

RESPONSE OF BIOGEOMORPHOLOGICAL PROCESSES ON MOUNTAIN SLOPES

TWO PRACTICAL APPLICATIONS OF HARVESTING IN SOUTHERN FRENCH PREALPS

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INTRODUCTION

Forest management contributes to several objectives in mountain regions. In the past, wood harvesting was used mainly for firewood and paneling. Today, forest offered a protection against natural hazard as rockfalls, avalanches, landslides and erosion. Thus, forest managements have many consequences on mountain slope processes. In the past, many studies were dealing with standing live trees. Today, forestry research focuses more and more on dead wood and slash wood. Slashes are the result of wood harvesting (logs, stump, branches, and snags).

Two case studies are presented in this paper based on different objectives of harvesting, but with one common research approach. The main objective is to study the loss of mechanical resistance and the decomposition rate of stumps.

First practical application (study 1) was to realize protection structures with slashes wood against rockfall. Slashes can offer an important protective role against rockfall. This research aims at studying the protective capacity of high stumps and lying stems. These structures can be used to increase efficiently the roughness of the soil and to limit or avoid rockfall triggering (Fig. 1.).

Second practical application (study 2) aims to increase sediment supply from hillslopes for replenishing the incised Drôme River. Clear-cut harvesting on forested slope increased sediment production and facilitate their transport to the river. One experimental area has been established in 2006 to study these processes on one forested slope and one clear-cutting slope (Fig. 2).



Fig. 1 Protection structure against rockfall



Fig. 2 Experimental site of Ausson, France

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METHODS

The predominant species sampled is the black pine (*Pinus nigra*) as in the rest of Southern Alps. It was planted since the late 19th century to reforest the catchment areas in order to control erosion. The type of climate is Mediterranean mountainous climate.

For both studies a jointly chronosequence analysis has been established in three forests. This chronosequence is made of black pine samples following harvesting, including 1, 5, 10, 15, 20 and 25 years since harvest. It was collected from similar sites within the Vercors and Diois mountains, an upland area underlain by Mesozoic limestone and marl and with a maximum elevation of 2000 m. The average elevation is between 600 and 800 m. The average DBH of sampled trees are between 5 and 40 cm.

Decomposition of slash wood is expressed as a decay rate constant k . Several methods for data acquisition have been used to sample stumps and to determine density and mass index necessary in the both study.

RESULTS

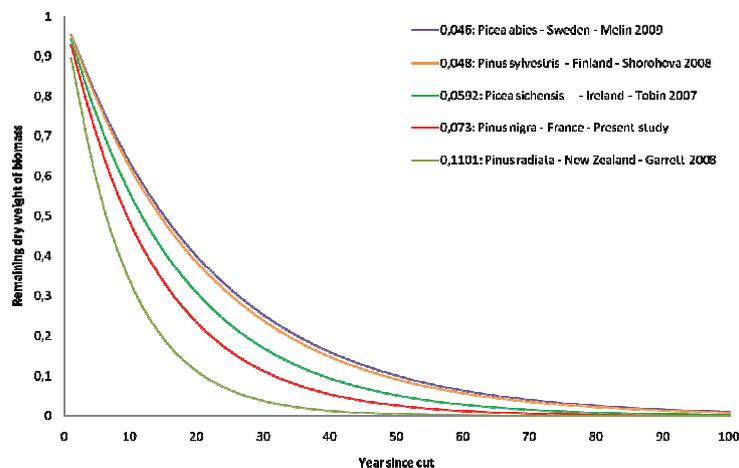


Fig. 3 Decomposition functions from previous studies of only stumps. The present study is included (red curve). All studies are based on a chronosequence approach to estimate the decay rate constants using a single exponential model.

Decomposition of stumps of black pine is faster in this alpine region as compared to spruce in Northern Alps. The main factor affecting the decomposition of wood appears to be the higher temperature (fig.3).

For study 1, the decomposition rate has been correlated with mechanical resistance of root anchorage obtained from winching test realized on the same forests. The life time of stumps since harvest seems not to exceed 42 years in mass (Fig.3). Therefore, the role of protection of high stump against rockfall has a lower life time.

Mass remaining is poor after 9 years. It has been correlated with sediment production. The density loss and the root resistance had dropped rapidly the early years after clear-cutting. Sediment production was 3 times increased (200%) during the period 2006-2010.

CONCLUSION

This research based on one common study of wood decay, allow us to improve the knowledge on decomposition of *Pinus nigra* in Southern Alps, and confirm the effect of deforestation on sediment supply from small ravines.

Keywords: rockfall, forest management, sediment recharge, decay rate, slash wood