forest are maximized and ensured. The implementing provisions of the forest act indicate a priority of the protective functions and effects of forests, but the main principle of the forest management is multifunctionality.
- Mountain forest protocol, Article 6 (1), and Soil conservation protocol, Article 13 (1): Mountain forests that have a highly protective function for their locations (note of author: *"site-protective functions of forest"*) and, especially, for the inhabited areas, for the transport infrastructures, for the farmed lands, etc., (note: *"object-protective functions"*) must be conserved on site with priority of the protective functions in forest management.
- Although the Austrian forest act (ForstG 1975 idF 2002) does not assign different priorities to the site- and to the object-protective functions of forest, protocols of the Alpine convention and recent activities to identify forest with object-protective functions indicate a special importance of the object-protective functions of forest.
- Although conservation and increase of (mountain) forests is an objective of the forest policy (ForstG 1975 idF 2002, § 1 (2), § 6 (2); BWaldP Article 1 (1); BodP Article 13 (1)), deforestation to implement other land use is not forbidden even in case of protection forests, if there is a high public interest in other use than forest.
- Incentives are a main instrument of (protection) forest management in Austria, and Austria agrees to provide sufficient incentives (BWaldP, Article 6 (11)), although there are some obligations of forest owners to carry out measures (e.g., ForstG 1975 idF 2002, §§ 13, 22) and of forest owners or beneficiaries to bear the costs. In fact, the beneficiary pays principle is only implemented marginally (*Weiss & Meier-Glaser 2012*), which is in line with the mountain forest protocol. Costs of protection forest management (note of author: *especially in object-protection forests*) are passed on to the public (*Weiss & Meier-Glaser 2012*).
- Austria agrees to ensure all groundwork necessary for planning specific measures in mountain forests, with particular attention to the protective functions of forest (BWaldP, Article 5). In fact, with regional differences, the expenditures for mapping forest functions have so far been rather low compared to other work. They could be increased in future due to a new protection forest action programme (*BMNT 2019*).

Summary of the regulation about protection forests in the national forestry law

Principles

- In Austria, a "protection forest" (protective forest) is a special legal category of forest to protect assets (including special forest sites) from damage by natural or cultural hazards. Protection forests are subject to specific planning and controlling instruments as well as to special authorizations of forest authorities in relation to their management. The regulations do not differ in objectives and principles for forests in public or private ownership.
- The Austrian forest act distinguishes two categories of protection forests: site-protection forests and object-protection forests (ForstG 1975 idF 2002, § 21). An object-protection forest can also be a site-protection forest.
- The "Bannwald" (ForstG idF 2002, § 27) is a special legal sub-category of object-protection forest with a direct protective effect (function). The Austrian term refers to forests protected and managed under special supervision of the forest authorities because of the very high importance of the protective effect (or of another societal benefit from forest). This category was already implemented in the 1852 forest act and was maintained in 1975, 1987 and 2002. With the amendment of the 1975 forest act in 2002, two categories of object-protection forest were created: object-protection forests, which are a "Bannwald" or not. Be aware that the German language term "Bannwald" (ban forest) can refer to different conditions in detail. For example, the "Bannwald" according to the Bavarian forest act 2005 does not refer to the same situations and functions of forest as in Austria.
- Protection forests according to the Austrian forest act (ForstG 1975, § 21 (1), (2)) are forests with a "protective effect" but be aware that this term refers to the protective function. However, to fulfil the legal status of a protection forest, there must also be the need for special treatment of the forest. This is an additional condition and a special peculiarity of the Austrian forest law. However, the need for special treatment is not defined in terms of content, neither in the forest act nor in any other federal statutory regulation (Perzl et al. 2019 b).
- According to the Austrian legal regulations and terminology, a "forest with a protective function (effect)" is not the same as a protection forest (Perzl 2014). A forest with a protective function is a planning category of forest function planning for the designation of (protection) forests that require special monitoring and treatment in terms of the protective effect.

Consequences

- Forest authorities have to identify (to map) forests with protective effects (functions) in the frame of the forest function mapping which is called WEP for short (ForstG 1975 idF 2002, §§ 6-9, BWaldP Article 5) (Figure 1), but they are not explicitly obliged to map the protection forests (at the scale of the real property cadastre). That sounds paradoxical but remember that there is a statutory difference between "forests with a protective function" and "protection forests". However, forestry authorities are obliged to determine the status as a protection forest if it appears necessary to avoid adverse protection forest management (ForstG 1975 idF 2002, § 23 (2)).
- Concerning object-protection forests, the forest act does not define rules and authorizations about the asset component of the protective function in detail. According to the forest act (ForstG 1975 idF 2002, § 21 (2)) everything made by men is to be protected

by forest, which is not purposeful (Perzl 2014). This issue is left to public authorities without coherent legal regulation.

- The forest authorities have to show the protective functions of forest not only in the WEP but also in the hazard zone planning (ForstG-GZP) (ForstG 1975 idF 2002, § 11 (2); ForstG-GZPV 1975 idF 2021, § 3 (1) 3. b). Consider that the information given by the ForstG-GZP is about real occurrence of gravitational hazards and not about hazard potentials as well as spatially limited to land use and hazard construction land for settlements. Therefore, the ForstG-GZP does not show the protective functions of forests in total.
- Forest owners have to recognize their protection forests as well as the category of protection forest by own (ForstG 1975 idF 2002, § 22 (2)). The forest act considers that environmental conditions such as water budget, occurrence of landslides or the presence of infrastructures may change rapidly and overtake administrative processes.
- The recognition of protection forests by forest owners is supported by the information on protective functions of forests given by the WEP and the ForstG-GZP. However, according to the current WEP guideline (WEP-R 2012), the WEP map does not distinguish object- and site-protective functions of forest (Perzl & Huber 2014), although according to the forest act these categories differentiate the cost bearing obligations. There are gaps and contradictions in the definition of object- and site protective functions in the forest act, the ordinances, and the administrative guidelines (Perzl et al. 2019 b). Perzl & Huber (2014) introduced the term "indirect object-protective functions" to overcome these gaps by means of spatial modelling.
- Since neither the WEP nor the ForstG-GZP provided the necessary information on the protective functions of forests in a sufficient manner, protection forest indicator maps were produced through spatial modelling by the federal forest research center (BFW) on behalf of the BMLRT (Figure 2) (Perzl & Huber 2014, Huber et al. 2017, Perzl et al. 2017, Perzl et al. 2019 a b, Perzl et al. 2021). The regulations of the forest act (ForstG 1975 idF 2002, § 8 (3), § 9 (5); WEP-V 1977, § 2 (3) enable the creation of such additional information in a flexible manner. However, consider that these protection forest indication maps do not represent the protection forest in the sense of a legally binding spatial allocation.
- The obligation of authorities to map protection forests (at the scale of the real property cadastre) is limited to the identification of protection forest areas with insufficient protective effects (ForstG 1975 idF 2002, § 24, § 100), to the identification of "Bannwald" (§ 30), to a request by the forest owner (§ 23, § 30 (1)) or – in order to identify "Bannwald" – to a request by the federal state, the WLW or beneficiaries of the protective effects.
- In the federal state Tirol, forest authorities map the protection forests.
- Deforestation of (protection) forests to implement another land use ("Rodung") is not forbidden in general (ForstG 1975 idF 2002, §§ 17 (2-5), 17a; BWaldP, Article 6 (1); BodP, Article 14 (1)), but subject to an official permit. The public interest in forest conservation must be weighted against the public benefits of the intended land use. However, deforestation of protection forests with a very high protective function is excluded.
- Forest owners have to manage their protection forests and to ensure the stability and the renewal (ForstG 1975 idF 2002, § 22 (1)). Forest owners are not obliged to ensure or achieve a certain protective effect of the protection forest. Their contribution is clearly focused on maintaining the resistance and the resilience of protection forests.

- The forest authority is mandated and entitled to prescribe the treatment of protection forests and to order measures for protection against hazards (ForstG 1975 idF 2002, § 22 (4), §§ 100-101; Schutzwaldverordnung 1977, §§ 2-3). They are authorized to prohibit measures that endanger protective effects and to order measures to ensure or restore protective effects.
- In principle, all silvicultural measures are to be carried out by the forest owner in protection forests as well. This also applies to silvicultural measures ordered by the authorities. However, a special item is the removal of logs or snags from torrents (Hübl et al. 2008): Forest owners have to remove logs from cuttings and to bear the costs. Removal of naturally deposited coarse woody debris is allocated to the municipalities, but in Kärnten without any restriction to the forest owner.
- In case of site-protection forests compliant to the statutory legal definition, which are not object-protection forests, the obligations of forest owners to silvicultural measures depend on the financial yields from logging (ForstG 1975 idF 2002, § 22 (3)). Forest owners are only obliged to carry out the measures and to bear the costs, so far as the owner can fully cover the costs from incomes of logging in this site-protective forest. The obligation of forest owners to reforest areas with a low canopy cover (ForstG 1975 idF 2002, § 13) is limited to "productive" site-protection forests, but not capped by the yields from logging (Jäger 2003).
- If the protection forest is an object-protection forest compliant to the statutory legal definition, the forest owners are obliged to carry out the silvicultural measures, so far as the cost are covered by public funding or payments of beneficiaries except for reforestation (ForstG 1975 idF 2002, § 22 (3a)). The obligation of forest owners to reforest areas with a low canopy cover (ForstG 1975 idF 2002, § 13) is not limited to "productive" object-protection forests (since "unproductive" forests are seen as site-protection forests).
- Forest owners have to carry out the silvicultural measures in a "Bannwald". The costs are transferred to the beneficiaries of protection, so far as they are not covered by public resources. (ForstG 1975 idF 2002, § 31 (1)). The beneficiaries have also to pay all losses of the forest owners due to limitations of forestry. "Bannwald" was and is designated primarily for the protection of transportation facilities, as the operators are obliged to compensate for forest management disadvantages anyway (Schmiderer & Weiss 1999). A variety of reasons led to a decline in the protection forest area declared as a "Bannwald" in Austria from about 30,000 ha in 1975 to 10,000 ha, including the fact that public funds are available for all protection forests (Schmiderer & Weiss 1999). Beneficiaries only require the elaborate administrative procedure if they are obliged to take measures in any case, forest owners if they want to pass on costs and responsibility in forests that are difficult to manage. Currently, ban forests cover about 2 % of forests with a direct object-protective function in Austria.
- The management of a "Bannwald" can be allocated to the WLW (ForstG 1975 idF 2002, § 100 (2)). This is not linked to an expropriation.
- Yield conditions determine taxes and, in the federal state Tirol, special financial duties according to the Tyrolean forest act.

- The competence of forest authorities to prevent damage to forest by wild ungulates is limited to report them to the hunting authorities and to propose measures. Plant protection measures must be carried out by forest owners.

Areas of application

- All forests according to the forest definition by the federal forest act (ForstG 1975 idF 2002). The regulations in relation to mitigate hazards by engineered constructions and afforestation in high altitudes also apply to non-forest land.

Objectives

- ForstG 1975 idF 2002, § 1 (2), § 6 (2): Ensuring the protective effects of forests: protection against natural hazards and other damaging environmental impacts ("cultural hazards") including soil erosion and balance of the climate and water budget.

Reference documents

- 1975-07-03 in the version of 2002, current version of amendments 2021-04-19: Forest act 1975 (ForstG 1975 idF 2002): Bundesgesetz vom 3. Juli 1975, mit dem das Forstwesen geregelt wird (Forstgesetz 1975). BGBl. Nr. 440/1975.

Legal act of establishment

- A protection forest is a protection forest according to its definition and classification in the federal forest act (ForstG 1975 idF 2002, § 22 (2)). There is now legal obligation and systematic procedure of administration to register (all) protection forests and their category. However, forest owners may request the determination of protection forest by an administrative decision of the BFI.

Procedure

- The identifying and classifying protection forests takes place at two procedural levels with different legal status: 1) the first level mapping and classification of "forests with a protective function" (WEP) and 2) of a "protection forest". The first level mapping of forests with a protective function gives just an indication to protection (protective) forests and is done for whole of Austria. The second level is only done by request of the forest owner spatially limited to his area of interest or in case of necessity to forest restoration (exception: Tirol).
- The WEP map showing the protective functions of forest is drawn by the LFD in consultation with the land use planning authorities of the federal state and the WLW. The methods and results are bound to regulations and subject to approval by the BMLRT.
- The WEP map does not allocate protective functions of forests to parcels of the real property cadastre, as the scale of the WEP mapping (1:50.000) is not appropriate for this (Figure 1).
- The WEP map does not distinguish forests with an object-protective function and forests with a site-protective function. The object-protective function was introduced as a forest category in 2002. Experience showed that due to the small-scale and fragmented land use in Alpine environment, mapping of the direct object-protective function of forest (of the damage potential due to gravitational hazards) is only possible via spatial modelling of hazard and damage potentials. The WEP map is currently still focused on the site-protective functions of forest.
- The WEP map drawn by LFD was blended with the modelling of the direct protective-function of forests made by the BFW (Perzl et al. 2019 b). The resulting protection forest indication map (Figure 2) is reviewed by WLW and LFD (BFI) also using regional hazard indication maps

(e.g., Proske & Bauer 2015) and adjusted if necessary. This procedure is new and ongoing and will be implemented in future.

- On request of a forest owner, the forest authorities (BFI) allocate the legal status as a protection forest (the categories) to his parcels or parts of them according to the real property cadastre for the areas of his interest.

Updating / Evaluation

- The mapping of the protective functions of forests (WEP) must be adapted to the actual state of conditions (ForstG idF 2002, § 9 (6)). However, the forestry law does not prescribe an interval of the updates. The administrative planning procedure (WEP-R 2012) currently provides for 10-year review intervals.

Legal effects

- Deforestation of protection forests to implement other land use is not forbidden but subject to an official authorization. In protection forests, this permit can only be given in exceptional cases. Deforestation may be bound to measures to compensate reduced effects of the forest.
- Clear cuts that endanger the effects of protection forests are forbidden in general.
- In protection forests, felling that reduce the canopy cover to less than 80 % over an area of 2,000 m² or more requires an official permit. In Tirol, this regulation does not consider the canopy cover and the felling is subject to tree marking by the public forest administration. In Vorarlberg, all felling in protection forests is subject to pre-registration and tree marking by the public forest administration.
- In Salzburg, any reduction of the forest cover in the upper timberline ecotone is subject to approval.
- In protection forests, the forest authority is entitled to prescribe the treatment of protection forests, to modify some regulations of the forest act, to limit pasture and to order measures. The forest authority is mandated to do so if the forest condition requires it.

Figures

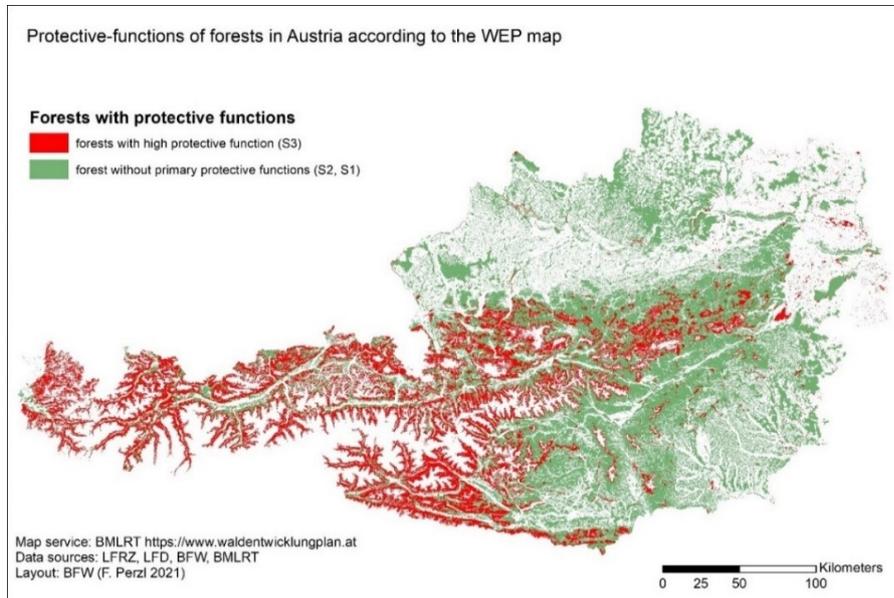


Figure 1: Protective function of forests in Austria according to the WEP map.

The Figure 1 shows forests with high relevance of the protective functions and effects of the forest (S3) in red color (~ 1,23 million ha, ~ 31 % of the forest) and all other forests without a primary protective function in green color. The map does not show protection forests. Forest without a primary protective function may also be protection forests if there is an object-protective function (OSF S3 or S2). State of mapping/GIS-analysis: 2021-01.

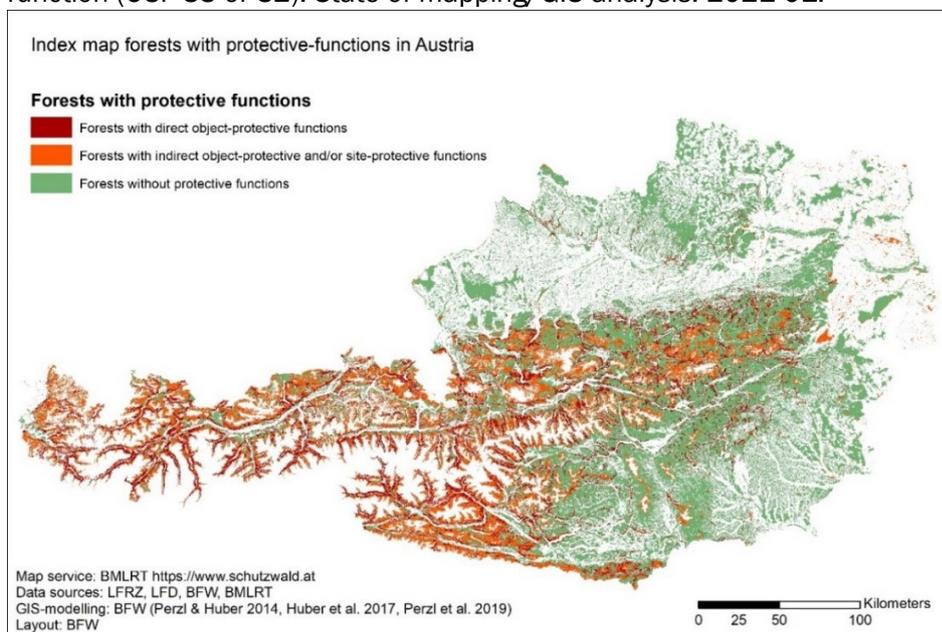


Figure 2: Protection forest indication map of Austria.

The Figure 2 shows forests with direct object-protective functions due to a damage potential of snow avalanches, rockfalls or shallow landslides (DOSF S3 and DOSF S2) and forests with (indirect) object-protective and/or site-protective functions (S 3).

The area of forests with direct object-protective functions on base of spatial modelling is about 598.000 ha (15 %). Indirect and/or site-protective functions count for 921.000 ha (23 %). Current state of mapping: 2021-01.

The different actors and their involvement

- Forests are not systematically and comprehensively designated as protection forests by the state. Forest owners are obliged to identify their forests as a protection forest and to treat them as such according to the provisions of forestry law. To support them in this, the state provides spatial information on the protective function of forests on the level of indication maps. Only in Tirol there is a definitive protection forest mapping.
- BMLRT, LFD, BFI, WLV and forest owners are involved in protection forest classification. The beneficiaries of the protective effect can also apply for classification as a protection forest ("Bannwald"). In this case, they are obliged to contribute to the costs.

Summary of other regulations about risk prevention including forests items

In Austria, hazard zone planning is a federal competence and organized into two technical areas of competence and administrative procedures of the BMLRT:

In relation to snow avalanches, torrential hazards, landslides and rockfall, hazard zone planning (ForstG-GZP) is based on the forest act (ForstG 1975 idF 2002, §§ 6, 11). The planning is allocated to the WLV.

The mapping of flood zones of high-stream-order rivers (WRG-GZP) is based on the water rights act (WRG 1959) and a task of the BWV. WLV and BWV are divided into regional planning offices to support the authorities of the federal states and of the districts in planning of hazard maps and in implementation of engineering construction.

Other hazard types such as earthquakes are subject to other zonings and regulations.

Both hazard zone mappings (ForstG-GZP and WRG-GZP) are informational instruments (such as the WEP) which formally do not have any statutory consequences. Nevertheless, hazard zone planning is one of the most important instruments for risk reduction in Austria. There are several reasons for that:

- 1) Land use planning and allocation of construction land is mainly a legal competence of the federal states and of the municipalities regulated by their land use and building acts. Each federal state has its own law. However, in all of them, the designation of construction land and construction permits as well as permitted construction properties depend on their location in relation to the hazard zones shown by the federal hazard zone mappings. Construction in hazard zones is forbidden or restricted. However, there is (old) building stock in hazard zones.
- 2) The hazard zone mappings support information useful for planning and implementation of engineering construction as well as of nature-based solutions for risk mitigation. The implementation of engineering constructions because of hazard zone mapping followed by reductions of hazard zones is called the "safe development paradox". This implementation of active risk reduction measures may be seen as a promotion of economy in contrast to other aims of land use development (e.g., Segoe 1937; Weiss 1999; Weiss 2003; Keiler 2004, Fuchs et al. 2004, Burby 2006 all cf. Pukall & Kruse 2016). The reduction of hazard zones because of hazard defense measures may result in higher vulnerabilities and

hazard risks. However, studies of Merz et al. (2009) and Fuchs et al. (2015) show low increases of damage potentials in hazard zones in Austria (Pukall & Kruse 2016). There is low evidence of such a feedback effect (Pukall & Kruse 2016). In administrative practice, hazard zones are hardly ever reduced despite the implementation of defense measures.

- 3) The allocation of public funds for hazard mitigation measures is not an entitlement of public or private legal entities. Federal funding can be denied if municipalities do not take hazard zone plans into account. Therefore, land use and building authorities consider the hazard zone planning. Furthermore, a disregard raises questions of legal responsibility in case of fatalities or other damage due to hazards. Constructions of building in hazard zones are subject to strict conditions.
- 4) The information provided by hazard zone planning is clear and focuses to areas of interest of the broader population. Hazard zone planning is well known by the property owners and population in the Alpine space of Austria (Perzl & Huber 2014). The relation of the hazard zones to the conditions of forest is probably much less known and understood by population. However, there are no studies on these perceptions.

Since the items of the ForstG-GZP are gravitational (Alpine) natural hazards, ForstG-GZP is more related to forest conditions than the WRG-GZP.

Name of the regulation

- 1975-07-03 in the version of 2002, current date of amendments 2021-04-19: Forest act 1975 (ForstG 1975 idF 2002): Bundesgesetz vom 3. Juli 1975, mit dem das Forstwesen geregelt wird (Forstgesetz 1975). BGBl. Nr. 440/1975.
- 2021-03-21: Ordinance on the hazard zone planning according to the forest act 1975 (ForstG-GZPV 1975 idF 2021): 132. Verordnung der Bundesministerin für Landwirtschaft, Regionen und Tourismus über die Gefahrenzonenpläne nach dem Forstgesetz 1975 (ForstG-GZPV). BGBl. II Nr. 132/2021.
- 1959-10-16 in the version of 2018-11-22, current date of amendments 2021-04-19: Wasserrechtsgesetz 1959 (WRG 1959).
- 2014-06-13: Ordinance on the hazard zone planning according to the water rights act 1959 (WRG-GZPV 2014): Verordnung des Bundesministers für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft über die Gefahrenzonenplanungen nach dem Wasserrechtsgesetz 1959 (WRG-Gefahrenzonenplanungsverordnung –WRG-GZPV). BGBl. II Nr. 145/2014.

Principles

- The hazard zone mappings are information tools with indirect legal effects.
- The hazard zone mappings show areas currently endangered by hazards classified by the hazard probability and intensity in relation to a recurrent design hazard event (Figure 3). Therefore, they show areas that are not suitable or only suitable to a limited extent for settlements.
- Be aware, that the main information given by the Austrian hazard zone planning is the current hazard component of risk but not the "risk" in the near sense of this term in natural hazard and risk science. There is no legal order to show risks.

- The mappings do not show hazard and damage potentials according to the contextual meanings of these terms used by Perzl & Huber (2014) and Perzl & Kleemayr (2020) suitable for mapping of protective functions of forests. Hazard and damage potentials of the forest function mapping (WEP, protection forest indication map) do not consider the (protective) effects of the forests. Hazard zone mappings complement this information by consideration of the effects of forests or other countermeasures on a more detailed level of analysis.
- The hazard zones of the ForstG-GZP and the WRG-GZP include the effects of the forest. Therefore, they indirectly refer to areas without or with insufficient protective effects of forest, but without clearly designating these areas in total. However, the technical guidelines do not indicate how to consider the protective effects. This is done by expert.
- Austrian hazard zone planning mainly designates hazard zones where natural hazard events have already been directly observed or are already likely to occur based on indirect indications. This is called the historical method of hazard mapping. However, the new generation of planning increasingly tends to derive hazard zones from hazard potentials and forest conditions, even without evidence of current natural hazard activity.
- The ForstG-GZP is spatially limited to land use and hazard construction land for settlements. Although the forest act only contains a vague spatial restriction and authorization for that (ForstG 1975 idF 2002, § 6 (3) b), the planning agency defines the spatial planning area mostly on its own. The spatial limitation results from pragmatic and practical considerations connected to the high planning effort.
- The Austrian hazard zone planning is primarily designated for snow avalanche, torrential and flooding hazards. Danger due to landslides and rockfall are only recorded and presented by way of indication and not systematically (Rudolf-Miklau & Promper 2015). This may be due to the low number of fatalities caused by landslides and rockfall in Austria. In addition, it is difficult to determine occurrence probabilities and hazard intensities in relation to recurrent design events for rockfall and landslides.
- The hazard zone planning is revised periodically and in the event of changes in conditions.

Consequences for forestry actions

- The Austrian hazard zone planning does not spatially cover the entire hazard and damage potential. It is to a certain extent decoupled from the protective functions and from the conditions of protection forests. This may be a consequence of the fact that up to now the protective functions (and effects) of forests and the hazard zones have been determined in separate planning procedures by different agencies. Due to the presentation of the current hazard probability based on observed hazard occurrences, the concept tends to focus planning on engineering constructions.
- Information given by the hazard zone mapping also initiate interests in improvement or restoration of protective effects of forests and trigger (silvicultural) countermeasures. However, the information is from limited solution power in relation to a preventive protection forest management.

Areas of application

- All land that could be affected by natural hazards. In administrative practice, hazard zones under the forest act (ForstG-GZPV) are primarily designated for dedicated construction land.

Objectives

- Risk reduction by prevention or reduction of settlement activity in areas affected by natural hazards.
- Provision of planning and decision-making bases for risk reduction through active measures.

Reference documents

- 1975-07-03 in the version of 2002, current date of amendments 2021-04-19: Forest act 1975 (ForstG 1975 idF 2002): Bundesgesetz vom 3. Juli 1975, mit dem das Forstwesen geregelt wird (Forstgesetz 1975). BGBl. Nr. 440/1975.
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- 1959-10-16 in the version of 2018-11-22, current date of amendments 2021-04-19: Water rights act 1959 = Wasserrechtsgesetz 1959 (WRG 1959).
- 2014-06-13: Ordinance on the hazard zone planning according to the water rights act 1959 (WRG-GZPV 2014): Verordnung des Bundesministers für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft über die Gefahrenzonenplanungen nach dem Wasserrechtsgesetz 1959 (WRG-Gefahrenzonenplanungsverordnung –WRG-GZPV). BGBl. II Nr. 145/2014.

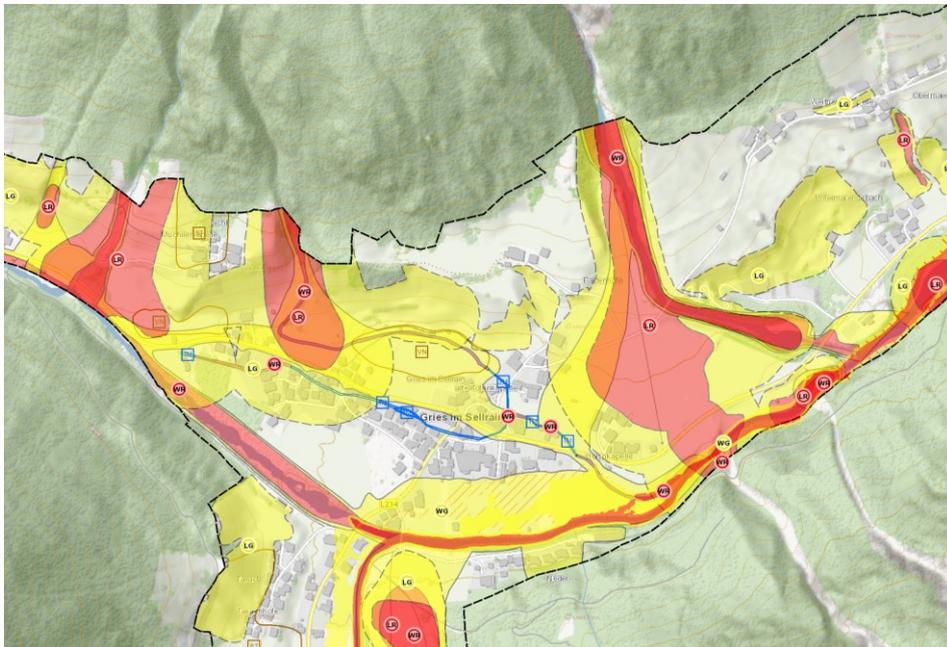


Figure 3: Clip from an Austrian hazard zone map according to the forest act (ForstG-GZP) and to the water rights act (WRG-GZP). Red and yellow areas are land endangered by snow avalanches, torrential hazards and/or floods by different degree. Source: TIRIS.

Barriers and policy needs for application of ecosystem-based natural risk mitigation concept/sustainable management

The Austrian regulations concerning hazard risk mitigation and forest management do not considerably hamper the implementation of nature-based solutions for risk mitigation such as afforestation and appropriate forest management. The regulations aim to encourage forest owners and beneficiaries to act on their own responsibility as well as to find consensual solutions through information and consultation, instead of creating defensive attitudes due to prescription of strict and rigid forest management requirements.

However, the regulations and procedures to a certain extent also create a tendency towards wait-and-see behaviour and favour forest restoration rather than a preventive silvicultural engagement. Preventive silvicultural action is the main driver for the success of risk mitigation by forest. Forest policy should promote preventive action even more strongly in relation to restorations, as well as the conditions for the success, such as appropriate stocks of games and more effective compensations of damages caused by game. Another point that often leads to the implementation of grey measures instead of or only with green measures is the high uncertainty in the assessment of the protective effect and development of forest. Such assessments are more difficult and time-consuming than those of engineered constructions. They need special considerations on the spatial and temporal resistance and resilience of the forest such as the probability of damage by windthrow and the rate of spread and growth of regeneration.

These assessments are even more difficult in the face of too much forest damage caused by game and the developments possible due to environmental change and introduction of pests. It is therefore logical and justified that planners provide for combined grey-and-green measures and a (minimum) protection by engineered constructions.

The following table synthesises the main input data about the current situation in Austria.

		Yes	No	Comments
Existence of a regulation for risks prevention	National	X		National mappings about hazard probabilities are implemented via regional land use allocation.
	Regional	X		
Existence of a protection forest classification	National	X		The national classification applies to all federal states.
	Regional		X	
Comprehensive mapping of natural hazards	National	X		Hazard zone mappings are available at national level.
	Regional	X		
	Local	X		
Comprehensive mapping of natural risks	National		X	The availability of hazard indication maps varies dependent on region and hazard type. Hazard zone mapping is done nationwide on municipality level but is limited to construction land except for floods.
	Regional		X	
	Local		X	
Comprehensive mapping of protection forest ecosystem service	National	X		The current mapping (modelling) status is incomplete only about deep-seated landslides and torrents.
	Regional	X		
	Local	X		
Financing of this ecosystem service	EU	X		Co-financing by various funds and contributions on each level (e.g., EARDF, national disaster fund, forest fund).
	National	X		
	Regional	X		
	Local	X		
Natural risk prevention document	National	X		The information is limited to land designated for construction.
	Regional	X		
	Local	X		
Natural risk prevention document integrating this ecosystem service	National	X		Formally, hazard zonings consider protective effects of forests. However, there is no common methodology.
	Regional	X		
	Local	X		

Individual expertise		X		Collective expertise is implemented to various extent.
Collective expertise		(X)		
Existence of past events data bases		X		No clear regulation of competences. Many databases exist resulting in redundancies and gaps in documentation.
Existence of a standardized methodology for risks zoning	National	X		No clear regulations and common methods concerning hazard indication maps.
	Regional	X		
	Local	X		
Existence of protection forest management guidelines	National	X		The application was limited to certain funded projects.
	Regional	(X)		Not in all federal states.
	Local	(X)		The national and regional ones are made for a use at local level
Insurance participation			X	
Societal demand for valuing forest-based solutions		---	---	No current studies about the demand. Statements in (scientific) literature rather may show the interests of certain stakeholder groups (e.g., of scientists).
Development of participative approach		---	---	Difficult to say: in some federal states/regions there are already well-developed systems, in some regions only occasional approaches.

These info have been used for providing the following SWOT analysis (Strengths - Weaknesses - Opportunities - Threats) summarizing the current barriers and policy needs for the application of forest based natural risk mitigation concept.

	Strengths	Weaknesses
Factors internal to Austrian regulations	<p>The protective functions and effects of forests are addressed by forestry law. It is a main objective of forestry law/policy to maintain and enhance the protective effects as well as a high resistance and resilience of forests.</p> <p>The forest law distinguishes object- and site-protective functions (effects) of forests which are different in terms of risk and differs obligations of forest owners and of the public domain in relation to them.</p> <p>The regulations obligate forest owners (and encourage beneficiaries) to consider the protective functions and effects of the forest and to be active by own and not only to refer to the responsibility of the state.</p> <p>In terms of costs, owners have to contribute mainly to site and forest maintenance, since this is also their private production (economic) capital.</p> <p>Beneficiaries can actively request protective effects and contribute to protective measures, which also creates an obligation for the forest owner to implement measures.</p> <p>The regulations do not allocate the obligation to ensure a certain protective effect to forest owners as that is impossible, but to contribute to the resistance and resilience of forests.</p> <p>The regulations on protection forest mapping (forest classification, mapping of protective functions) motivate forest owners to consider the protective functions</p>	<p>The forest law does not define operational protection targets and priorities in terms of the asset components of risk. This applies to both, object- and site-protective functions. There is no legitimized and coherent process of protection target setting. Everything made be men is to be protected by forest, which is not purposeful.</p> <p>The forest law does not clearly allocate hazard types (hazard potentials) and the protective potentials of forests to the direct- (object) or to the indirect- (site) protective functions of forests.</p> <p>The forest act, the ordinances and guidelines do not allocate different priorities to the object- and to the site-protective functions (effects) of forests despite their different role in risk mitigation.</p> <p>The administration is not obliged to inform the forest owner or the beneficiaries in detail that it is a protection forest. Administration only must do so if the protective effect is endangered or on request of forest owners. This therefore rather promotes forest restoration (based on public funds) than preventive forest management.</p> <p>Forest owners may be overburdened with the task of recognizing the legal protection forest status or current damage potentials resulting from site and forest conditions. The information provided by hazard and protection forest indication maps may not be perceived or no importance may be attributed to them,</p>

	<p>and effects of the forest without a definitive prescription that can cause a negative attitude.</p> <p>The regulations of the forest act allow to provide information about protective functions and effects of forest in a flexible manner.</p> <p>Public forestry administration is mandated and obliged to map and to report protection forest with unsatisfactory conditions as well as to plan and prescribe measures. The concept is only to interfere when necessary. The regulations allow participation of forest owners (and of beneficiaries in case of "Bannwald") on district and municipality level via requirements on protection forest statement, incentives, or announcement of measures.</p> <p>Public incentives can be allocated to cover cost of silvicultural management. Incentives are not bound to a formal declaration of protection forest.</p> <p>The obligation of forest owners to announce intended cuttings and/or to apply them for approval in protection forests allows for advisory monitoring and specification of management, even without the forest owners having to have (officially) approved management plans.</p>	<p>as authorities at the same time emphasizes the legally non-binding nature of them.</p> <p>The administrative procedures for mapping protective functions of forests and of protection forest implements duplicity and leads to contradictory statements. This duplicity used to be justified by issues of scale because of the technical possibilities of mapping but are no longer appropriate today. The information given by hazard zone planning does not provide preventive silvicultural measures in protection forests but rather forest restoration.</p> <p>The hazard zone planning does not spatially cover the entire hazard and damage potential. It is to certain extent decoupled from the protective functions and the conditions of forest.</p> <p>The concept not to designate protection forests by an official notice in each case is associated with a certain degree of legal uncertainty and can lead to wait-and-see behaviour.</p> <p>The regulations concerning the survey of the conditions of protection forests by forestry authorities are very general. The surveys are done unsystematically. The survey regulation provides forest restoration rather than preventive management.</p> <p>The rules for cost allocation and about the forest owners' shares of costs are complicated and, in many situations, cannot be implemented at all, as there is no corresponding accounting and measures cannot be clearly designated to object- or site-protective effects.</p> <p>All actors (authorities, owners, beneficiaries) are not interested in a definite mapping of protection forests, because of the cumbersome rules of cost allocation and to avoid costs and responsibilities. They tend to prefer forest restoration based on public funds when problems become apparent. This is also why the Austrian "Bannwald" concept has failed.</p> <p>The direct beneficiaries have no special obligation for participation in forest classification (and management) except for "Bannwald". Especially private individuals pass on their interest to the representation by the political municipality. They only participate in planning in case of hazard occurrence. The costs of protection forest management are largely allocated to public funding. The associated administrative effort inhibits private initiatives.</p> <p>The threshold of intended felling without announcement/approval do not fully ensure the maintenance of the protective capacity of the forest. It is a flat rate with exception and its suitability varies depending on the local situation.</p> <p>Hunting and forestry matters are legally separate. There is no legally competence of the federation about hunting management.</p>
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	Opportunities	Threats
<p>Factors external to Austrian regulations</p>	<p>Increasing improvement of strategic and professional cooperation and coordination through administrative reorganization and bundling of competences is ongoing.</p> <p>The new protection forest indication map may reduce the uncertainty about the legal status as a protection forest and indicate hazard possibility in case of insufficient protective effects.</p> <p>The visualization of hazard potentials (protective functions) and protective effects may initiate more interest of forest owners and beneficiaries in protection forest management and participation.</p> <p>Bundling of competences in hazard susceptibility and forest function and effect assessment and nationwide implementation of approaches may improve the results and their acceptance in relation to differing national and regional modellings.</p> <p>Austria is a nation with a very good coverage and quality of basic geodata such as high-resolution elevation data (from LiDAR) and colored aerial images necessary to monitor protection forests effectively.</p> <p>The basic knowledge about protective functions and effects of the forest improves.</p> <p>The condition of forest is increasingly considered not only in terms of site-related silvicultural targets but also in terms of hazard-related targets.</p> <p>The nation-wide availability of high-resolution elevation and spectral data from remote sensing as well as their use in spatial modelling and mapping of hazard susceptibility and forest conditions speeds up and improves the baseline surveys considerably.</p> <p>A new competence center for protection forest management may enhance science and education about protection forest management.</p> <p>There is public awareness for protection forests and agreement on their superordinate function.</p>	<p>The distribution of competences among different administrative levels and agencies still delays decisions and implementations.</p> <p>There is interest in reduction of the extent of protection forest to avoid the duties of owners and the influence of forest authorities. This is supported by the uncertainty in the legal status resulting from the classification procedure.</p> <p>Non-coordinated mappings and spatial modelling of hazard susceptibility at national and regional level with contradictory message counteract the effects of such information tools.</p> <p>Some geodata necessary to assess protective functions effectively do not show sufficient quality. The quality of geodata in vector format is neglected in relation to the high quality of raster data from remote sensing.</p> <p>The survey of protection forest conditions on slope level is not done systematically but allocated to episodic large-area actions with rough designations or to small-area actions.</p> <p>The regulations provide to some extent wait-and-see behaviour. They rather initiate forest restoration than preventive silvicultural management.</p> <p>The cost allocation rules are partly unworkable and tend to act as a deterrent. Reinvestment of yields from logging is not controllable and not possible in most cases. In connection to time-consuming funding applications this may hamper activity of owners of small forest property. Owners should be able to create a yield from their forests in each case.</p> <p>No common standard and high uncertainty in assessment of the protective effect and the stability of protection forests may bias priority-rankings. This also provides a tendency to prefer engineering constructions.</p> <p>There are redundancies of hazard inventories and a lack of high-quality data on past events and the forest condition prior to them which are necessary to improve assessments of the protective effects of forest.</p> <p>The tendency in science and administration to assess the conditions of protection forests primarily based on characteristics that can be derived inexpensively from remote sensing sensors jeopardises the synoptic view considering factors that cannot be estimated at that way.</p> <p>Browsing by wild ungulates considerably hampers the regeneration of protection forests and thin out species such as fir and broadleaved deciduous trees in some regions. The solution power of the regulations is not sufficient. This also provides a tendency to prefer engineering constructions.</p> <p>The compensations of forest damage caused by game are small in relation to their impact on the forest health and growth and thus on forest effects. They have no control effect.</p> <p>Introduction and spread of new plant diseases due to international trade and enhanced by effects of climate change endangers native tree species and thin them out.</p>

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SWOT ANALYSIS – BARRIERS AND POLICY NEEDS FOR APPLICATION OF FOREST AS NATURE-BASED HAZARD RISK MITIGATION IN BAVARIA

[Overview \(with a focus on protection forest\) on the forestry law of Bavaria](#)

Germany is a federal republic (federation) consisting out of 16 federal states. Bavaria is one of them and like Austria divided into administrative districts and county-free cities without legal competences.

Concerning forestry regulations, it is important to consider that 58 % of the forest in Bavaria is of private ownership with a complex ownership structure. The average size of a forest property units is 2.9 ha and 71 % of the private forest owners representing 15 % of the forest area own forests with less than 2 ha. The forest property units are spatially fragmented to a high extent (LWF 2012).

The term “protective forest” was defined in the first Bavarian Forest Act in 1852 and has not changed fundamentally to this day.

In article 10 of the Bavarian forest act (BayWaldG) “Protective forest” is defined as

- in the highlands and ridges of the Alps and low mountain range,
- on sites prone to karstic or strongly are at risk of erosion,
- which is used to prevent avalanches, rockfalls, rockfalls, landslides, floods, floods, to prevent landslides or similar hazards or preserve the banks of the river. “

All these protective forests are classified according to defined criteria and registered in the official list of protective forests.

The primary aim of the Alpine Protective Forest is to protect people and infrastructure in the Alps from the natural hazards of the mountains. At the same time, it should also secure its own site/location. The protective effect extends far beyond the direct protection of objects that the forest offers settlements or traffic routes, for example from rockfalls or avalanches. Intact protected forests are of considerable importance for the preventive flood protection along the Alpine rivers. The intensively rooted forest floor can store large amounts of precipitation and prevent surface runoff. Through this indirect protective effect in the catchment area of the streams and rivers results in a delayed runoff and a noticeable reduction in the number of high water peaks – an effect that will become even more important in the future with increased heavy rainfall events in the course of climate change.

The Bavarian Forest Act contains special provisions for the protection and improvement of the condition of protected forests. For example, permission to clear-cut protected forests must be generally withheld if there are fears of disadvantages to their protective function. In principle, clear-cut in protective forest requires a permit.

In article 1 legal purpose of the Bavarian forest act (BayWaldG) is stated in paragraph (1) that

- Forests are of particular importance for the protection of climate, water, air and soil, animals and plants, for the countryside and for the natural environment.
- It is an essential part of the natural basis of life and has cultural, economic, social and health functions to fulfil.
- Forests must therefore be managed sustainably to provide these services in the long term for the benefit of the public.

In article 1 (2) specific reference (2) is given to the purpose of the law to

- maintain and, if necessary, increase the forest area.

- maintain or establish a condition of the forest that is appropriate to the site and as close to nature as possible, considering the principle of “forest comes first before game”.
- to safeguard and strengthen the protection, health and performance of the forest in the long term,
- to secure and increase the production of wood and other natural resources through sustainable forest management.
- to allow the recreation of the population in the forest and to improve the recreation possibilities,
- maintain and, where necessary, increase forest biodiversity.
- to support and promote forest owners and their self-help organisations in pursuing these objectives.
- strike a balance between the interests of the community and forest owners.

The Federal Forestry Act (BWaldG, 1975) is providing the framework for protective forest under § 12 Protective forest

- (1) Forestry may be declared a protected forest where it is necessary to implement or refrain from certain forestry measures to prevent risks, serious disadvantages, or nuisance to the public. The declaration on protective forest is particularly relevant to protection against harmful environmental effects within the meaning of the Federal Immission Control Act of 15 March 1974 (Federal Act on Environmental Protection, p. 721), erosion by water and wind, dehydration, damaging runoff of rainwater and avalanches. Section 10 of the Federal Roadway Act and Section 51 (1) sentence 1 point 3 of the Water Budget Act remain unaffected.
- (2) A declaration on protected forest as referred to in paragraph 1 shall not be required if the status of protected forest is given directly based on a federal state legislation.
- (3) A clear-cut or measures equivalent to it in effect requires the approval of the competent authority in the protected forest under the act of the federal state. The permit may be subject to conditions to the extent necessary to maintain the functions of the forest.
- (4) The details are to be determined by the federal states. They may commit the forest owner to refrain from or carry out certain measures in the protected forest by further regulations.

Protection forests are also named "protective forests" in the literature (e.g., in *Miura et al. (FAO (2021))*, although the second term may refer to forests with a (sufficient) protective effect and can be refused with it. Both terms can be found for forests with protection purposes (e.g., in *FAO (1981, 2000)*), but be aware that a "protective forest" (a forest with a protective function) does not necessarily provide a (sufficient) protective effect.

Hunting matters are legal competences of the federal states and based on the Bavarian Hunting Act (BayJG, 1978). In article 1 Legal Purpose is stated that;

- (1) The wildlife is an essential part of the native nature. It must be preserved in its diversity as part of the natural structure of action.
- (2) This act, in addition to the Federal Hunting Act¹, is intended to:
 - to maintain a species-rich and healthy wildlife stock in a balance with its natural basis of life.
 - to safeguard and improve the natural basis of life of wildlife,
 - to avoid as far as possible any interference with the proper use of wild animals in agriculture, forestry and fisheries, in particular hunting should allow the natural

rejuvenation of the species of trees appropriate to the site, essentially without protective measures.

- to balance hunting interests with other public interests, in particular those of national culture, nature conservation and landscape management.

Like Austria the Ownership in hunting is addicted to a certain extent of land property. Therefore, most forest owners do not hold the hunting right. Small properties are grouped into hunting cooperatives and hunting is leased out. Game browsing is a major cause of insufficient regeneration of protection forests.

Date and reference document of the current Bavarian forestry act:

- Bavarian Forest Act (BayWaldG) in the version of the notice of 22. July 2005 (GVBl S. 313) BayRS 7902-1-L
- Federal Forest Act (BWaldG) Date of issue: 02. 05. 1975, full quote: “Federal Forest Act of 2 May 1975 (BGBl I, p. 1037), most recently amended by Article 1 of the Act of 17 January 2017 (BGBl. 75)”

The main objectives of the Bavarian forestry policy are (BayWaldG, BWaldG):

- The aim of the Forestry Act is to preserve and sustainably manage forests and secure their functions over the entire area. The necessary balance of interests between the needs of the community and the interests of forest owners plays a key role here.
- Forest function plans may be drawn up as technical forestry planning, subject to the objectives of spatial planning and considering the principles and other requirements of spatial planning.
- Forests have protection, use and recreation functions and are important for biodiversity. Therefore, in terms of area, geographical distribution, composition and structure, it must be preserved, increased and designed in such a way as to enable it to fulfil its respective functions – in particular those of protection in mountain forests – and its importance for biodiversity in the best possible and sustainable way.
- Forestry is particularly supported under this act and under the Bavarian Agricultural Act (financial support, advisory service); This also includes the training and advanced vocational training of private forest owners at the Bavarian Forest Farmers School.
- Under the initiatives “Future forest Bavaria”, “Mountain Forest Initiative” or Forest initiative East Bavaria: With the help of regional projects, the Bavarian Forest Administration supports forest owners in adapting their forests to climate change
- Mountain forest protocol, Article 1 (1): The preservation of mountain forests as a near-natural habitat and, whenever necessary, to develop them or increase their extent and improve their stability as they provide protection against natural hazards, influence climate, are a source of renewable materials, are important habitats of plants and animals, and have recreational functions.
- Mountain forest protocol, Article 6 (1), and Soil conservation protocol, Article 13 (1): Mountain forests that have a highly protective function for their locations (note of author: "*site-protective functions of forest*") and, especially, for the inhabited areas, for the transport infrastructures, for the farmed lands, etc., (note: "*object-protective functions*") must be conserved on site with priority of the protective functions in forest management.

The fundamental principles of the Bavarian forestry policy are:

- Sustainable forest management and forestry needs people. People who are dedicated to the needs of the forest and its owners with all their energy. In Bavaria we have a whole series of people who are pulling together: In forestry associations, forest owner associations and self-help institutions, the Bavarian State Forest company (BaySF) and the Bavarian Forestry Administration.
- The Bavarian State Government and the forest owners are committed to the fact that integrated forestry on the entire area best meets the needs of society as a whole. In this way, while respecting the interests of the owners, an appropriate balance of all interests can be ensured.
- Given that every fixed cubic-meter of wood used and processed generates a tax revenue of about 60 euros, the production of wood, the forest-wood value chain, the safeguarding of jobs in rural areas and the safeguarding of a broad distribution of ownership are becoming increasingly important. Services for society, such as CO₂ capture, water purification and water storage, as well as recreational functions, are also gaining importance.
- The essential basis for securing multifunctional forestry on the entire area is supporting the forest owners in climate-friendly forest conversion and the timely care of forest stands. The Bavarian State Government has set an example in Germany with the Forest Adaptation Program 2030 to support forest owners in adapting their forests to climate change by expanding advice and training for forest owners and providing them with a reliable budget allocation for forestry promotion.
- Since it is difficult to manage small and micro-private forests efficiently by individual forest owners and at the same time the greatest need for conservation and forest adaptation measures is in these forests, there is a need for a significant increase in management support for this group of forest owners. To preserve or restore management in small and small-scaled private forests, an initiative “Structural Improvement in Private Forest” with measures to overcome management difficulties is being launched and jointly promoted.
- In implementing the 2030 Forest Adaptation Campaign, the Bavarian State Government will ensure adequate financial support, particularly in view of calamities and subject to the decisions of the budget legislator. The Bavarian State Government will provide the necessary advice on site by adequately qualified staff of the Bavarian Forestry Administration.
- Incentives are a main instrument of (protection) forest management in Bavaria, and Bavaria agrees to provide sufficient incentives (BayWaldG, Article 1 and 20), although there are some obligations of forest owner to carry out measures (e.g., BayWaldG, Article 4) and of forest owners or beneficiaries to bear costs.
- The forest owners and the Bavarian State Government are committed to the strategy adopted in 2008 for the conservation of biodiversity in Bavaria.
- In implementation of the Federal Forestry Act, the 136 forestry associations aim to improve the management of the forest areas of their members and to overcome the disadvantages of small area size and other structural deficiencies. As voluntary self-help organizations, they are therefore indispensable pillars of rural areas, organizing an appropriate and open marketing of the valuable raw material wood and supporting forest conversion and care.

Forest owner associations are also important multipliers and providers of training services for forest owners.

Summary of the regulation about protection forests in the national forestry law

Principles

- In Bavaria, a "protection forest" (protective forest) is a special legal category of forest to protect assets from damage by natural or cultural hazards. Protection forests are subject to specific planning and controlling instruments as well as to special authorizations of forest authorities in relation to their management. The regulations do not differ in objectives and principles for forests in public or private ownership.
- The Bavarian forest act distinguishes two categories of protection forests: site-protection forests and object-protection forests (BayWaldG, Art. 10). An object-protection forest can also be a site-protection forest.
- "Bannwald" (BayWaldG, Art. 11) is a special legal sub-category of object-protection forest with a direct protective effect (function). It is a forest, which due to its location and its size is irreplaceable, especially in densely-populated areas and areas with little forest, must therefore be preserved in its surface substance and which is of exceptional importance for the climate, the water balance or for air purification, is to be declared a ban forest by legal decree.

Consequences

- Forest authorities must identify (to map) forests with protective effects (functions) in the frame of the forest function mapping which is called WFP (BayWaldG, Art. 5).
- In the case of protective forests as defined in BayWaldG, Art. 10
 - in the highlands and ridges of the Alps and the low mountains,
 - on sites that tend to karst or are at high risk of erosion
 - that prevent avalanches, rockslides, rockslides, landslides, floods, floods, landslides, or similar hazards or to preserve riverbanks,
 - Protective forest is also a forest that protects neighbouring forest stands from storm damage.

a list of protective forests ("Schutzwaldverzeichnis") has been drawn up after enforcement of the BayWaldG. The protective function of a forest can be determined ex officio upon request. In addition to the forest owner, third parties who can prove a legitimate interest are also entitled to apply.
- Forest owners must manage protection forest (and Bannwald) and to ensure their stability and their renewal (BayWaldG, Art. 1). Forest owners are not obliged to ensure or achieve a certain protective effect of the protection forest. Their contribution is clearly focused on maintaining the resistance and the resilience of protection forests.
- Deforestation of (protection) forests to implement another land use ("Rodung") is not forbidden in general (BayWaldG, Art. 9), but subject to an official permit. The public interest in forest conservation must be weighted against the public benefits of the intended land use. Deforestation of Protective forest can be permitted, where there are no risks of disadvantages to the protective function of the forest.
- In principle, all silvicultural measures are to be carried out by the forest owner in protection forests as well.

- Specific incentive programmes support the forest owners of protective forest. Programmes for the restoration and maintenance of the protective function and the Mountain Forest Initiative (BWO) have been launched due the importance of protective forests.
- In general, a balance between the game density and forest must be established (BayWaldG, Art. 1). In particular in areas with protective forest the natural regeneration and afforestation have to be enabled to maintain or establish a condition of the forest that is appropriate to the site and as close to nature as possible, taking into account the principle of “forest against game”.

Areas of application

- All forests according to the forest definition by the federal and Bavarian forest act (BayWaldG, Art. 2 and 10).

Objectives

- BayWaldG, Art. 1: The forest is of particular importance for the protection of climate, water, air and soil, wildlife, and plants, for the landscape and the natural environment. It is an essential part of the natural basis of life and has cultural, economic, social and health responsibilities. The forest must therefore be managed sustainably to be able to provide these services for the benefit of the general public in the long term. The purpose of this act is to:
 - to maintain and, where necessary, to increase the forest area.
 - to maintain or establish a condition of the forest that is appropriate to the site and as close to nature as possible, considering the principle of “forest against game”.
 - to sustainably safeguard and strengthen the protective function, health, and performance of the forest.
 - to safeguard and increase the production of wood and other natural resources through sustainable forest management.
 - to allow the recreation of the population in the forest and to improve the recreation possibilities.
 - to preserve and, where necessary, increase forest biodiversity.
 - to strike a balance between the interests of the community and forest owners.

Reference documents

- Bavarian Forest Act (BayWaldG) in the version of the notice of 22. July 2005 (GVBI S. 313) BayRS 7902-1-L
- Federal Forest Act (BWaldG) Date of issue: 02. 05. 1975, full quote: “Federal Forest Act of 2 May 1975 (BGBl I, p. 1037), most recently amended by Article 1 of the Act of 17 January 2017 (BGBl. 75)”

Legal act of establishment

- A protective forest is mapped in the forest function planning and in case of its definition and classification in the Bavarian Forest Act (BayWaldG, Art. 10) determined upon request or ex-officio.

Procedure

- The identifying and classifying protection forests takes place at two procedural levels with different legal status:

- the first level mapping and classification of "forests with a protective function" can be determined in the Forest Function Planning (WFP) for Bavaria (BayWaldG Art 6))
- The second level mapping, the (stronger) protective function of a forest according to BayWaldG, Art. 10 can be determined ex officio or upon request. In addition to the forest owner, third parties who can prove a legitimate interest are also entitled to apply.
- Determination as “Protective Forest” in the Forest Function Planning (WFP):
 - WFP map showing the protective functions of forest is drawn by the Bavarian Forest Administration every 10 years for all 18 Planning regions in Bavaria.
 - The WFP consists out of the text document and a map showing the forest functions.
 - The WFP map does not allocate protective functions of forests to parcels of the real property cadastre, as the scale of these mapping (1:50.000) is not appropriate.
 - Categories for protective forest: Forests of particular importance for water protection, soil protection, avalanche protection, local pollution, noise protection and sight protection.
 - The regional forest office (AELF) responsible for the planning region, invites representatives of forestry associations, nature conservation associations, forestry companies of the Bavarian State Forests (BaySF), regional planning associations and other important special authorities such as water management, road construction, nature conservation and regional planning, as well as the neighbour AELF to a kick-off meeting to present the legal basis and the priorities of the revision in the region.
 - The concerned forestry companies of the BaySF as well as interested organisations and authorities receive the draft text on request with the opportunity to comment. Requests for changes are examined and, if necessary, accepted.
 - After finalisation of the revised WFP (Text and map) it is presented in a final meeting to the stakeholders and authorities invited to the kick-off event.
 - The WFP is finally approved by the Bavarian Ministry for Food, Agriculture and Forestry.
- Determination as “Protective Forest” according to BayWaldG, Art. 10:
 - On request of a forest owner or entitled third parties, the forest authorities (BFI) allocate the legal status as a protective forest to a forest parcels of the real property cadastre.
 - The categories are defined in the BayWaldG:
 - in the highlands and ridges of the Alps and the low mountains,
 - on sites that tend to karst or are at high risk of erosion
 - that prevent avalanches, rockslides, rockslides, landslides, floods, floods, landslides or similar hazards or to preserve riverbanks,
 - forest that protects neighbouring forest stands from storm damage
 - The protective forest is included in the cadastre of protective forest (“Schutzwaldverzeichnis”).

Updating / Evaluation

- The mapping of the protective functions of forests must be adapted to the actual state of conditions (BayWaldG, Art 6 and 10). However, the forestry act does not prescribe an

The different actors and their involvement

- Forest owners are obliged to identify their forests as a protection forest and to treat them as such according to the provisions of forestry act. To support them in this, the state provides spatial information on the protective function of forests on the level of indication maps.
- Forests are systematically and comprehensively designated as protection forests by the state of Bavaria.
- Bavarian Forest administration: Forest Function Planning, Determination as protective Forest (Art 10 BayWaldG), Mapping of Indications of protection status (“Schutzwaldhinweiskarte”), Protective forest rehabilitation planning.
- Bavarian Environmental Administration: List of protected forests, Avalanche Register, Information Service Alpine Natural Hazards (IAN)) of the Bavarian State Office for the Environment (LfU)

Summary of other regulations about risk prevention including forests items

In Bavaria, hazard zone planning is a state competence and organized by various administrative competences and procedures.

Name of the regulation

- Water protective forest
 - Water Budget Act (WHG) and Bavarian Water Act (BayWG)
 - Part B of the State Development plan (LEP)
 - Regional plan
 - Maps and Regulations for water protected areas (State office for water management)
 - Torrent register and Information Service Alpine natural hazards (IAN) - State Office for the Environment (LfU)
 - EGAR (mapping of catchment areas in alpine regions) - State Office for the Environment (LfU)
 - Spatial Information Systems of the Higher Regional Planning Authorities (RISBy)
 - Forest reports (regional nitrogen input)
 - Publications and information of the Bavarian State Institute of Forestry (LWF), State Office for the Environment (LfU) and State office for water management (WWA) about floods, Riparian forests, forest and water, nitrogen saturation in forests
- Soil and avalanche protective forest
 - Alpine Plan
 - State development plan (LEP)
 - Regional plan
 - Slope stability mapping (Bavarian Forest service) for parts of the region upper Bavaria

- Register of protective forests (Bavarian Forest service) according to Bavarian forest act Art. 10
- Protective forest rehabilitation planning (Bavarian Forest Service)
- Vegetation based site mapping (forest types)
- Geological maps
- Soil Information System (BIS) - State Office for the Environment (LfU)
- Avalanche register - State Office for the Environment (LfU)
- Information Service Alpine natural hazards (IAN) - State Office for the Environment (LfU).

Principles

- Regular inventories and mapping of forest stands and potential natural hazards (rock fall, avalanches that caused damages in the past) to enable preventive measures
- Long term planning to enable preventive measures and concepts against the impact of climate change on protective forests.
- Programmes for the involvement of concerned stakeholders and state, regional and communal offices (Mountain Forest Initiative – BWO) to follow a participatory approach
- Incentive programmes provided by the state of Bavaria to support forest owners in the management of protective forest.

Consequences for forestry actions

- Information given by the hazard mapping (rock fall, avalanches that caused damages in the past) also initiate interests in improvement or restoration of protective effects of forests and trigger (silvicultural) countermeasures.
- Regular inventories of protective forest restoration areas (every 5 years on selected areas)
- Increase of certain tree species that are most suitable to fulfil a stabilizing effect in the mountain protective forests, e.g. fir, beech, maple.
- Regular stabilizing measures in mountain forests, e.g. thinning, afforestation
- Hunting management to prevent game browsing in sensitive forest areas to protect important tree species, average duration from afforestation till initial protective functions of a forest can be 30 to 40 years.
- Limitation of forest pasture – in best-case separation of forest and pasture.

Areas of application

- All land in the Bavarian Alps that could be affected by natural hazards.
- In administrative practice, hazard zones under the forest act are primarily designated to protect dedicated residential areas/infrastructure.

Objectives

- Risk reduction by prevention (or reduction) of settlement activity in areas affected by natural hazards.
- Provision of planning and decision-making bases for risk reduction through active measures.

Reference documents

- Instruction on Protective Forest Rehabilitation Planning (as of April 2012); Bavarian Forest Service.

Other legislative texts usable for regulating protection forest management

Principles for the forest management in the high mountains at the Bavarian State Forest enterprise

Next to the Bavarian Ministry of Food, Agriculture and Forestry, which is responsible for the private forest owners, we have in Bavaria also the Bavarian State Forest enterprise, a state-owned company that manages the Bavarian state forest. They also have a handbook «Principles for the forest management in the high mountains at the Bavarian State Forestry» in which they have their principles and rules for managing forest in the Bavarian alps:

Principles

The main ten principles of forest management in the high mountains:

1. The preservation and improvement of protective functions of the mountain forest always take precedence, in doubt, all other requirements.
2. Forest management in the mountain forest is geared to the forest soils in their capacity, production power and protective effect undiminished to maintain or improve. Especially on shallow locations is the main focus on the humus.
3. Rising risks for the mountain forest due to climate change and its multiple functions is through the preservation and creation especially site-adapted encountered natural mixed mountain forests. Adverse location spruce stands are being rebuilt. Forest protection risks, in particular the risk by bark beetle, are subject to active monitoring and effective preventive and countermeasures.
4. By regular moderate thinning the wood supplies are kept at an optimal level in the mountain forest, so that the desired structural wealth and an ongoing rejuvenation can be achieved.
5. A permanent regeneration of mixed mountain forest on the largest possible area sought to safeguard the protective functions and the silvicultural ones to achieve goals.
6. The intensity of forest management and silvicultural approach is directed in the mountain forest in particular dimensions of the site conditions.
7. The concerns of nature conservation are integrated in the management of the mountain forest. For nature conservation valuable forests are separately for rare species, such as the capercaillie, becomes the silvicultural approach customized.
8. The special significance of the mountain forest as a recreational area is used in silvicultural planning and the targeted forest management.
9. The use of forestry technology and infrastructures in the mountain forest takes care of nature and aligns itself the site conditions and the silvicultural requirements out.

10. The hunting of red deer, chamois and roe deer in the mountain forest ensures that natural regeneration is more site-appropriate mixed old stocks and planting or seed of main tree species essentially without protective measures is possible.

Consequences for FORESTRY actions

- Proper forest management in accordance with the Forest act and with special regard to the requirements of the protected forest in the mountains (see the 10 principles above)

Barriers and policy needs for application of ecosystem-based natural risk mitigation concept/sustainable management

Like in Austria:

The Bavarian regulations concerning hazard risk mitigation and forest management do not considerably hamper the implementation of nature-based solutions for risk mitigation such as afforestation and appropriate forest management.

The regulations aim to encourage forest owners and beneficiaries to act on their own responsibility as well as to find consensual solutions through information and consultation, instead of creating defensive attitudes due to prescription of strict and rigid forest management requirements.

However, the regulations and procedures to a certain extend also create a tendency towards wait-and-see behaviour and favour forest restoration rather than a preventive silvicultural engagement.

Preventive silvicultural action is the main driver for the success of risk mitigation by forest. Forest policy should promote preventive action even more strongly in relation to restorations, as well as the conditions for the success, such as appropriate stocks of games and more effective compensations of damages caused by game.

Another point that often leads to the implementation of grey measures instead of or only with green measures is the high uncertainty in the assessment of the protective effect and development of forest. Such assessments are more difficult and time-consuming than those of engineered constructions.

They need special considerations on the spatial and temporal resistance and resilience of the forest such as the probability of damage by windthrow and the rate of spread and growth of regeneration.

These assessments are even more difficult in the face of too much forest damage caused by game and the developments possible due to environmental change and introduction of pests.

It is therefore logical and justified that planners provide for combined grey-and-green measures and a (minimum) protection by engineered constructions.

The following table synthesis the main input data about the current situation in Austria.

		Yes	No	Comments
Existence of a regulation for risks prevention	National		X	Only forest fire alarm plans
	Regional	X		
Existence of a protection forest classification	National	X		Forest function planning, Forest act
	Regional	X		
Comprehensive mapping of natural hazards	National		X	Rock fall, avalanche damages
	Regional	X		
	Local	X		
Comprehensive mapping of natural risks	National		X	
	Regional		X	
	Local		X	
	National	X		
	Regional	X		

Comprehensive mapping of protection forest ecosystem service	Local	X		The current mapping (modelling) status is based on the forest function planning - no ESS mapping.
Financing of this ecosystem service	EU		X	Some examples for PES exist, e.g. drinking water provision Incentive programmes for protective forest restoration and management
	National		X	
	Regional		X	
	Local	X		
Natural risk prevention document	National		X	The available information is limited to land designated for construction or riparian forests.
	Regional		X	
	Local		X	
Natural risk prevention document integrating this ecosystem service	National		X	
	Regional		X	
	Local		X	
Individual expertise		X		Collective expertise is implemented to various extent. Mountain Forest Initiative to discuss issues with other stakeholders (NGO, GO)
Collective expertise		X		
Existence of past events data bases		X		Avalanche damage and rock fall damage
Existence of a standardized methodology for risks zoning	National		X	No clear regulations and common methods concerning hazard indication maps.
	Regional		X	
	Local		X	
Existence of protection forest management guidelines	National		X	Exists for the federal state Bavaria
	Regional	X		Bavaria
	Local	X		Forest management planning
Insurance participation			X	
Societal demand for valuing forest-based solutions		X		Stakeholder groups participate in round tables (Mountain Forest Initiative - BWO).
Development of participative approach		X		Stakeholder groups participate in round tables (Mountain Forest Initiative - BWO).
Others item?			X	
		Yes	No	Comments
Existence of a regulation for risks prevention	National	X		National mappings about hazard probabilities are implemented via regional land use allocation.
	Regional	X		
Existence of a protection forest classification	National	X		The national classification applies to all federal states.
	Regional		X	
Comprehensive mapping of natural hazards	National	X		Hazard zone mappings are available at national level.
	Regional	X		
	Local	X		
Comprehensive mapping of natural risks	National		X	The availability of hazard indication maps varies dependent on region and hazard type. Hazard zone mapping is done nationwide on municipality level but is limited to construction land except for floods.
	Regional		X	
	Local		X	
Comprehensive mapping of protection forest ecosystem service	National	X		The current mapping (modelling) status is incomplete only about deep-seated landslides and torrents.
	Regional	X		
	Local	X		
Financing of this ecosystem service	EU	X		Co-financing by various funds and contributions on each level (e.g., EARDF, national disaster fund, forest fund).
	National	X		
	Regional	X		
	Local	X		
Natural risk prevention document	National	X		The information is limited to land designated for construction.
	Regional	X		
	Local	X		

Natural risk prevention document integrating this ecosystem service	National	X		Formally, hazard zonings consider protective effects of forests. However, there is no common methodology.
	Regional	X		
	Local	X		
Individual expertise		X		Collective expertise is implemented to various extent.
Collective expertise		(X)		
Existence of past events data bases		X		No clear regulation of competences. Many databases exist resulting in redundancies and gaps in documentation.
Existence of a standardized methodology for risks zoning	National	X		No clear regulations and common methods concerning hazard indication maps.
	Regional	X		
	Local	X		
Existence of protection forest management guidelines	National	X		The application was limited to certain funded projects.
	Regional	(X)		Not in all federal states.
	Local	(X)		The national and regional ones are made for a use at local level
Insurance participation			X	
Societal demand for valuing forest-based solutions		---	---	No current studies about the demand. Statements in (scientific) literature rather may show the interests of certain stakeholder groups (e.g., of scientists).
Development of participative approach		---	---	Difficult to say: in some federal states/regions there are already well-developed systems, in some regions only occasional approaches.

These info have been used for providing the following SWOT analysis (Strengths - Weaknesses - Opportunities - Threats) summarizing the current barriers and policy needs for the application of forest based natural risk mitigation concept.

	Strengths	Weaknesses
Factors internal to Bavarian regulations	<p>The protective functions and effects of forests are addressed by forestry act. It is a main objective of forestry act/policy to maintain and enhance the protective effects as well as resistance and resilience of forests.</p> <p>The forest act does not define operational protection targets and priorities in terms of the asset components of risk. – Means that all protective forests are important.</p> <p>The regulations obligate forest owners (and encourage beneficiaries) to consider the protective functions and effects of the forest and to be active by own and not only to refer to the responsibility of the state.</p> <p>In terms of costs, owners must contribute mainly to site and forest maintenance since this is also their private production (economic) capital.</p> <p>The regulations do not allocate the obligation to ensure a certain protective effect to forest owners as that is impossible, but to contribute to the resistance and resilience of forests.</p> <p>The regulations on protection forest mapping (forest classification, mapping of protective functions) motivate forest owners to consider the protective functions and effects of the forest, without a definitive prescription that can cause a negative attitude.</p> <p>Public forestry administration is obliged to map and to report protective forest with unsatisfactory conditions as well as to plan and prescribe measures. The concept is only to interfere when necessary.</p> <p>Forest restoration will be paid by public funds when problems become apparent.</p> <p>Public incentives can be allocated to cover cost of silvicultural management. Incentives are partly bound to a formal declaration of protective forest.</p> <p>Forest owners receive advisory service by the forest service but remains responsible.</p> <p>Browsing inventories of regeneration serve as a basis for game density and is a key stone for the hunting management.</p>	<p>There is no legitimized and coherent process of protection target setting.</p> <p>Everything made be men is to be protected by forest, which might not be purposeful.</p> <p>Administration only informs the forest owner if the protective effect is endangered or on request of forest owners.</p> <p>This therefore rather promotes forest restoration (based on public funds) than preventive forest management.</p> <p>Forest owners may be overburdened with the task of recognizing the legal protective forest status or current damage potentials resulting from site and forest conditions.</p> <p>The information provided by hazard and protection forest indication maps may not be perceived or no importance may be attributed to them by private forest owners, as authorities at the same time emphasizes the legally non-binding nature of them.</p> <p>The information given by rock fall planning maps does not provide preventive silvicultural measures in protection forests but rather forest restoration.</p> <p>The survey regulation provides forest restoration rather than preventive management.</p> <p>Forest owners are not always interested in a definite mapping of protective forests, because of the cumbersome rules of cost allocation and to avoid costs and responsibilities.</p> <p>The direct beneficiaries have no special obligations for contribution to protective forest restoration.</p> <p>There are only incentives for certain measures but not for the forest area.</p> <p>The costs of protective forest management are largely allocated to public funding.</p> <p>Hunting and forestry matters are legally separate.</p>
	Opportunities	Threats
Factors external to Bavarian regulations	<p>Increasing improvement of strategic and professional cooperation and coordination between administrative organization and bundling of competences is ongoing.</p> <p>The visualization of hazard potentials (protective functions) and protective effects may initiate more interest of forest owners and beneficiaries in protection forest management and participation.</p> <p>In Bavaria a high share of protective forests belongs to the state, especially in upper Bavaria. This guarantees the maintenance of the forest functions.</p> <p>Bavaria (and Germany) is a state with a very good coverage and quality of basic</p>	<p>In private forest might be an interest in reduction of the extent of protective forest to avoid the duties of owners and the influence of forest authorities.</p> <p>In many cases an economic viable management of mountain/protective forest is not possible for private and communal forest owners.</p> <p>High uncertainty in assessment of the protective effect and the stability of protection forests done by different administrations may</p>

	<p>geodata such as high-resolution elevation data (from LiDAR) and coloured aerial images necessary to monitor protection forests effectively.</p> <p>The survey of protection forest conditions on slope level is done systematically. The basic knowledge about protective functions and effects of the forest improves. The condition of forest is increasingly considered not only in terms of silvicultural targets but also in terms of hazard-related targets.</p> <p>The state-wide availability of high-resolution elevation and spectral data from remote sensing as well as their use in spatial modelling and mapping of hazard susceptibility and forest conditions speeds up and improves the baseline surveys. But there is a lack of information of regeneration which cannot be closed by remote sensing.</p> <p>There is public and political awareness for protective forests and agreement on their important function.</p> <p>The existing forest protective rehabilitation offices/teams in the region of the Bavarian alps contribute towards a sustainable management of protective forest.</p> <p>The importance of the protective forest is reflected in the programmes of the Bavarian government, in particular programmes to adapt the mountain forests to climate change.</p>	<p>bias priority-rankings. This also provides a tendency to prefer engineering constructions. There is a lack of high-quality data on past events and the forest condition prior to them which are necessary to improve assessments of the protective effects of forest.</p> <p>The tendency in science and administration to assess the conditions of protection forests primarily based on characteristics that can be derived inexpensively from remote sensing sensors jeopardises the synoptic view considering factors that cannot be estimated at that way.</p> <p>Browsing by wild ungulates considerably hampers the regeneration of protection forests and thin out species such as fir and broadleaved deciduous trees in some regions. The respective regulations are in principle sufficient but there is a lack of implementation.</p> <p>The compensations (payments) of forest damage caused by game are small in relation to their impact on the forest health and growth and thus on forest effects. They have no control effect.</p> <p>Introduction and spread of new pests and diseases due to international trade and enhanced by effects of climate change endangers native tree species and thin them out.</p>
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SWOT ANALYSIS – BARRIERS AND POLICY NEEDS FOR APPLICATION OF FOREST AS NATURE-BASED HAZARD RISK MITIGATION IN FRANCE

[Overview \(with a focus on protection forest\) on the forestry law of France](#)

The forest, a national asset in France

The conservation of forests is a very old concern of the French State. The forestry administration was created by Philip the Fair in 1291, and the first Forestry Code was created in 1346 by Philip of Valois. It has been revised several times throughout history, but the basis of the Forestry Code of 1827 has been retained, establishing a restriction of use rights in forests, with the aim of restoring the forest area and the sustainable production of stands.

In the field of natural risk prevention, the first effective and specific law was that of March 1860 on the "reforestation of mountains", followed by the law on the "grassing of mountains" in 1864. The law of 4 April 1882 on the restoration and conservation of mountainous areas completed and modified these laws. The task that the 1882 law entrusted to the foresters was no longer to extend the wooded area but to "restore mountain land by correcting torrents, regulating pastures and planting eroded watersheds". In the new areas, the State must acquire the land by amicable purchase or by expropriation with prior compensation. This law remains the basis for the current legislation on the restoration and conservation of mountain land. It has served as a model for many foreign legislation. The law has redefined state intervention in form and spirit: The restoration of mountain land is an action of public interest that concerns all owners. The State expresses national solidarity by acquiring certain land in order to act as an owner within the framework of an overall policy aimed at the near and distant safety of people and property.

It was the "Chauveau Law" of 28 April 1922 that established the status of protection forests for the first time in France. It concerns forests "whose conservation is recognized as necessary to maintain land on mountains and slopes, to defend against avalanches, erosion and the invasion of water and sand" (art. 2 of the law and articles L.411 and R.411 of the Forestry Code). Two priority objectives led to the classification as a "protection forest":

- to increase the possibilities of controlling forest management outside the forest areas managed by the State, and
- to control clearing and abusive felling in certain forest areas. The law allows the Administration to subject forests to binding regulations regardless of who owns them.

This «special forestry regime» aims to guarantee the sustainability of the wooded area by imposing the establishment of exploitation regulations or a request for prior authorisation for each cut.

The idea of the 1922 law was taken up again in the law of 10 July 1976 on the protection of nature by extending its scope. Since then, two categories of forests have been added: "areas where the maintenance of forests is necessary either for ecological reasons or for the well-being of the population" and peri-urban forests (Article L. 411-1 of the Forestry Code)

Since 2001, the first articles of the Forestry Code present the basic principles of the new French forestry policy:

- Forests, woods and trees are placed under the protection of the Nation, without prejudice to collective and individual titles, rights and uses.
- The following are recognized as being of general interest:
 - The protection and development of woods and forests as well as reforestation within the framework of sustainable management;
 - The conservation of genetic resources and forest biodiversity;

- The protection of water resources and air quality by the forest within the framework of sustainable management;
- The protection and fixation of soils by forests, particularly in mountain areas
- The fixation of carbon dioxide by woods and forests and the storage of carbon in woods and forests, wood and products made from wood, thus contributing to the fight against climate change.

The fundamental principles of the French forestry policy are:

1. The development and protection of forests are recognized as being of general interest within the framework of the objectives defined in Article L. 111-2 of the Rural Code. The forestry policy defined by the State, which ensures its coherence at national level, takes into account the economic, environmental and social functions of forests and participates in regional planning with a view to sustainable development. Its purpose is to ensure the sustainable management of forests and their natural resources, to strengthen the competitiveness of the forestry production, harvesting and value-adding sector for wood and other forestry products, in particular through job qualifications, and to satisfy social demands relating to forests. It affirms the exemplary and innovative nature of public forest management.
2. Forestry policy shall contribute in particular to rural development, to the fight against the greenhouse effect and to the prevention of natural risks.
3. It shall take into consideration the respective specificities of forests under the forestry regime, in particular state and communal forests, and private forests. It actively develops conditions favorable to the technical and economic grouping of forest owners and encourages inter-professional organization. It also encourages the development of the environmental and social functions of the forest by ensuring, where appropriate, the contractual compensation of the resulting constraints and additional costs.

Summary of the regulation about protection forests in the national forestry law

Principles

- Forests classified as protection forests have a special legal and administrative status. This guarantees the conservation of woodlands and forest areas regardless of whether they are publicly or privately owned.

Consequences

- It prohibits not only any clearing leading to the disappearance of the forest but also any modification of the appearance of the woodland contrary to the objective of the classification. The protection afforded by the protection forest classification therefore appears to be far superior to other types of protection which allow certain derogations:
 - State-owned forest land, or land subject to the forestry regime, limits transactions and the use of land but does not prevent the construction of infrastructure after a Declaration of Public Utility (DUP),
 - the classification in the Local Urban Plan (PLU) as a "classified wooded area" ensures the conservation of woodlands in even largely urbanized areas, but can be removed in the context of a revision and transformed into a "space to be urbanized",

- the forestry code makes it possible to oppose clearing under certain conditions, but clearing can be authorized by prefectural order if these conditions are not met,
- the prescriptions of the Regional Master Plans make it possible to determine the destination of the various parts of the territory but they can be modified during the course of their application on the occasion of a revision.

Areas of application

- All woodlands and forests, regardless of their owners (public authorities or private individuals).

Objectives

- To ensure the conservation of forests recognized as necessary for the maintenance of land on mountains and slopes, for defense against avalanches, erosion and the invasion of water and sand;
- Protect woodlands and forests, regardless of ownership, on the outskirts of large urban areas, as well as in areas where their preservation is necessary, either for ecological reasons or for the well-being of the population.

Reference documents

- Articles L.141-1 to L.144-1 (16 articles) and R.411-1 to R413-4 (39 articles) of the Forestry Code
- Law n° 2001-602 of 9 July 2001 on the orientation of the forest :
 - Title I: Developing a sustainable and functional management policy (Articles 1 to 3)
 - Title I: Developing a sustainable and multifunctional management policy (Articles 4 to 6)
 - Title II: Promoting the development and competitiveness of the forest-based sector (Articles 7 to 26)
 - Title III: Integrating forestry policy into territorial management (Articles 27 to 35)
 - Title IV: Strengthening the protection of forest or natural ecosystems (Articles 36 to 46)

Legal act of establishment

- Council of State Decree.

Procedure

- The procedure for classifying a protection forest as being in the public interest is relatively cumbersome in terms of the restrictions placed on property rights and forest management methods.
- It is the responsibility of the departmental prefect to define the list of woodlands and forests that may be classified as protection forests. When a woodland or forest extends over several departments, the minister responsible for forests entrusts one of the prefects with the task of centralizing the procedure.
- The prefect has the Departmental Director of Territories, in conjunction with the competent services, the ONF (Forest National Office), the CRPF (Regional Centre for Forest Property) and the mayors of the municipalities concerned, draw up a report recognizing the woodlands or forests to be classified, as well as a plan of the area, taking

into account existing town planning documents and regulations affecting land use (in particular, the charters making up regional nature parks)

- The reconnaissance report states and specifies the circumstances that make the classification necessary for one or more of the reasons mentioned in Article L. 411-1 of the Forest Code. This document is accompanied by a parcel table drawn up according to the cadastral documents.
- The prefect submits the classification project to an enquiry in the manner provided for in Articles R. 11-4 to R. 11-14 of the Code of expropriation in the public interest, subject to specific provisions for protection forests. Article R. 411-5 defines the content of the explanatory note containing all the management measures that will be applicable and must be respected by the owner(s). Notice of the opening of the enquiry is sent by registered letter to each of the owners concerned.
- Once the owner has been notified of the intention to classify a forest as a protection forest, no changes may be made to the state of the land, no felling may be carried out and no right of use may be created, for a period of fifteen months from the date of notification, unless special authorization is given by the administrative authority (art. L. 411-2 c. for.).
- At the end of the enquiry, the investigating commissioner's report is sent to each of the mayors of the municipalities concerned. The mayor refers the matter to the municipal council, which must give its opinion within six weeks. After this period, the opinion of the municipal council is deemed to be favorable.
- The departmental commission for nature, landscapes and sites also gives its opinion on the classification project in the light of the investigation report and the opinions of the municipal councils. The latter must give its opinion within two months of the referral, failing which it is disregarded.
- The classification decision is taken by decree in the Council of State.
- The decision is posted for fifteen days in each of the town halls of the municipalities concerned. A delimitation plan is deposited in the town hall. The completion of these formalities is certified by the mayor, who sends a bulletin of posting and deposit to the prefect for this purpose.
- The classification decision and the delimitation plan of the protection forest are included in the approved Local Urban Plan (PLU) or in the urban planning document in lieu thereof and are therefore binding on the purchaser in the event of the alienation of the land(s) concerned.

Updating / Evaluation

- The texts do not require regular revision of the status of protection forests. On the other hand, any modification of the classification must be done by decree in the Council of State.

Legal effects

- The protection forests are subject to a special forestry regime, derogating from common law, which concerns management, the exercise of grazing and usage rights, the regime of exploitation, excavations, extraction of materials as well as the search for and exploitation of water resources by the public authorities or their delegates.

- The major legal effect of classification as a protection forest consists in the prohibition of any change of use or any type of land occupation likely to compromise the conservation or protection of the woodlands (art. L. 412-2 forestry code).
- The plans for the prevention of foreseeable natural risks, drawn up in accordance with Articles L. 562-1 et seq. of the Environmental Code, the purpose of which is to prevent flooding, land movements or avalanches, may provide for rules for forest management and exploitation in the risk areas they determine. These approved rules are required:
 - To forest owners and operators;
 - To the authorities responsible for approving forest management documents drawn up pursuant to this code, as well as to those responsible for examining the cutting authorizations provided for in this code or the prior declaration provided for in the Town Planning Code.
- Forest owners and holders of a right of use benefit from the guarantees provided by Article L. 141-7 of the forestry code and the texts adopted for its application.
- No clearing, excavation, extraction of materials, public or private infrastructure works, or any raising of the ground or deposit may be carried out in a protection forest, except for works aimed at creating equipment essential to the development and protection of the forest and provided that these works do not fundamentally modify the forestry use of the land. The owner may proceed with these works subject to the application of laws and regulations and on condition that the DDT, notified two months in advance by registered letter, has not objected. The owner's declaration shall indicate the nature and extent of the work and shall be accompanied by a site plan.
- Grazing is only tolerated in the parts declared as defensible.
- Research and exploitation work by public authorities or their delegates on water resources intended for human consumption that have been the subject of a DUP (declaration of public utility) and that do not fundamentally modify the forestry destination of the land may be carried out under the conditions provided for by the special forestry regime (art. L. 412-2-1 of the Forestry Code; provision introduced by the DTR law of 24 February 2005).
- Public use of any protection forest may be regulated or even prohibited if it is necessary to ensure the continued existence of the woodland. These measures are taken by order of the prefect, on the proposal of the Departmental Director of Territories (DDT) for forests not covered by the forestry regime and of the ONF for forests covered by this regime.
- In all protection forests, the circulation and parking of motorized vehicles or caravans, as well as camping, are forbidden outside the roads and areas provided for this purpose and signposted to the public. Exceptions to this rule are motorized vehicles used for the management, exploitation and defense of the forest against fire (art. R. 412-16 Forestry code).
- In classified forests, violations by the owner of the rules of use imposed on him are considered as forestry offences committed in the forest of others and punished as such.
- For protection forests not covered by the forestry regime (i.e., generally speaking, private forests), the owner has the option of having the prefect approve operating regulations

resulting either from constant use or from regular management. These regulations are issued on the advice of the DDT and are valid for between 10 and 20 years.

- Felling not provided for in the operating regulations (or in the absence of such regulations) is subject to special authorization by the Prefect issued on the proposal of the DDT.
- When a felling has been carried out in disregard of the obligations thus laid down or when the work prescribed in the approved regulations or the special authorization has not been carried out within the time limits laid down, the Prefect may, on the proposal of the DDT, order by decree the restoration of the area to woodland status or the carrying out of such work.
- Any compensation that may be claimed by owners and users in the event that the classification of their woodland as a protection forest results in a reduction in income shall be settled, taking into account any increase in value resulting from the work carried out and the measures taken by the State, either by direct agreement with the administration or, failing that, by decision of the administrative court
- The State may also acquire woods so classified. The owner may, however, demand this acquisition if he can prove that the classification as a protection forest deprives him of half of the normal income he derives from his forest. The acquisition is made either by mutual agreement or by expropriation.

Figures

- The protection forest classification represents about 123,000 hectares in France.
- 45% of the classifications concern private forests; 33% state forests and 22% communal forests.
- 43% of classifications concern peri-urban forests; 42% mountain forests; 10% dune or coastal forests and 5% alluvial forests.
- The list of forest areas classified as protection forest is available here : <https://www.data.gouv.fr/fr/datasets/liste-des-massifs-forestiers-classes-en-forets-de-protection-30379254/>

The different actors and their involvement

- The initiative for classification as a protection forest belongs to the State, under the responsibility of the prefect.
- However, many entities are involved in the classification of a protection forest: DDT, ONF, CRPF, local authorities.

Summary of other regulations about risk prevention including forests items

While the Forestry Code allows for the legal classification of protection forests, other codes offer alternatives to protect and/or regulate the management of woodland areas. They can also be used for protecting forest with a protective effect against natural risks but not classified as protection forest by the forestry code.

Environmental CODE: Natural Risk Prevention Plans

The most important of these codes is the Environmental Code. Indeed, it is the code of direct application of the law for the prevention of natural risks. A particular book of this code is entirely devoted to this subject.

Reference documents

- Book V - Prevention of pollution, risks and nuisances (Articles L511-1 to L597-46). It contains 86 main articles.
- Guide méthodologique, Plans de prévention des risques naturels (PPR), Risques de mouvements de terrain. La documentation française, 1999- ISBN 2-11-004354-7

Legal effects

- It regulates the Natural Risk Prevention Plans (PPRn in French). The PPRn created by the law of 2 February 1995 is today one of the essential instruments of the State's action in terms of natural risk prevention, in order to reduce the vulnerability of people and property.
- The PPRn is defined by articles L562-1 et seq. of the Environment Code and must be carried out within 3 years of the date of prescription. The PPRn can be modified or revised. It is a public utility easement associated with penal sanctions in case of non-compliance with its prescriptions and with consequences in terms of compensation for natural disasters.
- A PPRn contains a note presenting the context and the procedure that was carried out, one or more regulatory zoning maps delimiting the regulated zones, and a regulation corresponding to this zoning. It is approved by a prefectural decree, at the end of a procedure which includes the prescription decree on the commune(s) concerned, the carrying out of studies to identify past phenomena, to qualify the hazard and to define the stakes of the territory, in consultation with the communities concerned, and finally a compulsory consultation phase (municipal councils and public enquiry).
- The PPRn allows all risks to be taken into account, including floods, but also earthquakes, land movements, forest fires, avalanches, etc. The PPRN is the responsibility of the State to control construction in areas exposed to one or more risks, but also in those not directly exposed, but where development could aggravate them. The scope of the regulations covers new projects and existing properties. The PPRN can also define and make mandatory general prevention, protection and safeguard measures.

General framework of the French Natural Risk Prevention Plan (PPRn)

The purpose of the PPRn is to delimit the areas directly exposed to risks, and other areas not directly exposed but where certain land uses or occupations could aggravate risks or cause new ones.

It primarily regulates new installation projects:

- With a wide scope of application since it can intervene on any type of construction, work, development or agricultural, forestry, craft, commercial or industrial operation, for their implementation, use or exploitation.
- The means of action range from prescriptions of all kinds (town planning, construction, operating rules, etc.) to prohibition.

Sites that have been subject to active or passive protection or stabilization measures should be given special attention.

Areas protected by built structures (dykes, berm, protective nets, etc.) will always be considered as still subject to the phenomena studied, i.e. vulnerable. As a rule, the effectiveness of even the best-designed and constructed structures cannot be fully guaranteed in the long term, especially if a project owner does not ensure their maintenance and management.

The delimitation of the hazard must be established without taking into account these structures.

The regulatory zoning will be established in accordance with the following two principles:

- The presence of structures must not lead to an increase in vulnerability but rather aim to reduce the exposure of existing issues;
- Construction can only be considered in very exceptional cases if the maintenance of the protection works is guaranteed by a reliable technical solution and determined financial resources.

In order to meet the needs of housing, employment and services in a given sector (cf. article L. 110-1 of the town planning code), adjustments to the principle of non-building in high risk areas behind protection works can be envisaged with the local players, in particular the local elected representatives, if the 3 following conditions are simultaneously met:

- There are no other possible urbanization sites in neighboring areas not subject to risks on a territory that may be inter-municipal.
- The works have a guaranteed level of safety and reliability with long-term management.
- The development of these sectors, particularly in terms of social balance or employment, provides sufficiently important benefits to compensate for the costs of the works and their maintenance.

The maintenance of forest cover can be recommended as a preventive, protective and safeguard measure.

The forest cover plays a recognized role in relation to five types of phenomenon:

- Torrential erosion: the forest spreads the flood wave for a given rainfall. This results in less erosion and therefore less solid transport.
- Meteoric surface erosion: the forest cover can reduce this phenomenon by 90% on soft soils such as the black marl of the Southern Alps.
- Falling rocks and boulders of less than a cubic meter in volume: experience shows that on a scree slope of about 30° and for an average forest with a basal area of 30m²/ha, almost all the boulders are stopped before 200 meters of travel.
- Mudflows are reduced in energy by dissipation of the flow in the forest.
- Shallow and fast-moving landslides.
- Finally, the forest does not have a recognized role with regard to collapses.

These observations made, the expert must define the hazard in the absence of the forest. On the other hand, the estimation of the risk and the prescriptions of the regulation must take into account the presence of the forest.

The management of protection works, if they are of collective interest, is the responsibility of the communes within the limits of their resources:

- On the one hand, in application of the police powers held by the mayors with regard to prevention and rescue in the context of accidents and natural risks (general code of local authorities and code of communes).
- On the other hand, because of their general interest or emergency nature from the point of view of agriculture, forestry or water management (rural code).

Town planning code: wooded areas to be preserved, protected or created

In France, pursuant to Article L. 113-1 of the Town Planning Code, local town planning schemes (PLU) may classify woods, forests, parks, isolated trees, hedges and aligned plantations as wooded areas to be preserved, protected or created (EBC).

Reference documents

- Book I - General planning and urban development rules (Articles L110-1 to L160-5)

Legal effects

- Land use plans may classify as wooded areas, woods, forests, parks to be preserved, protected or created, whether or not they are subject to the forestry regime, enclosed or not, adjoining or not adjoining dwellings.
- The classification prohibits any change of use or any type of land use likely to compromise the conservation, protection or creation of woodlands.
- Notwithstanding all provisions to the contrary, it entails the automatic rejection of the request for authorization to clear land as provided for in Article 157 of the Forestry Code.
- In woodlands, forests or parks located on the territory of municipalities where the establishment of a land use plan has been prescribed but not yet been made public, as well as in any classified wooded area, cutting and felling of trees are subject to prior authorization.
- An area can therefore be classified as a classified wooded area (EBC) even before it is wooded and thus encourage forestry plantations.
- Classification as an EBC prohibits changes of use or land use that could compromise the conservation, protection or creation of woodland.
- Classification as an EBC entails the automatic rejection of requests for authorization to clear land as provided for in the Forestry Code, and entails the creation of a system of administrative declaration prior to any cutting and felling of trees.
- Other protections for wooded areas or natural areas exist in French urban planning law. These include the implementation of certain protection regimes provided for in Article L. 151-23 of the Urban Planning Code:
 - The regulations may identify and locate landscape features and delimit sites and sectors to be protected for ecological reasons, in particular for the preservation, maintenance or restoration of ecological continuity and define, where appropriate, prescriptions to ensure their preservation. In the case of wooded areas, these prescriptions are those provided for in Articles L. 113-2 and L. 421-4. It may locate, in urban areas, cultivated land and undeveloped areas necessary to maintain ecological continuity to be protected and unbuildable regardless of the facilities that may serve them.
 - The classification as landscape areas to be protected concerns sites and sectors to be protected for ecological reasons, in particular for the preservation, maintenance or restoration of ecological continuity and to define, if necessary, the prescriptions to ensure their preservation.
 - It is less restrictive than the EBC and allows for landscape maintenance,

- It can locate, in urban areas, cultivated land and undeveloped areas necessary for the maintenance of ecological continuities to be protected and not built on, regardless of the facilities that may serve them.

Other legislative texts usable for regulating protection forest management

The following table summarize the main status of protection that can be used for regulating management in woodlands and forests in France.

INDIRECT PROTECTIONS	TEXTES DE REFERENCE	DESCRIPTION	OBJECTIVES	LEGAL EFFECT
Classified sites	Article 341-1 to 22 of the Environmental Code Article 341-1 to 22 of the Environmental Code Article 341-1 to 22 of the Environmental Code	Remarkable natural area (historical, artistic, scientific, legendary or picturesque)	Conservation as is (maintenance, restoration, enhancement, protection...)	Prior authorization for all works likely to modify the state or appearance of the protected area, including tree felling
Historical monuments	Heritage Code, Book IV, title II	Forests or parts of forests may be included in the protection perimeters of historical monuments.	Protection of monuments and their perimeter (field of visibility)	Prior authorization for any intervention in the 500-metre protection perimeter (Article L621-30-1 of the Heritage Code)
Remarkable heritage sites	Article L.631-1 to 5 of the Heritage Code	Towns, villages or districts of public interest (history, architecture, archaeology, art or landscape) Rural areas and landscapes linked to these sites may be classified.	Protection, conservation and enhancement of cultural heritage.	Public utility easement affecting land use. Establishment of a management plan for the site.
Sites of geological interest, natural habitats, animal or plant species and their habitats	Article L411-1 of the Environmental Code	Sites of scientific interest, or essential to the ecosystem or to be preserved as natural heritage. geology, natural habitats, non-domesticated animal or non-cultivated plant species and their habitats.	Protection of species and their habitats, natural habitats or geological sites.	Prohibitions: - Destruction or alteration of natural habitats or habitats of protected species - Destruction or alteration of sites of geological interest

Barriers and policy needs for application of ecosystem-based natural risk mitigation concept/sustainable management

One of the five objectives of the French forestry legislation is the conservation of forests for the stabilization of mountainous terrain and protection against natural hazards. All these objectives should ensure that forests are managed appropriately and accordingly to their priority ecosystem service. Nevertheless, many mountain forests playing an important role of protection against hazards are not currently taken into account by the legislation.

This is due to the limited use of the protection forest classification, either through the Mountain Land Restoration policy (only 130,000 ha of forests within the perimeters acquired by the State for this purpose), or within the framework of the Chauveau law (only 50,000 ha of classified forests for all France). The limited use of this classification in the northern and southern Alps does not allow the benefits of this legislation to be realized. In addition, the current financial and technical problems facing the management of protective forests call into question the existing legislative framework and its effectiveness in maintaining the protective effect of the forest.

The following table synthesis the main input data about the current situation in France.

		Yes	No	Comments
Existence of a regulation for risks prevention	National	X		National regulation to be applied at all the other administrative levels
	Regional		X	
Existence of a protection forest classification	National	X		National regulation to be applied at all the other administrative levels
	Regional		X	
Comprehensive mapping of natural hazards	National	x		Hazards atlas are available at national level. The level of info depends on the hazard.
	Regional	x		
	Local	x		
Comprehensive mapping of natural risks	National		X	In France the mapping is done at the municipality level, except for flooding and forest fire
	Regional	X		
	Local	X		
Comprehensive mapping of protection forest ecosystem service	National	X		Currently only available for rockfalls
	Regional	x		
	Local	x		
Financing of this ecosystem service	EU			On a national level only for classified forest On a regional level: depending on the regional administration and the mobilization of ERDF funds.
	National	x		
	Regional	x		
	Local		x	
Natural risk prevention document	National		x	For flooding and forest fire regional documents are provided The common scale is the one of the municipality due to the French regulation.
	Regional	x		
	Local	x		
Natural risk prevention document integrating this ecosystem service	National		x	The expert must define the hazard in the absence of the forest. On the other hand, the estimation of the risk and the prescriptions of the regulation can take into account the presence of the forest.
	Regional		x	
	Local		x	
Individual expertise		x		The expert has to be a Swiss Army Knife
Collective expertise			x	
Existence of past events data bases		x		Depending on the phenomena. Their access is not easy.
Existence of a standardized methodology for risks zoning	National	x		The French regulation define how to provide PPRn at municipal level
	Regional		x	
	Local	x		
Existence of protection forest management guidelines	National	x		Too basic very general. None updating of the PPRn methodological guide of 1999!
	Regional	x		Only for the Alps and the Pyrenees
	Local	x		The regional ones are made for a use at local level
Insurance participation			x	Not yet but a will from the some assurance companies
Societal demand for valuing forest-based solutions		x		Strong demand
Development of participative approach			x	A strong willingness for

These info have been used for providing the following SWOT analysis (Strengths - Weaknesses - Opportunities - Threats) summarizing the current barriers and policy needs for the application of forest based natural risk mitigation concept.

	Strengths	Weaknesses
Factors internal to French regulations	<p>Clear identification of this forest ecosystem service (FES) in the forestry code</p> <p>Different possibilities of regulatory classifications in other codes</p> <p>Public forests subject to the forestry regime must carry out a natural risk assessment in their management document. The same applies to private forests of 10 ha or more in a single block.</p> <p>The various codes set out management requirements: they act as a safeguard.</p> <p>The mayor is responsible for "policing natural hazards". It's the main actor at the local scale.</p> <p>The most important one is the regulation of felling and clear-cutting which are subject to administrative authorization.</p> <p>Regulatory management constraints may require the use of the natural hazard chapters of the Northern Alps and Southern Alps French mountain forestry guides.</p> <p>Financial compensation can be allocated for covering management costs.</p> <p>Development of the new concepts of risk basin, integrated territorial management of natural risks.</p> <p>Clear distribution of the legal responsibilities</p> <p>Clear distribution of legal and judicial responsibilities</p>	<p>The main natural hazard prevention document (PPRn) does not directly recognize the protective effect of forests in the hazard-mapping step. This effect can be integrated under conditions in the regulatory risk zoning</p> <p>The State protects citizens 'in spite of themselves'. Lack of governance to define "accepted risk".</p> <p>The funding allocated to the PPRn does not allow the use of real collective expertise: the expert must be a Swiss Army knife.</p> <p>Lack of comprehensive mapping of the ecosystem service of protection/economic valuation of this ecosystem service</p> <p>The protection forest classification is not promoted.</p> <p>The protection forest classification process is too complicated and long.</p> <p>The financial compensations are only possible for classified forests.</p> <p>The different codes offer too many different possibilities.</p> <p>The State's doctrine does not allow for a hazard zoning that takes into account the effect of forest ecosystems. The doctrine of the State is not written!</p> <p>There is a potential antinomy and misunderstanding between the State's doctrine for the realization of risk prevention plans and the consideration of the protective effect of forests.</p> <p>The financial means allocated to the PPRn are undersized</p> <p>Lack of feedbacks on real integrated management at the scale of the risk basin.</p> <p>Lack of a real policy for framing and supervising modelling analysis work.</p> <p>Administrative structuring and centralization that can generate a gap between local reality and administrative guidelines.</p> <p>No place for real participative/governance approaches according to the current distribution of legal and judicial responsibilities</p>
	Opportunities	Threats
Factors external to French regulations	<p>Societal demand in France for the valorization of nature-based solution</p> <p>Societal demand for better governance of risk management</p> <p>The French forest recovery plan in association with the climate plan to face the impacts of climate changes</p> <p>European directives that can change the State's doctrine</p> <p>Exchanges on good practices and success stories</p> <p>The willingness of insurance companies to value nature-based solutions where possible</p> <p>Regional planning and development plans: drawn up by local and regional authorities to specify their rules, strategy and objectives in the main areas of regional planning.</p>	<p>Severe fragmentation of private forest ownership.</p> <p>The financing of forest ecosystem services is too dependent on fluctuations in the timber market.</p> <p>Lack of public understanding of the need to manage and maintain forests</p> <p>The idea that forest cover can disappear overnight (windstorm, forest fire...) and thus its protective effects</p> <p>The French administrative layer cake which dilutes decision making</p> <p>Lack of appropriate training for practitioners and administrative officers</p> <p>Lack of economic valuation of this ecosystem service</p> <p>Lack of real collective expertise associating experts/scientists/decision makers.</p>

	<p>The European Regional Development Fund for financing protection forests management The opportunity offered by the Common Agricultural Policy EUSALP and Alpine Convention strategies/directives Improvement democratization and of modelling tools and knowledge about the interaction between forest stands and natural hazards Open science Participative science for improving knowledge bases</p>	<p>An expert as usually one field of expertise and can't be an efficient Swiss Army Knife. Lack of high resolution data about or for forests descriptions :i.e Lidar data for all France Lack of past events data bases adapted the improvement of numerical simulation models Lack of natural hazards propagation models integrating forest effects Lack of an adapted communication and dissemination strategies about the efficiency and limits of forest based solutions Lack of methodology for developing participative approach and governance Changes in European funds allocations Forests are currently not part of the EU CAP for France</p>
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SWOT ANALYSIS – BARRIERS AND POLICY NEEDS FOR APPLICATION OF FOREST AS NATURE-BASED HAZARD RISK MITIGATION IN ITALY

[Overview \(with a focus on protection forest\) on the forestry law of Italy](#)

Forest matter, in Italian legislation, is simultaneously subject to the competence of different administrations: Ministry of Agricultural, Food and Forestry Policies (MiPAAF), Regions and Autonomous Provinces for the aspects concerning land management, production and transformation of goods; Ministry of Ecological Transition (MiTE), with core expertise in environment and biodiversity protection and conservation (“Environmental Code” - Legislative Decree n. 152 of 2006); Ministry of Culture (MiC) for the matter concerning landscape conservation (“Urbani Code” - Legislative Decree n. 42 of 2004).

In compliance with the Constitutional order, the MiPAAF, unlike the MiTE and the MiC, only plays a role of direction and coordination, as the primary competence in the field of land and forest management are up to the Regions and the Autonomous Provinces (Delegated decrees No. 11 of 1972 and No. 616 of 1977, Constitutional Law n. 3 of 2001).

Until the first national law about forestry policy and coordination (“Orientation and Modernization of Forestry sector” - Legislative Decree 18 May 2001, n. 227) Regions have regulated and managed based on the so-called “Prescrizioni di Massima e Polizia Forestale - PMPF” (meaning “general prescriptions and forestry police”) provided by the Royal Decree 30 December 1923, n. 3267.

The reference law concerning the forest sector at national scale was therefore from 1923! Entitled “Reorganization and legislation reform on forests and mountain lands”, the so-called “Serpieri law” (Royal Decree 30 December 1923, n. 3267) obviously became over time outdated, as it borned in a really different socio-economic scenery. Despite this, it is still in force with legal value at national level, as we’ll see later.

Finally, after a long process (about 6 years, starting in 2012) of public and institutional consultation, the “Consolidated Law in the field of forests and forestry chains – TUFF” (Legislative Decree 3rd April 2018, n.34) become the new national Framework Law on the subject of silviculture and forestry chains, repealing the Legislative Decree n. 227 of 2001.

So, as we said, the competence to legislate in details on forest issues has always been delegated to Regions and Autonomous Provinces, which have therefore produced specific regional and provincial laws on forestry matters. Also, the “Forest Plan” is widely used in Italy. This is a local-scale application tool of the National Forestry Framework Program and is provided by the Art. 3 of the Legislative Decree 227/2001. Based on this law, Regions and Autonomous Provinces must provide themselves with “...lines of protection, conservation, enhancement and development of the forest sector in their territory through drafting and revision of their own forest plans”.

Everything said has led Italy to have a very heterogeneous, detailed, complex and diversified Forest legal frame, as partially shown in the next table.

PIEDMONT	Regional law 4/2009 «Management and economic promotion of forests» R.C.P.D. 8R/2011, R.C.P.D. 2R/2017, R.L. n.45/1989, Forest plans
AOSTA VALLEY (Special Statute Region)	Ministerial Decree 28 aprile 1930 «General prescriptions and forestry police» (R.D.L. 30/12/1923, n. 3267) R.L. 11/1998, General Forestry Plan 1987
LIGURIA	Regional law 4/1999 «Rules concerning forests and hydrogeological structure» R.R. 1/1999, Forest plans
LOMBARDY	Regional law 31/2008 «Consolidated text of regional laws about agriculture, forests, fisheries and rural development» R.R. 5/2007, R.C.D. 53262/1990, R.C.D. X/901/2013, R.C.D. 7728/2008 e R.C.D. 6089/2016, Forest plans
TRENTINO ALTO ADIGE (Autonomous Provinces of Trento & Bolzano)	AP Trento (PAT) Provincial law 11/2007 «Government of forest and mountain territory, watercourses and protected areas» P.P.D. 8/2011, P.L. 5/2008, P.L. 9/2011, Forest and Mountain Plans AP Bolzano (PAB) Provincial law 21/1996 «Forest legal frame» P.L. 28/1981, P.L. 291/2000, P.C.P.D. 56/2007, Provincial Forest Plans
VENETO	Regional Council Provision 1066/1980 and Regional Council Deliberation 51/2003 «General prescriptions and forestry police» R.L. 52/1978, R.L. 8/1985, Forest plans
FRIULI VENEZIA GIULIA (Special Statute Region)	Regional law 9/2007 «Rules on forest resources» R.L. 10/2010, R.C.P.D. 274/2012, R.C.P.D. 73/2016

Italian forest legal frame updated to 2018 (only ALPINE SPACE Regions & Autonomous Provinces): for each Region/Province the basic law (in bold) together with ancillary laws are indicated. RL = regional law; PL = provincial law; RCD = regional council deliberation; RCPD = regional council president decree; RR = regional regulation; PPD = province president decree; PCPD: province council president decree

“TUFF” in details (birth, principles, objectives)

The “Consolidated Law in the field of forests and forestry chains”, repealing the Legislative Decree n. 227/2001, not only gives unitary guidelines and regulatory coordination for Regions, Autonomous Provinces and competent Ministries, but also updates the national provisions according to the deep economic, social and, above all, regulatory and institutional changes that the forest context has suffered at national, European and Global level for the past 17 years.

In fact, from 2001 until today Italy has transposed European directives, implemented numerous regulations and signed many international commitments on climate, environment and biodiversity, landscape, economy and bio-economy, energy, local socio-economic development, cooperation, commerce and culture. Themes that increasingly involve directly the forest sector and an "active" role of Sustainable Forest Management.

Furthermore, the institutional system of roles and competences became even more complex, the insurmountable limits set by the State to protect the environment and the landscape have grown and the territorial socio-economic needs and the forestry sector needs have changed, with an increasingly growing demand for “green” goods and environmental services.

TUFF therefore laid the legal foundations to coordinate the 21 (one for each Region/Autonomous Province) regional forest regulations by defining a unique national framework. In a growingly global context the Italian forest heritage (the richest in Europe for biological, ecological and bio-cultural

diversity) assumes, together with its production (wood and non-wood products), environmental and recreational tourism chains a strategic and transversal role in the policies of our country.

Process that led to the TUFF

Starting from 2012 it has been undertaken by MiPAAF a difficult participatory process (“Wood supply chain table”) among all institutional subjects, public and private, related to forest matter and its supply chains to identify useful proposals to update and adapt the national legislation in force on the matter.

The first articulated proposal, presented in 2015 from the “Wood supply chain table”, formed the starting basis for the TUFF, meeting immediately some limits imposed by the Delegated Law no. 154/2016 (with which the Parliament delegated the Government to legislate this matter). So, the proposal was integrated with the instances of a public debate promoted by MiPAAF with the National Forest Forum (2016-2017), although not required by the delegated law.

The process for approving the decree has first of all provided a revision of the text by MiPAAF together with ministries of Simplification, Economy and Finance, Environment and Cultural heritage. The new amended proposal in the light of the consultation was therefore acquired by the Unified Conference (State-Regions-Local Autonomies) and provided for the opinion of the Council of State and the competent Parliamentary Committees, undergoing further changes as well as technical and political compromises up to the signature of the President of the Republic on 3 April 2018

Principles and Purposes

In the first two articles, the TUFF describes its fundamentals and objectives:

- Art. 1
Principles
 1. The Republic recognizes the national forest heritage as part of the national natural capital and as an asset of significant public interest to be protected and enhanced for the stability and well-being of present and future generations.
 2. In compliance with the competences enshrined in the Constitution, with the powers attributed by the respective special statutes and the relative implementation regulations to the regions with special statutes and the autonomous provinces of Trento and Bolzano and in implementation of the principle of loyal collaboration, this decree contains the fundamental norms aimed at guaranteeing the unitary direction and national coordination in the field of forests and forestry chains, in compliance with the undertaken commitments at international and European level.
 3. State and Regions, within the scope of their respective competences, promote sustainable forest management through the fundamental contribution of silviculture, with particular reference to the provisions of the resolutions of the Ministerial Conferences for the protection of forests in Europe of Forest Europe, in order to recognize the social and cultural role of forests, to protect and enhance the forest heritage, the territory and the national landscape, strengthening the forestry chains and guaranteeing, over time, the multifunctionality and the diversity of forest resources, environmental protection, the fight and adaptation to climate change, the socio-economic development of the mountain and inland areas of the country.
 4. State, Regions and entities delegated by these, promote in a coordinated way the protection, the management and the active enhancement of the forest heritage also in order to guarantee the balanced development of its supply chains, in compliance with the undertaken commitments at European and international level.

5. Any regulatory intervention affecting this single text or on the matters governed by it must be implemented by explicit modification, integration, derogation or suspension of the specific provisions contained therein pursuant to article 13-bis of the law of 23 August 1988, n. 400.
- Art. 2
Purposes
1. The provisions of this decree are aimed at:
 - a) guarantee the protection of forests in their extension, distribution, geographical compartment, ecological and bio-cultural diversity;
 - b) promote the active and rational management of the national forest heritage in order to guarantee environmental, economic and socio-cultural functions;
 - c) promote and protect forest economy, mountain economy and the respective production chains as well as the development of agrosilvopastoral activities through the protection and rational use of the land and the productive recovery of fragmented land properties and abandoned terrains, supporting the development of associated management forms of the forest property, public and private;
 - d) protect the forest by promoting prevention actions against natural and anthropogenic risks, hydrogeological defense, defense against fires and biotic and abiotic adversities, adaptation to climate change, recovery of degraded or damaged areas, carbon sequestration and provision of other ecosystem services generated by sustainable forest management;
 - e) promote the programming and planning of forest management interventions in compliance with the role of Regions and local autonomies;
 - f) favor the elaboration of general principles, guidelines and national guidelines for the protection and enhancement of the forest heritage and the rural landscape, also with reference to the intervention tools provided for by the common agricultural policy;
 - g) encourage the active participation of the Italian forestry sector in the definition, implementation and development of the European forestry strategy and related policies;
 - h) guarantee and promote knowledge and monitoring of the national forest heritage and its ecosystems, also in order to support the exercise of policy functions in the forestry and environmental sector;
 - i) promoting and coordinating, in the sector, the training and the updating of operators and the companies qualification;
 - j) promote research, experimentation and technical dissemination activities in the forestry sector;
 - k) promoting forestry culture and environmental education.
 2. The Ministry of Agricultural, Food and Forestry Policies, in agreement with the Unified Conference and in coordination, to the extent of their respective competence, with the Ministry of the Environment and the Protection of the Territory and the Sea and with the Ministry of Goods and cultural activities and tourism, adopts the documents of direction and ensures the coordination of the activities needed to guarantee the unitary prosecution and on all the national territory of the purposes in paragraph 1.

3. State and Regions promote agreements, institutional understandings and projects of interregional and international significance to pursue the purposes referred to in paragraph 1.
4. The implementation of the purposes referred to in this article is dealt within the human, financial and instrumental resources available under current legislation and without new or greater charges for public finance.

A prerequisite for the new law is the compliance of the environmental and landscape protection regime of our forest heritage, among the most stringent in Europe, limiting the use of the forest as in any case subordinate to the public interest, thanks also to a long-standing tradition that on this principle built the whole forestry regulations. Based on these assumptions, silviculture, as the science of ancient forest cultivation practices, deals today in Italy with a very detailed and complex legal framework, always attentive to ecological and territorial needs, but which often does not adequately support local socio-economic needs.

In this context the TUFF, without providing new or increased burdens on public finance, carries out a simplification of the entire normative corpus relating to the sole competences of the MiPAAF, by guaranteeing conservation, protection and sustainable management of the Italian woods. The purposes of the TUFF remain, in fact, those of the Legislative Decree n. 227/2001: "improving the protective and productive potential of forest resources and the development of local supply chains connected, enhancing the fundamental role of silviculture and placing the public interest as a limit to private interest", within the constraints of heritage protection and conservation, guaranteed and defined in other regulatory bodies.

Legislative Decree n. 227/2001, repealed by the TUFF, in many ways innovative and precursor, became increasingly inadequate to pursue international commitments and the European strategic objectives. Above all, within the mandatory limits set by the State to protect environment and landscape, it did not seem to satisfy the complex institutional system of roles and competences nor the growing socio-economic needs of the territory and of the "forest sector", as an internationally recognized strategic tool for local development, environment conservation policies and fight against climate change.

By updating the provisions already in force since 2001, it is reaffirmed in the TUFF that the environmental and conservation of biodiversity and landscape aspects (Environmental Code and Urbani Code) are of central competence and can't be modified in a direction and coordination law like the TUFF, which in fact incorporates them for a sustainable development of the forestry sector and the supply chains.

Consistent with the national strategy of Framework Program for the Forestry Sector (PQSF 2008), the Forest Strategy and the European Union legislation, the National Strategies for sustainable development and biodiversity conservation and the undertaken commitments at European and international level, the TUFF resumes the concept of "active management" of forests, as a synonym for Sustainable Forest Management (art. 3), with the meaning of assuming social and territorial responsibility in contrast to abandonment and lack of interest of public and/or private owners.

This concept, which caused the heaviest criticism the TUFF, was already introduced by the PQFS in 2008 and it has been widely implemented by regional legislation and programming. This concept follows the strategies promoted by the "Forest Europe" process, which inspires all the more managerial parts of the TUFF (art. 6, 7, 8, 9, 10) in which minimum common national directions are outlined for a matter, as said, of exclusive competence of Regions and Autonomous Provinces.

With the TUFF forest management once again becomes an expression of a conscious cultural choice (conservative or productive) which finds its implementation in the Forest Planning, as the only legal instrument able to urge the owners, public or private, to guarantee the public interest, placed always as a limit to the private one.

TUFF reorganized the concept of “forest programming” (art. 6), formalizing the duty to define the National Forest Strategy and the forest management programming and planning, highlighting the concept of public and private responsibility in forest protection, conservation and enhancement.

More attention than in the Legislative Decree n. 227/2001 is given to the professional skills of those who work in the woods, to the certification of products and processes, to the enhancement of wood and non-wood products and to the ecosystem services generated by forest-environmental commitments and sustainable management. The text recognizes the international criteria of “Sustainable Forest Management” as the operational tool to ensure safety, protection, conservation and development of the forests and the forest chains, as well as the effective tool to guarantee territorial protection and governance, hydrogeological structure and fire prevention; sustainable management criteria are also the perfect tool to deal with the modern economic, productive and employment needs of mountain areas and with specific international and European duties assumed by the Italian Government in the field of the environment, bioeconomy, circular economy and the fight against climate change.

TUFF provides minimum and common definitions (art. 3) to be applied throughout the national territory standardizing the legal and technical language. In particular, it defines what is forest and what it is not and what the “forest assimilated” areas are (art. 4 and 5), and forestry management activities (silviculture, naturalistic engineering, forest roads, etc.). In compliance with regional competences applies more specific and limiting provisions on transformation of the forest and on replacement and concession on the management of forest properties; defines the state of “abandonment of forest areas” in case it is necessary to protect the public interest and safety.

TUFF also provides administrative simplification tools to unify properties to promote: planning and management over larger areas; the recovery of interesting agro-pastoral areas and abandoned villages invaded by pioneer vegetation; the “silently owned land” management (surfaces whose ownership is no longer traceable to a legal entity); the realization and the adjustment of forest roads to serve for agrosilvopastoral activities and fire prevention and extinction.

TUFF promotes forestry operators’ competence and professionalism through the institution of regional companies lists/registers and professional training.

TUFF recognizes ecosystem services generated by sustainable forest management.

TUFF attributes a prominent value to forest statistics, research and experimentation in forestry matter and, and for the first time in a national law, it recognizes to “oldgrowth forests” the qualification and the same protection previously reserved only to monumental trees.

Ministerial Implementing Decrees

For the delicate and complex nature of the matter, and for the multiple roles and interests it represents, the TUFF provides for an effective and uniform implementation of the law throughout the national territory, the drafting of Ministerial Implementing Decrees. These aim specifically to the definition of minimum national criteria about priority issues and will be agreed between competent Ministries and Regions, to make forest policy concrete, innovative and unitary.

The first, and most important, provides for the definition of a new National Forestry Strategy (art. 6), then we have the definition of minimum criteria for the training of forestry operators (art. 10, already drafted in 2020), for forest plans of territorial address (art. 6, already drafted in 2020), for the parameters to access the regional registers of forestry companies (art. 10, already drafted in 2020), for the recognition of the “state of abandonment” of former agricultural areas worthy of protection (art. 7). Furthermore, the TUFF provides the definition of the forest management guidelines for areas deemed worthy of protection under the art. 136 of the Legislative Decree. n. 42 of 2004 (art. 7), of the criteria concerning purposes, types and characteristics of forest roads (art. 9, already drafted in 2020) and of the criteria for the exemption from compensatory interventions in the event of forest transformation (art. 8, already drafted in 2020).

The process is still running and over time, other implementing decrees were approved and are waiting to be drafted and implemented by regional regulation.

Focus on protection forest

Nowadays there is no specific national law on protection forests in Italy; consequently, aspects that concern them are included in the evolution of the more general forest legislation we mentioned above.

In this direction assumes particular importance the 1923 Serpieri Law, where forests are recognized as having a key role in water regulation. For this reason, even today, most of the national forests are subject to the “hydrogeological constraint”, which strictly limits and regulates the economic management.

The Serpieri Law identifies (art. 1) in the hydrogeological constraint the instrument to protect “lands of any nature and destination which, due to forms of use conflicting with the one described in art. 7, 8 and 9, can with public damage suffer denudation, lose stability or disturb the water regime”. Consequently, almost every hill and mountain forests are subject to hydrogeological constraint in Italy, even today! art. 7 states that it is not possible to convert lands described in art. 1 into other types of cultivation without prior authorization.

The Serpieri Law also identifies another type of constraint “for other purposes”, art. 17: "Forests which for their special location defend lands or buildings from the fall of avalanches, from the rolling of stones, from the fury of the winds and those useful for local sanitary conditions may, at the request of the Provinces, Municipalities or other interested bodies, be subject to limitations in their use". Therefore, the Serpieri law already contains the identification of the protective role of the forest and the possibility of constraining its use for other purposes, including the rockfalls!

This second type of constraint, however, did not ever find concrete application, also because, as explained, these forests were already included in lands subject to hydrogeological constraint.

In the following articles the TUFF, finally gives an explicit reference to direct protection forests:

ART. 3 (Definizioni) comma 2

r) **bosco di protezione diretta**: superficie boscata che per la propria speciale ubicazione svolge una funzione di protezione diretta di persone, beni e infrastrutture da pericoli naturali quali valanghe, caduta massi, scivolamenti superficiali, lave torrentizie e altro, impedendo l'evento o mitigandone l'effetto (...)

Definition of direct protection forest: wooded area that, thanks to its special location, plays a role of direct protection of people, property and infrastructure from natural hazards such as avalanches, rockfalls, surface slips, debris flows and others, preventing the event or mitigating the effect (...).

ART. 8 (Trasformazione del bosco e opere compensative) comma 7

I boschi aventi funzione di protezione diretta di abitati, di beni e infrastrutture strategiche, individuati e riconosciuti dalle regioni e dalle province autonome, non possono essere trasformati e non può essere mutata la destinazione d'uso del suolo (...)

Forests having the function of direct protection of inhabitants, strategic assets and infrastructures, identified and recognized by Regions and Autonomous Provinces, cannot be transformed and the land use cannot be changed (...).

National types of protection forests

A common classification in Italy is not available since each Region has its own (in some cases more than one!), but in order to get a simple classification we can generalize them in three recurrent types:

- Generic protection forests: forests protecting soil by erosion mainly from weathering
- Indirect protection forests: forests protecting themselves from natural disturbances (avalanches, rockfalls...)

- Direct protection forests: forests protecting human infrastructures from natural disturbances (avalanches, rockfalls...)

Management methods and practices

Common methods and practices in Italy are not defined for protection forests, nor common methods are available for the Italian Alps and also the Regional legal frame is often lacking.

...some shared main concepts for protection forests interventions:

- every silvicultural activity must be aimed at improving or maintaining the stability of the population (Resistance and Resilience).
- in broadleaves forest it is better to prefer high forest to coppice for their stability and larger diameters, even though in particular situations it would be good to have agamic regeneration and the “cage effect”, typical of the coppice.
- coniferous forests are generally at higher altitudes where site constraints become preponderant and must always be considered.
- in most cases protection forests are located in high slope and low fertility, so minimization of intervention costs trying to reach the minimum level of protection required
- promote natural regeneration allowing light to reach the ground to help the seedlings and little plants to develop
- felled trees left in place: tall cut stumps, oblique logs and brushwood on the ground to increase roughness (taking care of wildfires fuels)

natural dead wood: good for roughness and regeneration (germination and protection)

Slovenian forestry has a long tradition that reflects in three fundamental principles of forest treatment and management, which are:

- sustainability (the sustained preservation of forests and the sustained use of their goods and non-material functions),
- close-to-nature management (exploitation of forests to such a degree and in such a way as to ensure the preservation of all their natural constituents), and
- multi-purpose management (a balanced significance of ecological, economic, and social roles of forests).

Responsibilities and consequences

The only common national reference is found in the Serpieri law (art. 26):

“Those who cut or damage plants or cause other damages in forest subject to hydrogeological constraint (...) will be punished with a pecuniary penalty from double to quadruple of the value of the felled trees or of the caused damage (...)”.

Furthermore, TUFF reorganized the concept of “forest programming” (art. 6), formalizing the duty to define the National Forest Strategy and the forest management programming and planning, highlighting the concept of public and private responsibility in forest protection, conservation and enhancement. Therefore, it is plausible that Regions will regulate in that direction, also providing measures and/or sanctions for negligent owners.

Example of good practices

- VV. AA. (2006) «Selvicoltura nelle foreste di protezione: esperienze e indirizzi gestionali in Piemonte e Valle d'Aosta» (Forestry in protection forests: experiences and management addresses in Piedmont and Aosta Valley) and subsequent additions and updates.

<http://www.regione.piemonte.it/foreste/it/pubblicazioni/89pubblicazioni/manualistica/744-selvicoltura-nelle-foreste-di-protezione.html>

- Aosta Valley protection forests map.

http://www.regione.vda.it/risorsenaturali/risorsenaturali/Foresteprot/default_i.aspx

- Trento Province protection forests from rockfall map.

<https://forestefauna.provincia.tn.it/Documenti/Carta-dei-boschi-di-protezione-da-caduta-massi>

- Trento Province probable location of avalanches map (CLPV).

http://www.territorio.provincia.tn.it/portal/server.pt/community/gcv/268/consultazione_carta_delle_valanghe_e_gestione_campagne_di_sopralluogo/19032

Summary of the regulation about protection forests in the Italian forestry law

Principles

- No specific national law on protection forests in Italy, nor unified and binding forest protection classification, TUFF although, finally gives an explicit reference to direct protection forests and the fact they can't be transformed or changed their land use.
- The Serpieri law identifies forests' role as primary in water regulation.

Consequences

- The only common national reference is found in the Serpieri law (art. 26): "Those who cut or damage plants or cause other damages in forest subject to hydrogeological constraint (...) will be punished with a pecuniary penalty from double to quadruple of the value of the felled trees or of the caused damage (...)".
- Furthermore, TUFF highlights the concept of public and private responsibility in forest protection, conservation and enhancement. Therefore, it is plausible that Regions will regulate in that direction, also providing measures and/or sanctions for negligent owners.

Areas of application

- Almost every forest, private or public, in mountain and hill areas are nowadays subjected to hydrogeological constraint.
- In the future, the indications of the TUFF on this matter, implemented by regional regulations, will be applied to all direct protection forests based on the new definition.

Objectives

- ensure the persistent presence of forests with the role of direct "protection of people, property and infrastructure from natural hazards such as avalanches, rockfalls, surface slips, debris flows and others, preventing the event or mitigating the effect."

Reference documents

- Royal Decree n. 3267/1923 - art. 1-26
- Legislative Decree n.34/2018 - art. 3-8

Legal act of establishment

- Royal Decree 30 December 1923, n. 3267 "Serpieri law"

- Legislative Decree 3 April 2018, n.34 “TUFF”

Procedure

- not yet defined

Summary of other regulations about risk prevention including forests items

The only real national law dealing with natural hazard/risk is the “framework law on forest fires” n. 353/2000, which defines prohibitions, prescriptions and sanctions on forest areas and pastures which have been crossed by fire, providing for the possibility for municipalities to place, as appropriate, constraints of different nature on the concerned areas.

The definition of forest fire, although it has already been identified by jurisprudence on several occasions, is established in precise and objective terms by this law, where the wildfire is defined as (art. 2) "A fire with a susceptibility to spread over wooded, bushy or arborated areas, including any human structures and infrastructures placed within the mentioned areas, or on cultivated or uncultivated land and pastures adjacent to these areas".

In particular, the law fixes three different time constraints that regulate the use of burnt areas: a fifteen-year constraint (for land use change), a ten-year constraint (for the construction of buildings) and a further five-year constraint (for public reforestation and environmental engineering activities). Obviously with the possibility of exceptions according to security and territorial needs.

To apply these constraints, the law establishes that the Municipalities provide for the census, through a special land registry (“catasto incendi”), of all the already covered by fire stands, using survey campaigns carried out by the “Carabinieri - Command Unit for Forestry, Environmental and Agri-food Protection” (former National Forestry Corps).

Interesting for us is art. 4 in which the law describes the prediction and prevention of forest fire risk. In paragraph 2 is stated “The prevention activity consists in implementing actions aimed at reducing the causes and potential triggering of fire as well as interventions aimed at mitigating the consequent damage. With this purpose, all the control and surveillance systems (...) and in general the technologies for monitoring the territory are used (...) as well as cultivation interventions, suitable for improving the vegetation structure of natural and forest environments” and also in paragraph 3 “Regions plan prediction and prevention activities (...). They may also, as part of the prevention activity, grant contributions to private owners of forested areas, for forestry cleaning and maintenance operations, primarily aimed at the prevention of forest fires.”

Name of the regulation

- “Framework law on forest wildfires” Law n. 353/2000

Principles

- State and Regions coordinated prevision, prevention and active fight in the matter of wildfires.

Areas of application

- Only about wildfires hazard, already crossed by fire forested areas and potential risk ones.

Objectives

- Protecting and preservation of the forest national heritage
- Registering and mapping of past and recent wildfires, fire prevention and active fight.
- About forest in particular the objective is preventing wildfires by “cultivation interventions, suitable for improving the vegetation structure of natural and forest environments”

References

- Law n. 353/2000 - art. 1 - 2 - 4 (purposes, principles, definition, prevision, prevenzione)

Barriers and policy needs for application of ecosystem-based natural risk mitigation concept/sustainable management

The following table synthesis the main input data about the current situation in Italy.

		Yes	No	Comments
Existence of a regulation for risks prevention	National		(X)	<p>“Civil Protection” integrated system: multilevel department established with framework law n. 225/1992 and reformed with Legislative Decree n. 1/2018 “Civil Protection Code”. A little more focused on emergency intervention and restoration than on prevention, which is however an important part of its skills.</p> <p>Framework law on forest fires n. 353/2000 Civil Protection plans and wildfires prevention plans both delegated at regional level</p>
	Regional	X		
Existence of a protection forest classification	National		X	some regions only
	Regional	(X)		
Comprehensive mapping of natural hazards	National	(X)		merge of regional maps but without harmonization
	Regional	X		
	Local	X		
Comprehensive mapping of natural risks	National	(X)		merge of regional maps but without harmonization
	Regional	X		
	Local	X		
Comprehensive mapping of protection forest ecosystem service	National		X	
	Regional		X	
	Local		X	
Financing of this ecosystem service	EU	X		most funds from ERDF (PSR in Italy)
	National		X	
	Regional		X	
	Local		X	
Natural risk prevention document	National		X	uneven and different in each Regions
	Regional	(X)		
	Local	(X)		
Natural risk prevention document integrating this ecosystem service	National		X	
	Regional		X	
	Local		X	
Individual expertise		X		multidisciplinary committee are often activated when they are useful, not permanent
Collective expertise			(X)	
Existence of past events databases		X		depending on which hazard, high difference of standard in the
Existence of a standardized methodology for risks zoning	National		X	depending again by Regions and the hazard
	Regional	X		
	Local	X		
Existence of protection forest management guidelines	National		X	depending on Regions and Regions peculiarity
	Regional	X		
	Local		X	
Insurance participation			X	not yet, but the frequency of catastrophic events makes this increasingly interesting for insurance agencies
Societal demand for valuing forest-based solutions		X		
Development of participative approach			(X)	some experimental experiences

These info have to be used for providing a SWOT analysis (Strengths - Weaknesses - Opportunities - Threats) summarizing the current barriers and policy needs for the application of forest based natural risk mitigation concept.

	Strengths	Weaknesses
Factors internal to Italian regulations	<p>Clear definition of "direct protection forest" and prohibition to change land use destination (TUFF)</p> <p>Definition of National Forest Strategy (TUFF) promotion of an active and sustainable management of forests (for this ecosystem service too)</p> <p>Promotion of forestry training for foresters and related administrators regarding protective forests</p> <p>Introduction of the concept of "silent ownership" which allows Regions to actively manage the land in the absence of the owner if unavailable</p> <p>Introduction of the right to merge forest properties, both public and private, for large-scale management despite land properties fragmentation</p> <p>Hydrogeological constraint on almost all mountain and hill forests, fundamental for water regulation and natural risk mitigation</p> <p>Clear cut (> 0,5 ha) is always forbidden unless there are specific exceptions for public safety or with special authorizations</p>	<p>Each Region should define which are the "direct protection forests" and map them in a binding way (not available for every Region yet)</p> <p>There is no cartography for protection forests nor standardized technical-operational definition, binding and legally valid</p> <p>Not yet legislative uniformity, overlapping of national competences (natura2000, hydrogeological constraint...) and regional ones training only recently introduced therefore the effects are not yet seen</p> <p>There is a lack of funds for prevention and ordinary management in protection forests, action is taken only after the events for restoration</p> <p>not yet remuneration for ecosystem services (including protection)</p> <p>Hydrogeological constraint which together with landscape and environmental constraints are very stringent and often do not allow an active and economically sustainable management (especially in mountain areas).</p>
	Opportunities	Threats
Factors external to Italian regulations	<p>Enormous and widespread safety problems, increasingly frequent and destructive events also due to climate change: pressure for the creation of a national framework law on natural risks prevention</p> <p>Multidisciplinary approach for natural risks management</p> <p>New software tools useful for standardized individuation and definition of protection forests</p> <p>Improve and enhance communication at a popular scientific and informative level</p>	<p>Unlike many other states, Italy a territorially very diverse country, e.g. studies on protective forests have tended to focus on the Alps, which makes it difficult to create homogeneous laws and regulations on the subject</p> <p>Consequences of widespread destructive events (Vaia 2018, big wildfires in 2017 ...) eg. Bark beetle attacking damaged plants, lack of multidisciplinary</p> <p>Lack of coverage of uniform remote sensing data (eg LiDAR) on the whole national territory</p> <p>public opinion awareness: the concept of "active forest management" is hardly accepted unless an event is taking place, people does not want the forest to be cut and that's it</p> <p>Extreme land fragmentation and abandonment of wooded areas by private and public owners</p>

References:

Law n. 353/2000 - art. 1 - 2 - 4 (purposes, principles, definition, prevision, prevenzione)
 Royal Decree 30 December 1923, n. 3267 "Serpieri law"
 Legislative Decree 3 April 2018, n.34 "TUFF"
 PIEMONTE Regional law 4/2009 «Management and economic promotion of forests»
 R.C.P.D. 8R/2011, R.C.P.D. 2R/2017, R.L. n.45/1989, Forest plans
 AOSTA VALLEY (Special Statute Region) Ministerial Decree 28 aprile 1930 «General prescriptions and forestry police» (R.D.L. 30/12/1923, n. 3267) R.L. 11/1998, General Forestry Plan 1987
 LIGURIA Regional law 4/1999 «Rules concerning forests and hydrogeological structure»
 R.R. 1/1999, Forest plans

LOMBARDY Regional law 31/2008 «Consolidated text of regional laws about agriculture, forests, fisheries and rural development» R.R. 5/2007, R.C.D. 53262/1990, R.C.D. X/901/2013, R.C.D. 7728/2008 e R.C.D. 6089/2016, Forest plans

TRENTINO ALTO ADIGE (Autonomous Provinces of Trento & Bolzano) AP Trento (PAT) Provincial law 11/2007 «Government of forest and mountain territory, watercourses and protected areas» P.P.D. 8/2011, P.L. 5/2008, P.L. 9/2011, Forest and Mountain Plans AP Bolzano (PAB) Provincial law 21/1996 «Forest legal frame» P.L. 28/1981, P.L. 291/2000, P.C.P.D. 56/2007, Provincial Forest Plans

VENETO Regional Council Provision 1066/1980 and Regional Council Deliberation 51/2003 «General prescriptions and forestry police» R.L. 52/1978, R.L. 8/1985, Forest plans

FRIULI VENEZIA GIULIA (Special Statute Region) Regional law 9/2007 «Rules on forest resources» R.L. 10/2010, R.C.P.D. 274/2012, R.C.P.D. 73/2016

SWOT ANALYSIS – BARRIERS AND POLICY NEEDS FOR APPLICATION OF FOREST AS NATURE-BASED HAZARD RISK MITIGATION IN SLOVENIA

Overview (with a focus on protection forest) on the forestry law of Slovenia

Slovenia is located between the Adriatic Sea, the Alps, and the Pannonian Basin, where three climatic types meet and interweave: alpine, Mediterranean, and continental, and where collisions between the polar air masses with warm and moist Mediterranean air occur, causing frequent extreme weather events. Considerable diversity in altitude reflects abundant orographic precipitation and is among the highest potentials for soil erosion among European countries. The main reason for the significantly reduced actual erosion in Slovenia are well preserved and biologically diverse forests, managed by mimicking natural dynamics.

Forests cover 1,1 million hectares which is over 58% of Slovenia's surface, of which over three quarters inclines greater than 20%, and 90% of the surface is with an inclination greater than 35%, reducing rapid surface runoff significantly reduce the influence of torrents. The main forest management goal in the steep areas is a protective role of forests; thus, forest structure and tree species composition are altered to achieve optimal protection.

The importance of protective forests has been recognized in Slovenia for a long time. In the first forest management plan (250th anniversary in 2021), the first known recognition of protective forests in Slovenia was in the Kopovišče forest near Tolmin in 1771 as a part of the plan for forests in the Tolmin region.

Slovenian forestry has a long tradition that reflects in three fundamental principles of forest treatment and management, which are:

- sustainability (the sustained preservation of forests and the sustained use of their goods and non-material functions),
- close-to-nature management (exploitation of forests to such a degree and in such a way as to ensure the preservation of all their natural constituents), and
- multi-purpose management (a balanced significance of ecological, economic, and social roles of forests).

When dealing with protective forests in Slovenia, it is necessary to distinguish between direct and indirect protection functions and declared protective forests.

The major tool for implementing these principles are forest management plans, using the participatory process to address relevant public (forest owners, municipalities, different organisations, public). Increasing demands for a vast array of ecosystem services emphasized the importance of multi-objective forest management. As a solution, integration model of multi-objective forest management has been practiced, presenting an important management tool to implement the concept of forest functions.

The protection function of forests and declared protective forests are part of all primary legislation – Forest Act (1993) and National Forestry Programme NFP (2007). In both contains, among others, key strategies for maintaining and strengthening the role of protective forests.

Summary of the regulation about protection forests in the national forestry law

Principles

Direct and indirect protection function

Forest act defines 17 forest functions, which are classified into social, ecological and productive functions. The importance of each function is ranked according to three levels: first level – function determines management regime, second level – function influences management regime and third level – function has no significant influence on management regime. Two forest functions are closely connected to the protective role of forests: 1) protecting forest soil and stands, hereafter “indirect protective function” and 2) protecting people, assets and properties, hereafter “direct protective function”.

Protective forests

Forests which in extreme ecological conditions protect themselves, their surrounding site and land below them, as well as forests with the exceeding role of any other ecological function (e.g. biodiversity conservation function), are declared by the Forest act (1993; article 43.) as a special category “protective forests”. Most forests with the indirect or direct protective function are included in this category.

Protective forests are forests:

- that protect their lands from sliding, rinsing and crumbling,
- on steep slopes or banks of waters,
- exposed to strong winds,
- that in the torrential areas delay water drainage and therefore protect the land from erosion and avalanches,
- bands protecting forests and land from the wind, water, snowdrifts and avalanches,
- in agricultural and suburban landscapes with an exceptionally emphasized biodiversity conservation function and forests at the upper limit of forest vegetation.

Consequences

Direct and indirect protection function

The functioning of protection forest function of forests is defined in NFP and contains:

- The areas of protective forests or protective functions of forests and endangered areas should be inspected under regulations on waters and guidelines for forest management in those areas should be prepared.
- Forest cover should be preserved and increased in areas liable to erosion and landslides.
- The following activities should be carried out in endangered areas:
 - reduce the negative influence of buildings and infrastructure in forests to a minor extent,
 - enable the natural renewal of forests,
 - provide the structure of tree species adequate to the stand,
 - pay particular attention to the protection against fire,
 - provide the optimal structure of forest stands considering the stability and possibilities to prevent erosion, landslides and rock and snow avalanches,

Strengthen the implementation of works in the area of the control of mountain torrents.

Protective forests

Protective forests are declared by the Decree on protective forests and forests with a special purpose. Slovenia Forest Service (SFS) must by this Decree ensure the implementation of works

that are defined in the forest management plans due to the implementation of the management regime for protective forests. In general, SFS must ensure:

- Timely restoration or cutting of old trees,
- Execution of small-scale surface cuts,
- Leaving appropriately high stumps when harvesting trees in areas where there is a danger of avalanches and landslides,
- Methods of harvesting and use of harvesting equipment, as defined by the forest management plan of the forest unit,
- Rehabilitation of damaged soils to prevent erosion,
- Removal of trees from torrential streams,
- Timely implementation of all forest breeding works that ensure the preservation and stabilization of the protective role of the forest and
- The use of biodegradable oils when working with machinery and appliances.

Furthermore, interventions in protective forests are determined:

- Interventions that are not connected with the management of protective forests and which do not significantly affect the functions of forests for which it was declared a protective forest might be implemented on the basis of a previously obtained permit issued by the Ministry of agriculture, forestry and food.
- The permit referred to in the preceding paragraph shall determine the conditions for carrying out an intervention based on an assessment of the impact of the intervention on the protection forest carried out by the SFS.

Areas of application

- All forestlands and forests, regardless the ownership.

Objectives

- In NFP, the objectives for all categories are to provide optimal functioning of forest with protection function.

Reference documents

- Forest Act (Official Gazette of RS, Nos. 30/93 , 56/99 - ZON, 67/02 , 110/02 - ZGO-1 115/06 - ORZG40, 110/07 , 106/10 , 63/13 , 101/13 - ZDavNepr, 17/14 , 22/14 - dec. US, 24/15 , 9/16 - ZGGLRS and 77/16)
- National Forest Program (NFP, 2007)
- Decree on protective forests and forests with a special purpose (Official Gazette of RS, Nos. 88/05 , 56/07 , 29/09 , 91/10 , 1/13 and 39/15)
- The regulation for forest management plans and game management (Official Gazette of RS, no. 91/10)
- SFS instruction manual for development of forest management plans (Internal document, 2012).
- Rules on forest protection (Official Gazette of RS, Nos. 114/09, 31/16)

Legal act of establishment

- The Slovenian Forest Act
 - Protection functions are defined in the process of the adoption of forest management plans.
 - Protective forests are designated as such by government regulation.

Procedure

Protection function

Protection functions are defined as part of preparing forest management plans for regional units (14 regional units in Slovenia), which are strategic documents on the regional level. This process runs every ten years. SFS is responsible for preparing forest management plans, which are confirmed by the Republic of Slovenia - government.

Indirect protection function

This forest function is determined for the individual forest areas according to the following criteria:

Forests in the areas of the following forest types (forest plant communities) are in the first level of emphasis:

- Basophilic pine forests (Genisto januensis-Pinetum, Orno-Pinetum, Pinetum subillyricum);
- Acidophilic pine forests on carbonate shale and sandstone ridges (Myrtillo-Pinetum p.p.-part);
- European hop-hornbeam and narrow-leaved ash forests (Cytisantho-Ostryetum, Querco-Ostryetum, Ostryo-Fraxinetum);
- Fir in the rocks (Neckero-Abietetum);
- Spruce forests in glacial scree (Asplenio-Piceetum);
- Subalpine beech (Fagetum subalpinum);
- Dwarf mountain pine associations (Rhodotamnio-Rhodoretum, Pinetum mughi);
- Spruce on peat and high moors (Oxycoco-Sphagnetum);
- and also:
- All forest vegetation above the upper limit of densely grown forest;
- Forests on compact bedrock with a slope of more than 35°;
- Forests on an erodible or sliding bedrock with a slope of more than 25°;
- Forests in torrential areas with high density of erosion occurrences;
- Forests on very shallow soils (10 cm) or forests with surface of more than 70% of rocks or stones (rocks and stones that are overgrown only with moss are considered);
- Forests that prevent or contain landslides;
- Forests near watercourses in the area of ten-year high waters; ten-year water area means an area that is flooded at least once every ten years on average. Please note that care must be taken when assessing this vegetation-based function. Some species, that are characteristic of forest communities in extreme habitats, in succession processes grow on sites that are non-extreme (mountain pine, spanish broom and many others). If this phenomenon is suspected, other criteria should be used to determine the prominence of this feature.

Forests in the areas of the following forest types (forest plant communities) are in the second level of emphasis:

- Spruce forests on rocky outcrops, scree areas, subalpine vegetation stages and karst sinkholes (Carici albae-Piceetum, Piceetum subalpinum, Villose-Piceetum inverzionum);
- Lime, maple and elm communities on colluvial soils (Tilio-Aceretum, Ulmo-Aceretum, Orvalo-Aceretum);

- Basophilic forests of sessile oak (Lathyro-Quercetum);
- Thermophilic beech forests (Ostryo-Fagetum, Carici albae-Fagetum, Calamagrostido-Fagetum);
- Beech forests on dolomite rendzines or humocarbonate soils in cold or ridge locations (Arunco-Fagetum, Isopyro-Fagetum, Aceri-Fagetum);
- Alpine beech forests (Anemone-Fagetum, Luzulo niveae-Fagetum) - in the upper part of the mountain range;
- The coastal forest of the European hop-hornbeam and the narrow-leaved ash (Seslerio-Ostryetum);
- Willow and poplar floodplain forests (Salici-Populetum);
- Black alder forests (Alnetum glutinosae);
- Ash forests (Carici remotae-Fraxinetum);
- Maple and ash forests (Aceri-Fraxinetum);
- Gray alder forests (Alnetum incanae);
- and also
 - Forests on dry parts with xerophilic vegetation that do not qualify for first level emphasis or forests on impervious occasionally flooded soil;
 - Forests on erodible or sliding bedrock with slope from 15-25 °;
 - Forests in areas with erosion occurrence;
 - Forests on shallow soil (up to 20 cm) or forests with rock or stones surface on 50-70% of the surface.

The third level of emphasis is not determined.

Direct protective function (protection of settlements and infrastructure)

This function of the forest is determined according to the following criteria:

The first level of emphasis:

- Forests on steep slopes along railway lines and public categorized roads;
- Forests on steep slopes above settlements or over individual outbuildings, industrial facilities or residential buildings;
- Forests near airports;
- Counter-wind forests and forest tree belts next to infrastructure facilities.

Second and third levels are not determined.

In order to determine the protective function of forests under slopes, criteria for determining the function of protecting forest lands and stands are reasonably taken into account.

Forests, which, due to the extreme nature of the situation, perform the function of protecting forest lands and stands at first level of emphasis, and at the same time directly protect the structures, as a rule, also perform a protective function at first level of emphasis.

Distance is not a criterion because, depending on the relief conditions, the distance in which forests still perform this function can be very different (slopes varying in length).

Areas proposed to be designated as protective forests by the criterion for the first level of emphasis are shown in the spatial part of the forest management plan of forest management units.

Protective forests

Protective forests are determined in line with compartments or sections of forest management units or regions. The proposals are inspected by SFS and submitted to the Ministry responsible for forestry, if they are found eligible. Ministry accordingly updates the Decree on protective forests and forests with a special purpose.

Updating / Evaluation

- Legislation is updated whenever eligible reasons for it are presented and confirmed, and not periodically.

Legal effects

- Forests with indirect protection function on first level of emphasis, which are declared in the Decree are under special management regime, that is defined in the forest management plan of forest management unit.
- Deforestation on areas of declared protective forests is prohibited.
- SFS sets out special traffic regimes on forest roads in protective forests.
- Where the designating of a forest to be a protective forest restricts the enjoyment or the exercise of ownership rights to a forest, the owner has the right to demand appropriate tax relief or the right to compensation according to the regulations on appropriation. The owner may demand that the Republic of Slovenia, which has declared the forest to be a protective forest, buys this forest. If this occurs, the body responsible for designating it so is bound to buy the forest.
- Notwithstanding the regulations governing physical and spatial planning, the minister responsible for forestry may approve an activity affecting a protective forest if the activity does not substantially reduce the protective function.
- Funds for planned activities in protective forests and torrent regions in privately owned forests are provided in the budget of the Republic of Slovenia.
- It is prohibited to set up arranged fireplaces in protective forests.

Figures

The area of indirect protection function on the first level/degree (the function determines management regime) is 191.000 hectares (17% of total forest area), and the area of indirect function on the second level/degree is 309.000 hectares (28% of total forest area). The area of protective forest is 99.000 hectares (9% of total forest area).

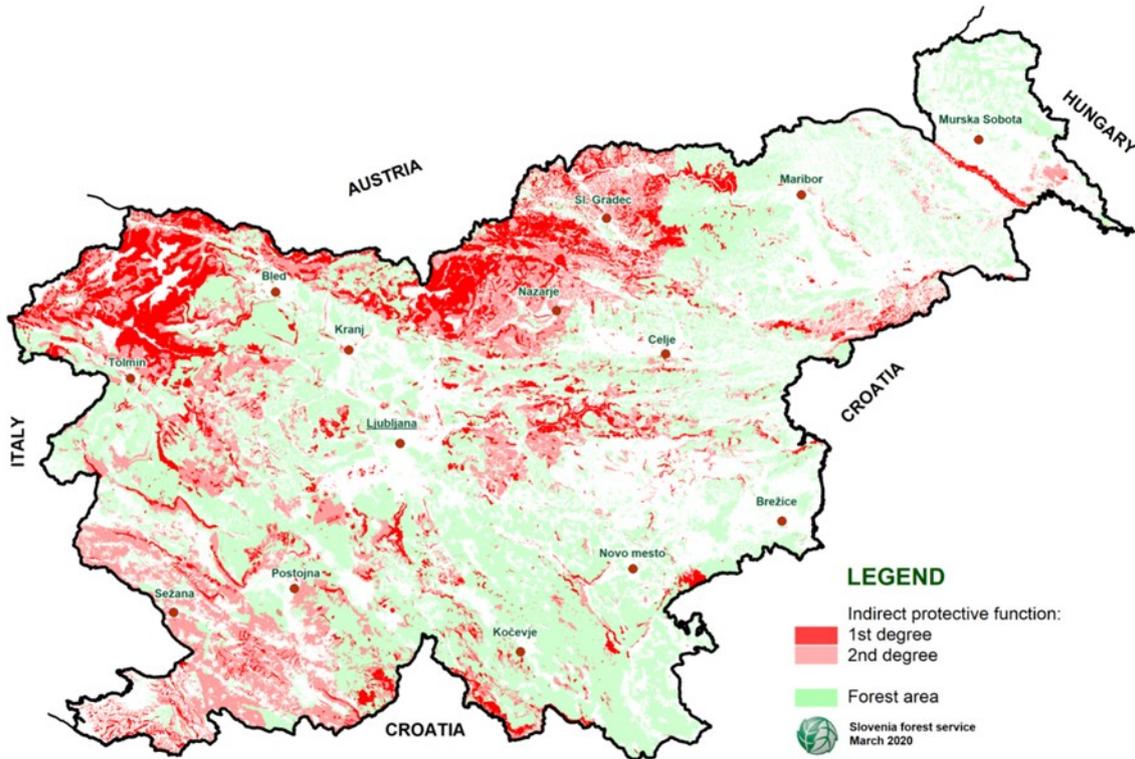


Figure 5: The spatial distribution of indirect protection function of forests in Slovenia.

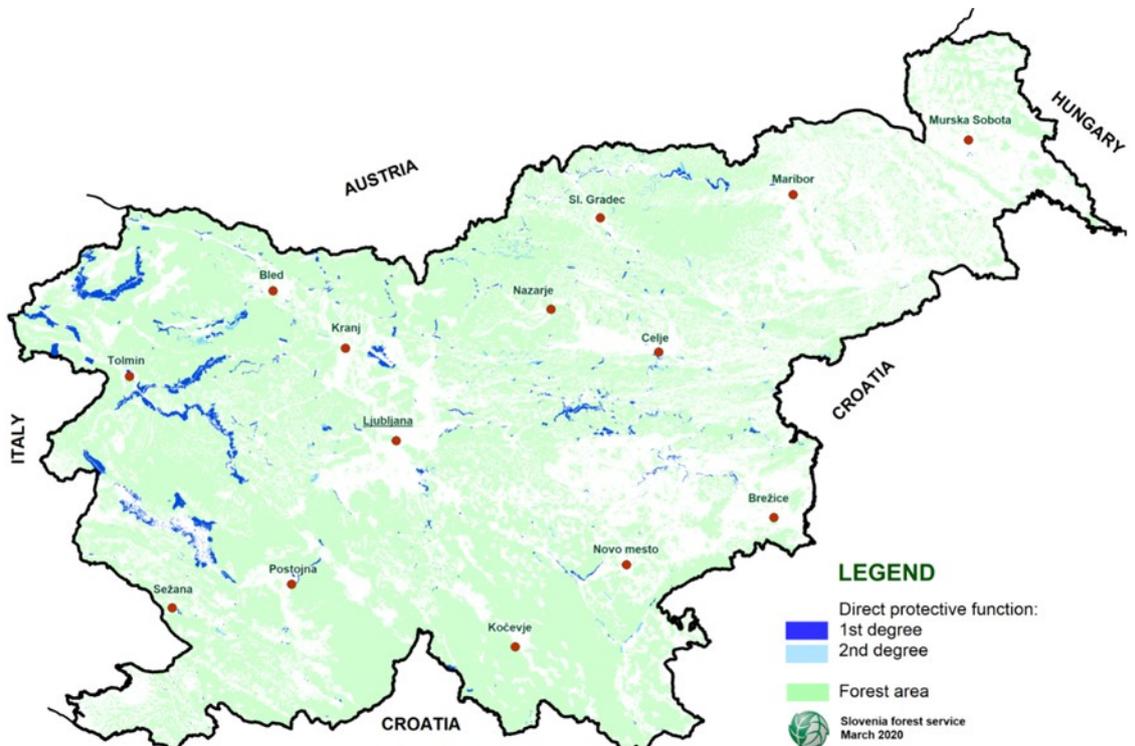


Figure 6: The spatial distribution of direct protection function of forests in Slovenia.

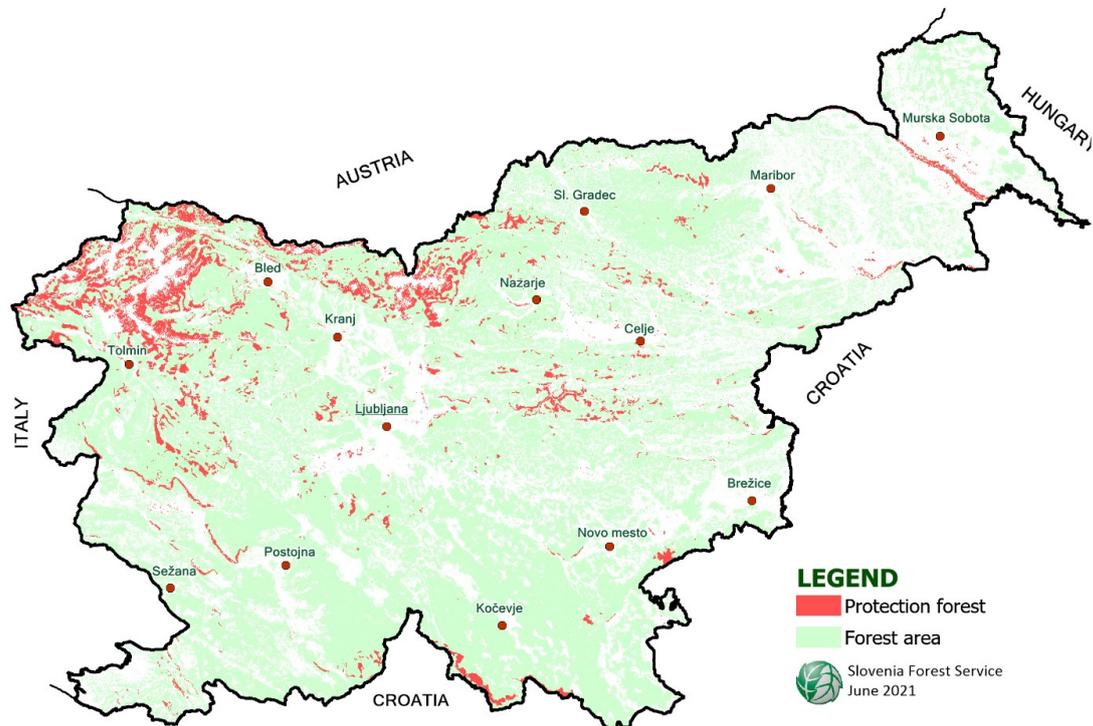


Figure 7: The spatial distribution of protective forests in Slovenia declared by the law.

The different actors and their involvement

Protective forests

Forest owners and local authorities provide proposals for classifying or declassifying a particular area as a protective forest declared by the Forest Act. SFS and Water Agency then check these proposals to define if these forests are in landslide areas, avalanche pathways, or torrent regions. If suggestions are found eligible, then they are passed forward to the Ministry responsible for forestry to include them into legislation. When the government adopts this proposal, the declaration of protective forests is in their jurisdiction.

Protection function

Direct and indirect protection functions are determined based on measures determined based on the criteria defined in the instructions for the preparation of forest management plans. These functions are prepared by the SFS and confirmed by the Government of RS in adopting forest management plans for regional units.

Summary of other regulations about risk prevention including forests items

Name of the regulation

- The Water Act

Principles

The objectives of water resource management and the management of water land and waterside land are:

- to achieve the better status of waters and other water-related ecosystems,
- to ensure protection against the harmful effects of waters,
- to preserve and balance water quantities,

- to promote sustainable water use that provides for various types of water use, taking into account the long-term protection of available water resources and their quality.
- In defining water resource management objectives and the related programs of measures, the effects of climate change shall be taken into consideration.

The hazard zone planning is revised periodically and in the event of changes in conditions.

Consequences for forestry actions

- The use of and other activities carried out on the land located in protection and risk areas, and on forest land must be designed, planned and carried out in such a manner so as:
 - to avoid the deterioration of water status,
 - to ensure protection against the harmful effects of waters, the maintenance of natural processes and of the natural balance of aquatic and semi-aquatic ecosystems, and the protection of valuable natural features and the areas protected in accordance with the regulations on nature conservation.
 - The deforestation of forest stands that prevent landslides and avalanches, regulate drainage conditions or in any other manner protect low-lying areas against the adverse effects of erosion, is prohibited in erosion areas.
 - Clearing or major regeneration of forest stands and shrub vegetation that promotes landslides is prohibited in landslide areas.
 - Deforestation, the levelling of terrain and the redirection of avalanche pathways from their standard natural routes to vegetation-covered, unstable or otherwise at risk land is prohibited in avalanche areas.
 - For the purpose of protection against avalanches, detailed conditions for carrying out activities that are applied in particular to accelerating the cultivation of forest stands that limit the sliding of snow and to carrying out protective measures for the permanent protection of buildings or facilities against avalanches.
 - Forestry work and other activities affecting the environment that might have an impact on the water regime may only be carried out on the basis of a water approval.

Reference documents

- The Water Act – ZV-1 (Official Gazette of the Republic of Slovenia [Uradni list RS], No. 67/02 of 26 July 2002),

Name of the regulation

- The Road Act

Principles

This Act lays down and regulates:

- the status and classification of public roads,
- the uniform rules concerning construction, management and maintenance of all public roads and conditions for the use of non-categorised roads used for public road traffic, to ensure equal conditions for safe road traffic throughout the road network,
- the mandatory public utility service for ensuring the condition of public roads for safe and unhindered traffic,
- the management, construction, maintenance and protection of public roads and traffic on them.

Consequences for forestry actions

The public road operator may propose that the Ministry responsible for transport declare a forest along a state road or near it important due to its protection against landslides, cross-winds, avalanches and similar, as a protective forest pursuant to the regulations governing forests.

Reference documents

- The Roads Act – zces-1 (official gazette of the Republic of Slovenia [Uradni list RS], no. 109/10 of 30 December 2010).

Barriers and policy needs for application of ecosystem-based natural risk mitigation concept/sustainable management

The following table synthesis the main input data about the current situation in Slovenia.

		Yes	No	Comments
Existence of a regulation for risks prevention	National	X		National legislation is applied at local levels
	Regional	X		
Existence of a protection forest classification	National	X		Part of forest management plans.
	Regional	X		
Comprehensive mapping of natural hazards	National		X	On the national and local level, mapping of erosion, landslides, shallow slides, snow avalanches exist, but not so good quality. The mapping of torrents is missing.
	Regional		X	
	Local		X	
Comprehensive mapping of natural risks	National		X	The same.
	Regional		X	
	Local		X	
Comprehensive mapping of protection forest ecosystem service	National	X		Part of forest management plans.
	Regional	X		
	Local	X		
Financing of this ecosystem service	EU	X		Some measures are financed from the rural development program, but mainly from the budget of RS and Forest Fund.
	National	X		
	Regional		X	
	Local		X	
Natural risk prevention document	National	X		Yes for fires, flooding.
	Regional	X		
	Local	X		
Natural risk prevention document integrating this ecosystem service	National	X		Part of forest management plans.
	Regional	X		
	Local	X		
Individual expertise		X		Individual and collective expertise is implemented to various extend.
Collective expertise		X		
Existence of past events data bases		X		Yes, in different applications.
Existence of a standardized methodology for risks zoning	National	X		Part of legislation.
	Regional	X		
	Local	X		
Existence of protection forest management guidelines	National	X		National Forestry Programme
	Regional	X		Forest management plans for regional units
	Local	X		Forest management plans for forest management units and silvicultural plans
Insurance participation			X	
Societal demand for valuing forest-based solutions		X		Very high.
Development of participative approach		X		Included by the law in the system of forest management planning in all levels, also other legislations provide participation.

These info have been used for providing the following SWOT analysis (Strengths - Weaknesses - Opportunities - Threats) summarizing the current barriers and policy needs for the application of forest based natural risk mitigation concept.

	Strengths	Weaknesses
Factors internal to Slovenia's regulations	<p>Protective function and protective forest are defined by legislation.</p> <p>Clear definition of protective forests and protection function.</p> <p>Ecosystem services are part of forest management plans done by the Slovenia Forest Service.</p> <p>Ecosystem services are defined and mapping for all forests in Slovenia regardless of ownership and size.</p> <p>Forest management is guided and controlled by the public forest service.</p> <p>Well-developed and implemented system of participatory approach in forestry planning.</p> <p>Some co-financial and financial possibilities for managing protective forests.</p> <p>Cooperation of forestry sector in natural risk prevention with other partners on national, regional and local level.</p> <p>Strong involvement of Forest service in forest fire prevention.</p> <p>The significant role of forestry in the inventory of damage after natural disasters.</p> <p>Easy transfer legal requirements (over the system of Slovenian forestry) to forest owners.</p> <p>A well-structured forestry service provides a good insight into what is happening in the field.</p> <p>The Constitution cares about the property right as a special shape of material care of human freedom. Therefore, the owner is not unlimited by performing his property rights. He has to consider the interests of other members of the community and the community itself.</p> <p>Strong public interest in the forest, which should ensure sustainable and environmentally friendly ecosystem roles.</p>	<p>There is no clear professional solution about forestry management in declared protective forests – to manage them or leave them untouched.</p> <p>Lack of detailed guidelines about managing protective forests, policies in forest management plans are not enough.</p> <p>Forestry is not recognized as a relevant profession in natural hazard issues—too intense competition between different actors.</p> <p>Insufficient data about former natural hazard risk and prevention. There is no uniform system of records of past events at the level of the state and local communities.</p> <p>No possibilities to finance simple forestry measures to protect against different gravitational natural hazard events.</p> <p>Lack of consistent data on torrential processes.</p> <p>Weak policy regarding the regulation of torrential areas.</p>
	Opportunities	Threats
Factors external to Slovenia's regulations	<p>Stronger connection of the forestry profession with science, especially in the field of modeling natural hazards.</p> <p>Building a unified system for mapping natural hazards, past events, and potential risks at all levels of government. It is necessary to use already existing systems and connect them into a single one.</p> <p>Connecting all key stakeholders in the field of protection against natural hazards, whereby it is necessary to harmonize their interests with the interests of society as a whole.</p> <p>Find all possible ways to finance measures to manage protective forests and strengthen the forest's protective role.</p> <p>Closer cooperation of forestry with responsible institutions that manage public infrastructure.</p> <p>The active role of the forestry sector in the preparation and amendment of relevant legislation.</p> <p>Participation in international projects mainly in the Alpine region.</p>	<p>Lack of economic valuation of forestry ecosystem services.</p> <p>The unwillingness of various institutions and professions to cooperate.</p> <p>Great possibility of exclusion of related professions by the currently strongest in cooperation and decision-making.</p> <p>Changes in European funds allocations</p> <p>Severe fragmentation of private forest ownership.</p> <p>Unclear developments in forests as a result of climate change. A destroyed forest cannot be immediately replaced with a new one.</p> <p>In all systems, forestry is pushed to the margins and thus receives smaller financial resources.</p> <p>An inactive attitude of the forestry profession towards the external environment - towards other subjects in society and the public; such an approach is mainly the consequence of the philosophy of omniscience of forestry among forestry professionals.</p> <p>A passive role of forestry profession in promoting forests and forestry.</p>

	Involvement of all target groups of the public in the decision-making process and finding common solutions.	
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References:

Forest Act (Official Gazette of RS, Nos. 30/93 , 56/99 - ZON, 67/02 , 110/02 - ZGO-1 115/06 - ORZG40, 110/07 , 106/10 , 63/13 , 101/13 - ZDavNepr, 17/14 , 22/14 - dec. US, 24/15 , 9/16 - ZGGLRS and 77/16)
National Forest Program (NFP, 2007)
Decree on protective forests and forests with a special purpose (Official Gazette of RS, Nos. 88/05 , 56/07 , 29/09 , 91/10 , 1/13 and 39/15)
The regulation for forest management plans and game management (Official Gazette of RS, no. 91/10)
SFS instruction manual for development of forest management plans (Internal document, 2012).
Rules on forest protection (Official Gazette of RS, Nos. 114/09, 31/16)
The Water Act – ZV-1 (Official Gazette of the Republic of Slovenia [Uradni list RS], No. 67/02 of 26 July 2002),
The Roads Act – zces-1 (official gazette of the Republic of Slovenia [Uradni list RS], no. 109/10 of 30 December 2010).

SWOT ANALYSIS – KEY BARRIERS AND POLICY NEEDS FOR APPLICATION OF FOREST AS NATURE-BASED HAZARD RISK MITIGATION IN THE ALPINE SPACE

The strategy of protection and prevention of natural hazards is a dynamic process that has strongly evolved over time. Initially it was built on the will to benefit from the action of forest. Over time and given the demand to obtain as quickly as possible an effective protection, forest engineering has given way to a specific civil engineering initially based on the reproduction of the actions of forest stands (nature-inspired solutions). One of the consequences is that the strategies of putting in safety of the goods and the persons based on the only use of civil engineering were imposed to the detriment of those valuing the solutions based on nature. At the same time, the planning and regulation of land use has developed accordingly. Very often, the reason evoked for not taking into account the solutions based on the forest is the possible disappearance of the forest cover following disturbances (storms, droughts, fires, pests...). The table below, which presents a synthesis of the analyses carried out by country, shows this tendency: the ecosystem service of protection against natural risks of forest ecosystems is mostly not taken into account.

		Austria		Germany		France		Italy		Slovenia	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Existence of a regulation for risks prevention	National	X			X	X			X	X	
	Regional	X		X			X	X		X	
Existence of a protection forest classification	National	X		X		X			X	X	
	Regional		X	X			X	X		X	
Comprehensive mapping of natural hazards	National	X			X	x		X			X
	Regional	X		X		x		X			X
	Local	X		X		x		X			X
Comprehensive mapping of natural risks	National		X		X		X	X			X
	Regional		X		X	X		X			X
	Local		X		X	X		X			X
Comprehensive mapping of protection forest ecosystem service	National	X		X		X			X	X	
	Regional	X		X		x			X	X	
	Local	X		X		x			X	X	
Financing of this ecosystem service	EU	X			X	x		X		X	
	National	X			X	x			x	X	
	Regional	X			X	x			x		x
	Local	X		X			x		x		x
Natural risk prevention document integrating this ecosystem service	National	X			X		x		x	X	
	Regional	X			X		X		X	X	
	Local	X			X		X		X	X	

Existence of a standardized methodology for risks zoning	National	X	X	X			x	X
	Regional	X	X		X	X		X
	Local	X	X	X		X		X
Existence of protection forest management guidelines	National	X	X	X			x	X
	Regional	X	X	X		X		X
	Local	X	X	X			X	X
Societal demand for valuing forest-based solutions		X	X	X		X		X

According to this table the three main categories (to be modulated according to the country) of national barriers are: i) the lack of comprehensive mapping of natural risks, ii) the non-integration of forest based solutions in natural risk prevention document, and iii) the financing of forest based solution .

From the identification of these barriers, emerge the first tracks for enhancing forests as nature-based solutions for natural risks mitigation in regional, national and European policies.

At this stage of the analysis, it is important to recall the concept of nature-based solutions as currently defined by the International Union for Conservation of Nature. This definition is the international reference in this field:

The World Conservation Congress, at its session in Hawai'i, United States of America, 1-10 September 2016 has adopted the IUCN Definitional Framework on Nature-based Solutions (<https://www.iucn.org/theme/nature-based-solutions>) :

- *Definition of Nature-based Solutions (NbS)*

Nature-based Solutions are defined as “actions to protect, sustainably manage, and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits.”



Figure 8: The concept of Nature Based Solutions as define by IUCN (<https://www.iucn.org/theme/nature-based-solutions/about>)

- *Overarching goal of Nature-based Solutions*

The goal of Nature-based Solutions is “to support the achievement of society’s development goals and safeguard human well-being in ways that reflect cultural and societal values and enhance the resilience of ecosystems, their capacity for renewal and the provision of services; Nature-based Solutions are designed to address major societal challenges, such as food security, climate change, water security, human health, disaster risk, social and economic development”.

- *Preliminary principles of Nature-based Solutions*

The following preliminary principles are to be considered in conjunction with the Nature-based Solutions (NbS) definition:

- *NbS embrace nature conservation norms (and principles);*
- *NbS can be implemented alone or in an integrated manner with other solutions to societal challenges (e.g. technological and engineering solutions);*
- *NbS are determined by site-specific natural and cultural contexts that include traditional, local and scientific knowledge;*
- *NbS produce societal benefits in a fair and equitable way in a manner that promotes transparency and broad participation;*
- *NbS maintain biological and cultural diversity and the ability of ecosystems to evolve over time;*
- *NbS are applied at a landscape scale;*
- *NbS recognise and address the trade-offs between the production of a few immediate economic benefits for development, and future options for the production of the full range of ecosystems services; and*
- *NbS are an integral part of the overall design of policies, and measures or actions, to address a specific challenge.*

Forest-based solutions are therefore part of NBS. However, it is important to specify that, in the fields of prevention and mitigation of natural risks, their framework of action aims firstly at not deteriorating biodiversity and if possible, secondly seeking to enrich it. Moreover, and depending on the situation, the scales of implementation of NBS may be different from that of the landscape.

Therefore, forest based solutions should be a part, as well as spatial planning and civil engineering of the overall design of policy and measures or actions to address human well-being coping with natural risks. In order to help decisions and policies makers to improve the current risks and protective forest policies, we are proposing an Alpine scale SWOT developed from the synthesis of the five national SWOTs presented in this report. The following table presents this Alpine scale SWOT figuring out its key items.

Strengths

- The forestry law/policy should address the protective services and effects of forests.
NB: The main objective of forestry law/policy in all the Alpine countries is to maintain and enhance the resistance and resilience of forests and of their ecosystem services.
- The forestry law/policy should state a clear definition of protective forests and protection function.
- The forest law should distinguish direct (object oriented) and indirect (site oriented) protective functions, that are different in terms of risk and differs obligations of forest owners and of the public domain in relation to them.
- The legal status of protection forest should be abandoned in favor of the recognition of the ecosystem service of protective forest
- Forest policy should define the methodology, data and tools to use for protective forest mapping. This mapping should not generate definitive prescription and has to be informative.
- The regulations should state a clear distribution of legal and judicial responsibilities among the different stakeholders.
- The regulations should not allocate the obligation to ensure a certain protective effect to forest owners as that is impossible (in particular due to the forest stands dynamics, climate changes impacts and effects of disturbances) , but to contribute to the resistance and resilience of protective forests.
- The regulations should obligate forest owners and encourage beneficiaries to consider the protective functions and effects of the forest.
- Regulatory management constraints should require the use of the natural hazard chapters of mountain forestry guidelines.
- Forest owners should be informed on regulatory management constraints in protective forests.
- The regulation should offer to merge forest properties, both public and private, for large-scale management despite land properties fragmentation
- Forest acts should provide information about protective functions and effects of forest in a flexible manner.
- Financial compensation/public incentives should be allocated for covering sylvicultural management over costs.
- Beneficiaries should also contribute to protective measures, which would create an obligation for the forest owner to implement measures.
- Forest law/policy should develop and implement an efficient system of participatory approach in forestry planning.
- The current strong public interest in the forest, which should ensure sustainable and environmentally friendly forest ecosystem services.

Opportunities

- Increasing improvement of strategic and professional cooperation and coordination through administrative reorganization and bundling of competences.
- The experience gained by the Alpine countries that have yet implemented nationwide protection/protective forest indication map.
- The visualization of hazard potentials (protective functions) and protective effects may initiate more interest of forest owners and beneficiaries in protection forest management and participation.
- Bundling of competences in hazard susceptibility and forest ecosystems services assessment and nationwide implementation of approaches may improve the results and their acceptance in relation to differing national and regional modelling.
- The basic knowledge about protective functions and effects of the forest have been efficiently improved since the last decades with the development of robust models
- The nation-wide availability of high-resolution elevation and spectral data from remote sensing as well as their use in spatial modelling and mapping of hazard susceptibility and forest conditions speeds up and improves the baseline surveys and monitoring actions.
- Availability of new software tools useful for standardized individuation and definition of protection forests.
- The project of creating an Alpine competence centre for protective forest management may enhance science and education about protective forest management.
- Connecting all key stakeholders in the field of protection against natural hazards, whereby it is necessary to harmonize their interests with the interests of society as a whole.
- There is public awareness for protective forests and agreement on their superordinate function.
- The societal demand for the valorisation of nature-based solution in natural risks prevention policies
- The societal demand for better governance in natural risks management and policies development.
- The willingness of insurance companies to value nature-based solutions where possible
- The need of a closer cooperation between foresters with responsible institutions that manage public infrastructure.
- The current active role of the forestry sector in the preparation and amendment of relevant legislations and regulations.
- Participation in international projects mainly in the Alpine region.
- The importance of the protective forest is reflected in the proposals of EUSALP and EU, in particular in programmes to adapt to climate change.
- The future opportunities offered by the Common Agricultural Policy for forestry policies.

- The EUSALP and Alpine Convention strategies/directives.
- The interreg Alpine Space programme and the capitalization of its projects risks prevention and forest ecosystems services oriented.
- The development of open and participative science for improving knowledge and databases.

Weaknesses

- On national level, risk prevention purposes are identified in different legislation/regulations/policies offering too many different possibilities.
- The forest law does not define operational protection targets and priorities in terms of the asset components of risk.
- Lack of legitimized and coherent process of protection target setting. Situation as “Everything made be men is to be protected by forest”, which is not purposeful, should be avoided by the forest law/policy.
- The States protect their citizens 'in spite of themselves'. Lack of governance to define "accepted risk".
- Lack of Alpine wide high resolution harmonized data for producing a robust base of comparison between Alpine countries.
- Lack of a European funds and funding policy for the management and improvement of Forest Based Solutions in natural risks protection and prevention policies.
- Lack of feedbacks on real integrated management at the scale of the risk basin.
- Lack of comprehensive mapping of the ecosystem service of protective/economic valuation of this ecosystem service.
- Lack of a real policy for framing and supervising modelling analysis work.
- Administrative structuring can generate a gap between local reality and administrative guidelines.
- The forest administrations are not obliged to inform forest owners or beneficiaries about protective forests, these stakeholders have to find this information by their own in the administrative/regulatory documents.
- The information provided by hazard and protection forest indication maps may not be perceived or no importance may be attributed to them by stakeholders, as authorities at the same time emphasizes the legally non-binding nature of them.
- The information given by risks/dangers plans does not provide preventive silvicultural measures in protective forests but rather forest restoration or regulatory constraints and can lead to wait-and-see behavior.
- The current protection forests survey regulation provides forest restoration rather than preventive management.
- The zoning in risks/dangers plans does not spatially cover the entire hazard and damage potential. It is to certain extent decoupled from the protective functions and the conditions of forest.
- Lack of feedbacks on real integrated management at the scale of the risk basin.
- Lack of a real policy for framing and supervising modelling analysis work.
- The current lack of adapted financial funds and funds attribution methodology dedicated to protective forest managements. The rules for cost allocation and about the forest owners' shares of costs are complicated and, in many situations, cannot be implemented at all, as there is no corresponding accounting and measures cannot be clearly designated to object- or site-protective effects.
- The threshold of intended felling without announcement/approval do not fully ensure the maintenance of the protective capacity of the forest.
- Hunting and forestry matters are legally separate.

Threats

- Some influent stakeholders perceive Forest Based Solutions as an “enemy” to civil engineering technics and not as complementary or alternative technics.
- Extreme land fragmentation and abandonment of wooded areas by private and public owners
- No common standard and high uncertainty in assessment of the protective effect and the stability of protection forests may bias priority-rankings. This also provides a tendency to prefer engineering constructions.
- The financing of forest ecosystem services is too dependent on fluctuations in the timber market.
- Lack of public understanding of the need to manage and maintain forests
- The idea that forest cover can disappear overnight (windstorm, forest fire...) and thus its protective effects provides a tendency to prefer engineering constructions.
- Lack of feedback on forest and services efficiency recovering kinematic after natural disturbances.
- Lack of feedback on cascading effects between natural hazards, forest services and natural disturbances.
- The distribution of competences among different administrative levels and agencies delays decisions and implementations.
- Non-coordinated mappings and spatial modelling of hazard susceptibility at national and regional level with contradictory message counteract the effects of such information tools.
- Some geodata necessary to assess protective functions effectively do not show sufficient quality.
- There is a lack of high-quality data on past events and the forest condition prior to them that are necessary to improve assessments of the protective effects of forest.
- The tendency in science and administration to assess the conditions of protective forests primarily based on characteristics that can be derived inexpensively from remote sensing sensors jeopardises the synoptic view considering factors that cannot be estimated at that way.
- The survey of protective forest conditions on slope level is not done systematically but allocated to episodic large-scale actions with rough designations or to small-scale actions.
- The regulations provide to some extent wait-and-see behaviour. They rather initiate forest restoration than preventive silvicultural management.

- Lack of appropriate training for practitioners and administrative officers
- Lack of economic valuation of this ecosystem service
- Lack of real collective expertise associating experts/scientists/decision makers.
- Browsing by wild ungulates considerably hampers the regeneration of protection forests and thin out species such as fir and broadleaved deciduous trees in some regions. The solution power of the regulations is not sufficient. This also provides a tendency to prefer engineering constructions.
- Introduction and spread of new plant diseases due to international trade and enhanced by effects of climate change endangers native tree species and thin them out.
- Lack of an adapted communication and dissemination strategies about the efficiency and limits of forest based solutions

Based on the results of this last SWOT analysis, the first action of all forestry policies should be to abandon or modify the legal status of “protection forest” for a better integration of protective forest ecosystems service in forest acts and risks policies.

The dynamic of existing spatial planning tools and concepts is very relevant in a fast-changing environment with new environmental impacts and emerging natural risks. Spatial planning tools are subject to challenges at local level (local authorities), national level (strategies, national financing) but also at territorial level. These tools should offer the possibility to integrate forest based solutions and options. To do so and in order to avoid the catastrophic consequences generated by the alteration or even the disappearance of the forest cover, the second action should be to promote the forest sectors that have a protective role, which requires a cartographic zoning of this service rendered by the forest ecosystems. Based on the results of scientific research and in order not to risk a degradation of the level of service, the areas at stake must be managed in such a way as to optimize the protection provided by the forest stands. This management should avoid biodiversity erosion with at minima a status quo with the current degree of biodiversity. The delimitation of protection forests must be done according to the potential of danger (hazards) and the potential of damage (stakes). The first step must allow the identification of sectors with a potential for damage, without taking into account the effect of forest stands. Such assumption is equivalent to working with a disaster scenario that ignores the presence of forest cover. When these hazard and maximum probable damage potentials are defined and mapped, then the second step consists in integrating the protective effect of the current forest cover to evaluate the current probable potentials. The third step consists in evaluating the consequences on these potentials of different scenarios of evolution of the forest cover with and without human intervention, and taking into account the effects of global changes. These elements of knowledge will have to be integrated in the decision-making process to define the final strategy for the safety of people, theirs and of the economic activities: valorization of forest-based solutions, mixed techniques associating civil engineering and forest engineering, exclusive use of civil engineering, regulatory provisions...

The last action should be dedicated to the economic valuation of this protective forest ecosystem service and its comparison to the different usable management and land planning options.

Finally, all policies should promote and facilitate participative strategy for developing a real risk governance involving all the relevant stakeholders (including the landowners and local population)..

The success of these improved policies will also rely on:

- The availability of the data necessary to carry out the modelling work.
- The support of territories in mastering geomatics tools and associated databases to develop a real Territorial Information System to help the development of the territories and the valorization of the Forest based solutions.
- The considering of the three pillars (environmental, social and economic) of sustainable development for managing alpine territories and natural risks in a sustainable way,

- The taking into account and adaptation to the specificities of the Alpine Region: multi-hazards/multi-risk context, rapid climatic and environmental changes, specific vulnerabilities due to the relief, etc.
- The development of an integrated risk management including mountain forests, soils, water/rivers and urban planning at the scale of living spaces / territories taken into account related ecosystemic services (including their economic evaluation).
- The taking into account the multifunctional uses of alpine ecosystems in order to manage them in an integrated way,
- The mainstreaming of national, alpine, European projects' outputs focusing on ecosystem services and the ones provided by forests, putting an emphasis on new standards for forest management integrating needs for effective natural hazard risk management. The rationale behind this logic is to favour Forest based solutions when considering the cost-benefits ratio. However, there is some controversy regarding these options and what has to be considered when modelling the effects of different solutions and calculating their costs and benefits.

All these actions are part of the Global Standard proposed by IUCN. This Global Standard is comprised of eight criteria and their associated indicators, effectively operationalizing the best-practice principles identified by IUCN in 2016 (<https://www.iucn.org/theme/ecosystem-management/our-work/iucn-global-standard-nature-based-solutions>).

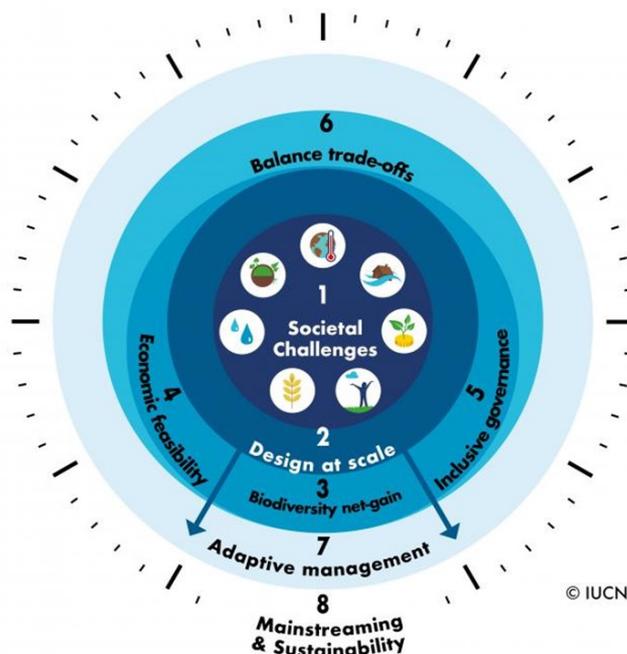


Figure 9: The concept of Global Standard of Nature Based Solutions as define by IUCN (<https://www.iucn.org/theme/ecosystem-management/our-work/iucn-global-standard-nature-based-solutions>)

These new approaches will make it possible to work on a whole range of natural, technical, mixt and organizational solutions, and optimize their combination for a better facing of climate changes adverse effects.

The work of the EU-Strategy for the Alpine Region (EUSALP) offers a great opportunity to facilitate the development and implementation of these future policies. This is evidenced by the future contribution of EUSALP to the next IUCN World Congress to be held in Marseille 3-11 September 2021. Hereafter the reader will find the key items in the draft of this EUSALP proposal coping with nature-based solution. These key items are coming from the document called “ PROJECT FOR AN OPERATIONAL CONTRIBUTION OF THE ALPINE MACRO-REGIONAL STRATEGY ON BIODIVERSITY AND NATURAL RISKS TO THE CONGRESS OF THE INTERNATIONAL UNION FOR CONSERVATION OF NATURE (IUCN) IN MARSEILLE IN JANUARY 2020 -Version of July 20, 2020”. For memo : due to the COVID19 crisis this world congress has been postponed to 3-11 September 2021.

One of the seven thematic axes of the 2020-2021 French presidency of SUERA aims to "preserve Alpine biodiversity and prevent natural risks associated with climate change".

Within the framework of its action plan, the French presidency of SUERA wishes, in close cooperation with the executive and operational bodies of EUSALP, but also in perfect harmony with the European guidelines and those defended by the Alpine Convention, to propose to the States and Regions of SUERA and the Alpine Convention to make an ambitious operational contribution on biodiversity and natural risks at the IUCN World Congress to be held in Marseille in January 2020.

This contribution, which is part of the political framework adopted in June 2020 of the Manifesto for a Sustainable and Resilient Alpine Region, will be an operational declination declaration of the key challenges for the future of the Alpine region on the themes of biodiversity and natural risks. It will highlight and capitalize on them, current and past projects on which to build and amplify these orientations and will finally aim at proposing the implementation of an action plan. This action is oriented towards nature-based solutions and aiming more widely, in the medium term, at promoting a multi-level governance of ecological continuities at Alpine scale as well as a better-integrated management of natural risks in a context of ever more marked climate change and a stronger need for territorial resilience.

A SUSTAINABLE AND RESILIENT ALPINE REGION THANKS TO NATURE-BASED SOLUTIONS TO PRESERVE BIODIVERSITY AND PREVENT NATURAL RISKS: Contribution of the Alpine Macro-Region to the World Conservation Congress (IUCN)

We, the representatives of the States and Regions of the Alpine Region, considering that:

- *A decompartmentalized approach Biodiversity-Natural Risks, in accordance with the line taken by the French Presidency, would allow moving towards a more integrated management of the territories of the Alpine Region, by developing interactions and common work between action groups. .*
- *Transnational multi-level governance remains a shared medium-term ambition for the Alpine Region in terms of integrated management of biodiversity and natural risks.*
- *Nature-based solutions will soon have the first everan important tool to help design robust and sustainable actions that deliver virtuous benefits for society and nature: the Nature-based Solutions (NBS) standard, which is expected to be officially launched in Marseille at the IUCN World Congress in September 2021.*
- *More than ever, in this context, a strong political leadership is needed to move from intentions to actual implementation.*
- *Resources commensurate with the ambition must be mobilised for the period 2021-2027 and beyond, through dedicated funding and a good articulation of co-financing between them,*

- *Youth and civil society must be involved in these paradigm shifts alongside policy makers.*

To this end, we commit ourselves, in connection with this impulse given by the States and Regions of the Alpine Region, to implement several series of concrete, structuring and complementary actions which will be based in particular on nature-based solutions:

- *Encouraging and supporting territories to set up mechanisms for Integrated Natural Risk Management (IRRM ,,,),INRM),) and sustainable risk governance, in particular by developing tools and mainstreaming existing tools for disseminating good practices and digital tools for sharing information to improve governance, by adopting a regulatory translation of these objectives in urban and municipal projects, and by adapting urban and municipal morphologies to the challenge of ecological continuity;*
- *dGive priority as much as possible to nature-based solutions for spatial planning as sustainable solutions for biodiversity protection and natural risk management, in particular through the development and operational transfer of decision support tools for the integrated management of protection forests , hydrosystems and forest fires Continue and disseminate the results of work in progress (projects: AlpGov, ROCKtheALPS, GreenRisk4Alps, Link4Soils, HyMoCARES, Vulter, etc.). Promote cross-cutting and interdisciplinary approaches, in particular in the framework of the Task Force on Multifunctional Forest Management.*

Finally, we commit ourselves to:

- *Improving knowledge and developing tools to monitor and anticipate changes in socio-ecosystems and the evolution of natural hazards in the Alpine Region, with a special focus on emerging risks : towards the creation of an Alpine observatory for natural hazards,, energy and climate, which will complement the Natural Hazards Platform of the Alpine Convention - PLANALP.*
- *To rely more on the Alpine research and innovation ecosystem to develop analysis, monitoring and early warning tools adapted to the specificities of mountain environments, in particular by reinforcing exchanges between the academic and private spheres within the framework of clusters and competitiveness clusters.*
- *Territorialise and synergise risk prevention policies (natural hazard management and disaster risk reduction - DRR) and climate change adaptation policies (CCA) in local and regional territorial strategies by continuing the work already started (in particular through the development of the CAPA platform ("Climate Adaptation Platform for the Alps"); Complementing the Alpine Convention's Advisory Committee on the Alpine Climate.Alpine Climate Board Promote the integration of DRCCR and CCA policies in spatial planning, planning and urban development*
- *Facilitate intermediation networks at the science-society interface to develop exchanges between risk and adaptation management stakeholders and the general public, particularly through communication activities aimed at the general public and especially young people (schoolchildren). Strengthen information, awareness raising and training for specific target audiences, such as journalists.*