The protective Functions of Forests in Mountain Watersheds in the context of a Changing Climate

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French national Report

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What does « protective forests » in France mean?

- with a role in the control of natural hazards (avalanche, erosion, rock fall, etc.)
- with an important ecological or social role
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- with a role in the control of natural hazards (avalanche, erosion, rock fall, etc.)
- with a protective function

Celliers, ONF-RTM 73©

with an important ecological or social role
**FRENCH FORESTS WITH A PROTECTIVE FUNCTION**

- only mountain forests

French forests by elevation (A) class:

- **A > 1200 m**
- **600 m < A < 1200 m**
- **600 m > A**

- **total French forests: 16.2 M ha**
- **(30 % French area)**

- **6 %**
- **21 %**
- **73 %**

French mountain forests: 27 % → 4.4 M ha
- **only mountain forests**: 4.4 M ha

- **with different owners**

- **but not all mountain forests**: c.a. 40 % have a real protective function
  - **1.9 M ha** of French forests with a protective function, in mountains

- **policy of reforestation and restoration of mountain areas (RTM)**
  - **0.2 M ha** of French State mountain forests (1860-1980)
PROTECTIVE FUNCTIONS OF MOUNTAIN FOREST

- **limiting soil erosion** and **concentration of solid materials in torrents**
  - *forest capacity:* to fix the soil (at first, the reason of RTM policy and still the major role)
  - *forest characteristics:* plant coverage in erosion area

- **preventing** from **release of snow avalanches**
  - *forest capacity:* to capture the snow in branches and stems
  - *forest characteristics:* evergreen species in release areas

- **limiting** or **stopping rock falls**
  - *forest capacity:* to decrease the speed or to stop rocks smaller than 1 m³
  - *forest characteristics:* great stem density and basal area in propagation zone
**PROTECTIVE FOREST CHARACTERISTICS AND RISK**

- **French mountain forests:**
  mainly spontaneous

  [Diagram showing proportions of hardwood (beech) species (37%) and coniferous species (fir, spruce, scots pine) (63%).]

- **RTM forest policy**
  → *increased forest area:*
    c.a. 0.2 M ha
  → *most used species:*
    Austrian pine, larch

- **Risk for sustainability** of protective function in mountain forest
  - *very prone to aging:*
    - under-exploitation of forests in high elevation: stands are not renewed
    - low stem density can impact the protective function
    - too old trees do not display the same resistance as youg ones
  - *plantations are even-aged forests:* "Renewal of Protection forest Stands Program" (2007)
  - *natural hazards:* big storms (1999, 2009), fire (Southern Alps)
  - *wild game* (mostly deers): difficulties for forest regeneration
MANAGEMENT OF PROTECTIVE FORESTS

- **Private forests:** management difficulties
  - highly fragmented with most forests < 4 ha    → no management obligation
  - slopes and lack of forest trails    → lack of management

- **Public forests:** adapting general management to protective forests
  - forest management plan: main document, definition of decisive function of the forest
  - assertion of protective function of forests:
    - Hazard Control Index (IMA): 0 to 6 (no to max efficiency of forest)
    - determination of silvicultural operations for maintaining protective function
  - renewal prioritization: 12 % of RTM stands with a high protection potential

- **Challenges**
  - financial:
    - management of mountain forests is expensive and less attractive
    - ONF receives around 600 to 700 k€ for whole measures in public forests
  - technical:
    - to reconstruct an equilibrium of life cycles in homogeneous forests
    - to develop a specific monitoring of wild game in protective forests
“Mountain guidelines of silviculture”
- national strategy for mountain forests
- good practices (timber marking, logging, other)
- technical sheets for each natural hazard and specie (global objectives, situations, adapted silvicultural interventions)

Effect of agriculture on protective forests
- during centuries: increase of population and demand for food and wood → negative
- then: rural exodus + industrial Revolution + politics of reforestation → positive
- nowadays: the lowest proportion of agricultural areas is in mountains (26 % in the Alps) but role of pastoralism on biodiversity and tourism → encourage silvopastoralism
PROTECTIVE FORESTS POLICY AND GOVERNANCE

- **Effect of recreational and touristic activities** on protective forests
  - important touristic activity increases the places to be protected
  - some societal conflicts (very limited): mainly linked to skiing

- **Protective forests and ecology**
  - mountain forests are really rich in terms of natural heritage
  - most protected forests are mountain forests

- **Research studies on protective forests** (examples)
  - Irstea: studies on the protective function of forests on rock fall
  - ONF / R&D: applied research project

French national and regional nature parks
EXPECTED EFFECTS OF CHANGING CLIMATE

- **drier weather** than observed nowadays
  - impacts the vitality of some mountain tree species not adapted (e.g. Austrian pines)
    → replacement adaptation is needed (e.g. cedar)

- **increase of natural hazards**
  - **fires**: more frequent and localized at higher altitudes and elevations
    → measure to decrease the speed of propagation and the time of firemen intervention
  - **storms**: windfall and broken branches → decrease the stands density
    → to look at the regeneration and see if young trees regenerate naturally or not

- **increase of the elevation of the tree line**
  - positive impact: forests will be able to maintain soil and the snow on new areas
    → their protective function will increase

- Until now, **no specific policy is developed to face these challenges**
SYSTEMATIC MAPPING OF PROTECTIVE FUNCTION

- Interreg project IV (2007-2013)

- Urban area of Grenoble (Northern Alps)

- Systematic application of Hazard Control Index (IMA)
  - in regard to rock fall
  - in regard to snow avalanches

- Quite representative of the role of protective forests in the high elevation mountains of France (Alps and Pyrenees)
1. Rock fall hazard (using an Irstea 3 D model)

- with protective forest
- without protective forest

2. Resulting Risk Plan

“Green zones”: identified forests are subject to specific silvicultural measures
TAKE HOME MESSAGE

▪ Forest with protective function against natural hazards (erosion, avalanches, rock fall) is a low part of French forests, specific to mountain areas

▪ Other issues to consider: agriculture, ecology, tourism

▪ Mainly private owners with no management, but a specific management by ONF in public forests

▪ Specific French silvicultural guides adapted to different mountain regions

▪ Financial and technical challenges to adapt silvicultural measures to even-aged forests, wild game and changing climate (fires and storms)

▪ A specific Index to help assessing effectiveness of forest protective functions

▪ Forests with protective functions can be considered in risk plan