

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

## 32<sup>st</sup> session of the EFC WP on the management of mountain watersheds

### French national Report

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- What does « protective forests » in France mean?

Celliers, ONF-RTM 73©



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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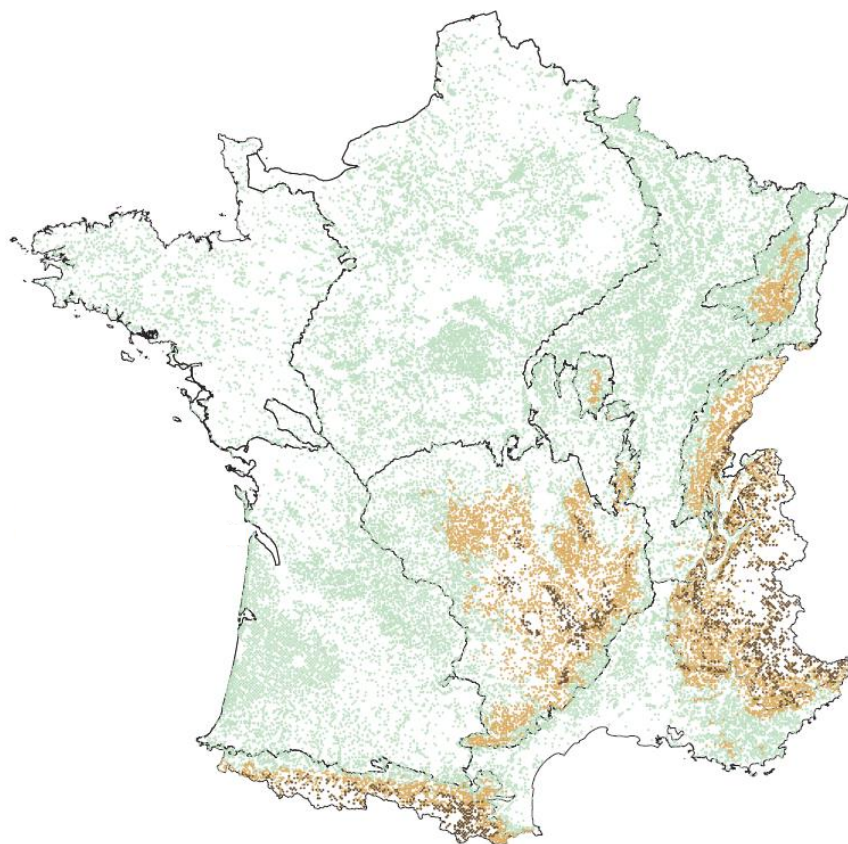
→ **with a protective function**



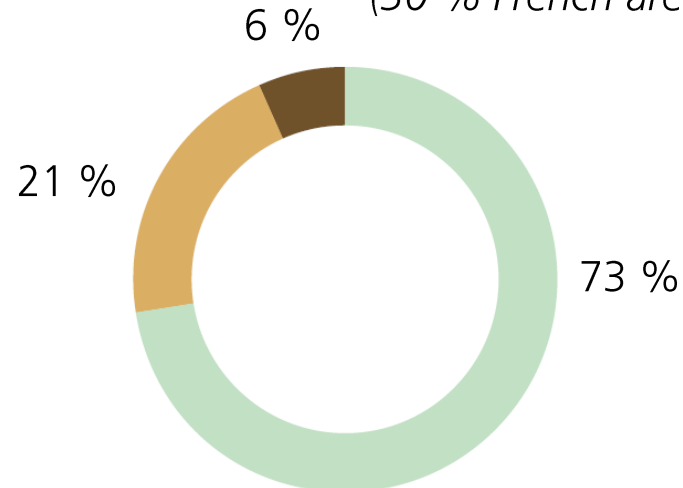
+ with an important ecological or social role

- only mountain forests

French forests by elevation (A) class



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

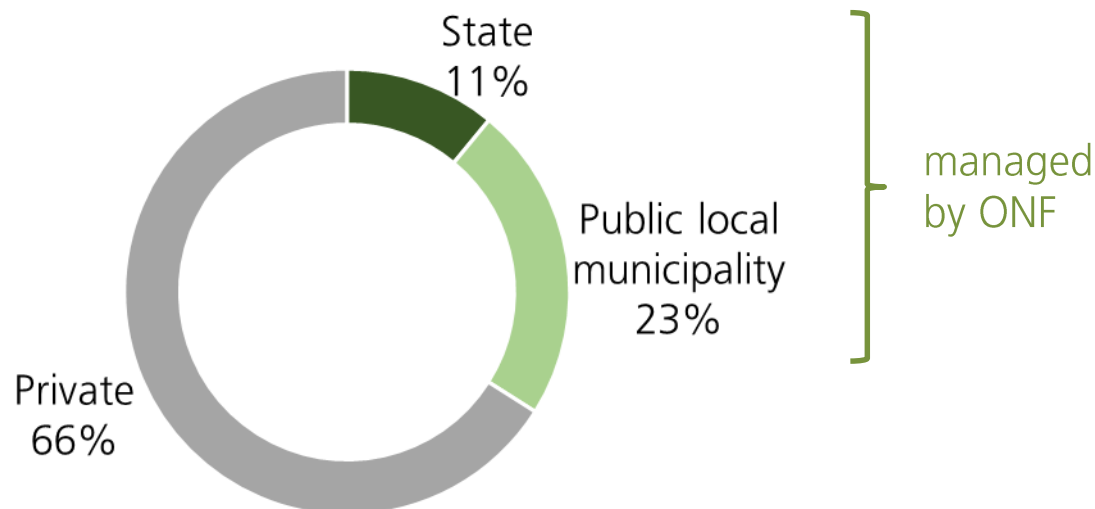


- $A > 1200 \text{ m}$
- $600 \text{ m} < A < 1200 \text{ m}$
- $600 \text{ m} > A$

**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)

- **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

1889



ONF-RTM 05©

2005



ONF-RTM 73©

- **preventing from release of snow avalanches**

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



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- **limiting or stopping rock falls**

- *forest capacity*: to decrease the speed or to stop rocks smaller than 1 m<sup>3</sup>
- *forest characteristics*: great stem density and basal area in propagation zone

- **French mountain forests:**  
mainly spontaneous



- **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 young 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

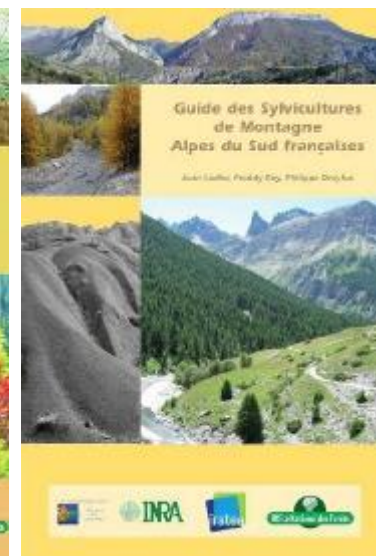
- **Private forests:** management difficulties
  - highly fragmented with most forests < 4 ha → no management obligation
  - slopes and lack of forest trails → lack of management
- **Public forests:** adapting general management to protective forests
  - **forest management plan:** main document, definition 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*)



Northern Alps



Southern Alps

## ■ 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

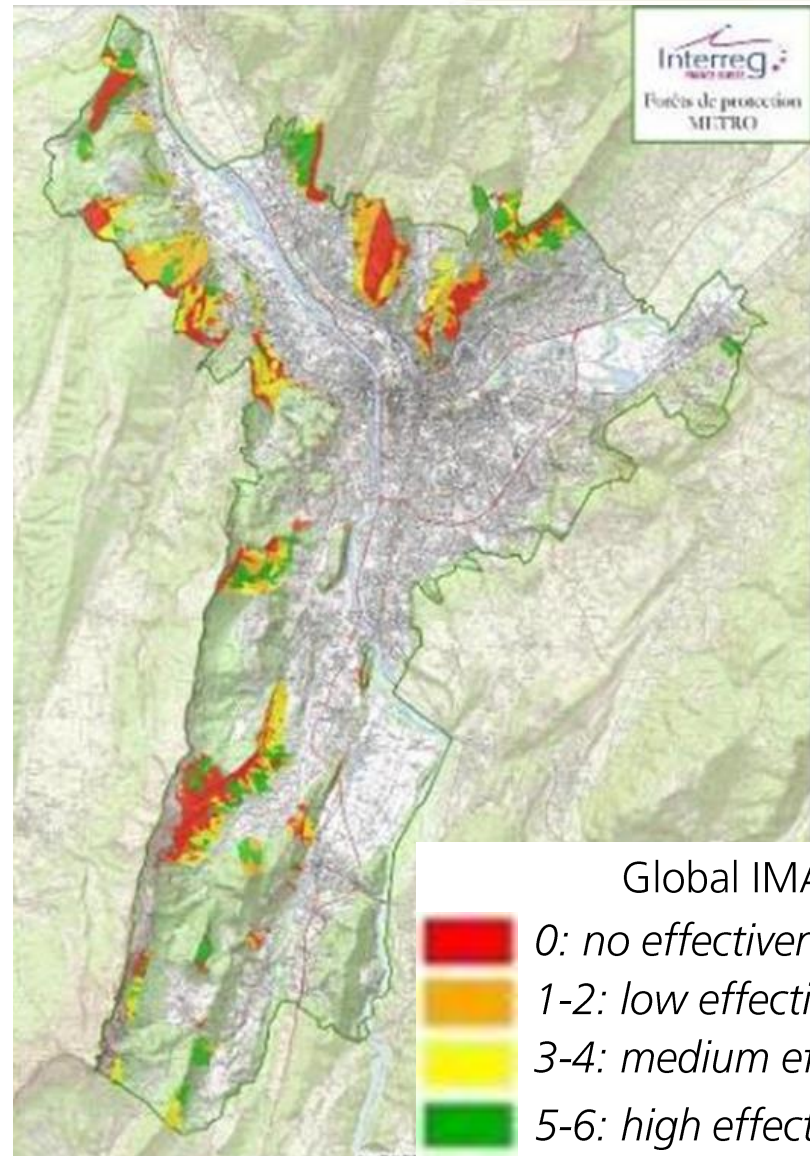
- **Effect of recreational and touristic activities** on protective forests
  - important touristic activity **increases** the places to be protected
  - some **societal conflicts** (very limited): mainly linked to skiing
- **Protective forests and ecology**
  - mountain forests are **really rich** in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

- **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**

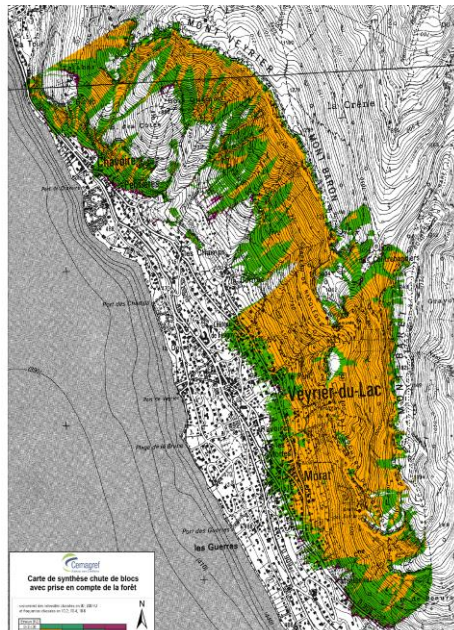
- **Interreg project IV (2007-2013)**
- **Urban area of Grenoble**  
(Northern Alps)
- **Systematic application of Hazard Control Index (IMA)**
  - in regard to rock fall
  - in regard to snow avalanches
- **Quite representative** of the role of protective forests in the high elevation mountains of France (Alps and Pyrenees)



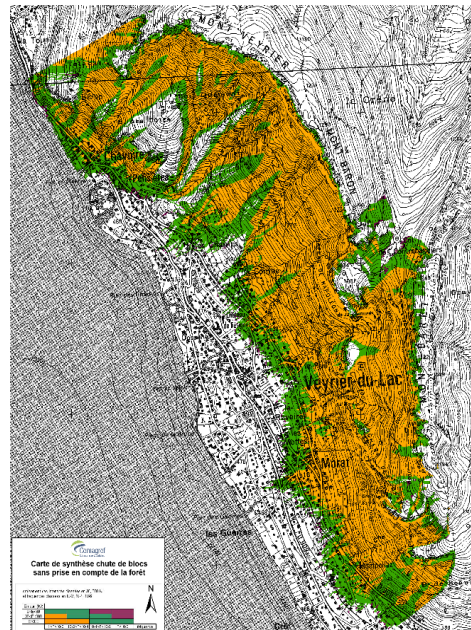
- **Example of Veyrier-du-Lac** (Northern Alps)  
→ 2010: risk plan review



## 1. Rock fall hazard (using an Irstea 3 D model)

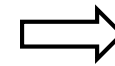


with protective forest



without protective forest

protective  
function  
of forest  
is proven



## 2. Resulting Risk Plan



■ "Green zones":  
identified forests are subject to  
specific silvicultural measures

- **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**



THANK YOU  
FOR YOUR ATTENTION

