



Natural disturbances and protective effect: the role of biological legacies in protection forests

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INTRODUCTION

Natural disturbances

Mountain forests

Protection gap
against natural hazards

Key role
of
biological
legacies

CASE STUDY

Study area

Rocca Pietore (BL),
eastern Italian Alps

Natural disturbance

Windstorm «Vaia»,
October 2018

Gravitative hazard

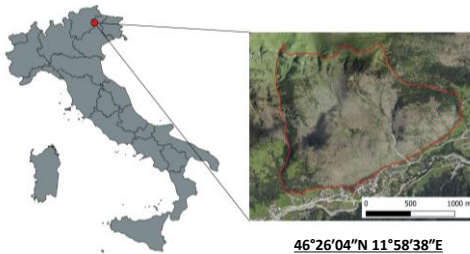
Rockfall

Biological legacies

Deadwood
(lying logs and stumps)

Forest type

Alpine forest
(mainly Norway spruce)



46°26'04"N 11°58'38"E



Figure 1. Study area in Rocca Pietore municipality (BL), eastern Italian Alps. Pictures taken during the field survey in October 2020

MATERIALS AND METHODS

Field survey

Evaluation of the terrain roughness and
the spatial pattern of biological legacies
through LiDAR data

Rockfall simulations with Rockyfor3D
(www.ecorisq.org) under different
scenarios

- 1 Before the storm Vaia (2015)
- 2 After the storm Vaia (2020)
- 3 After a hypothetical salvage logging

Computation of protective efficiency
(PE) indices for the observed forested
slope [1]

PROTECTIVE EFFICIENCY INDICES

BARrier effect Index

$$BARI(x) = 100 \times \left(1 - \frac{N_{rockforest}(x)}{N_{rockno-forest}(x)} \right)$$

Maximum Intensity Reduction Index

$$MIRI(x) = 100 \times \left(1 - \frac{E95_{forest}(x)}{E95_{no-forest}(x)} \right)$$

OverAll Protection Index

$$ORPI(x) = 100 \times \left(1 - \frac{\sum_{i=1}^n E(x)}{\sum_{k=1}^n E(x)} \right)$$

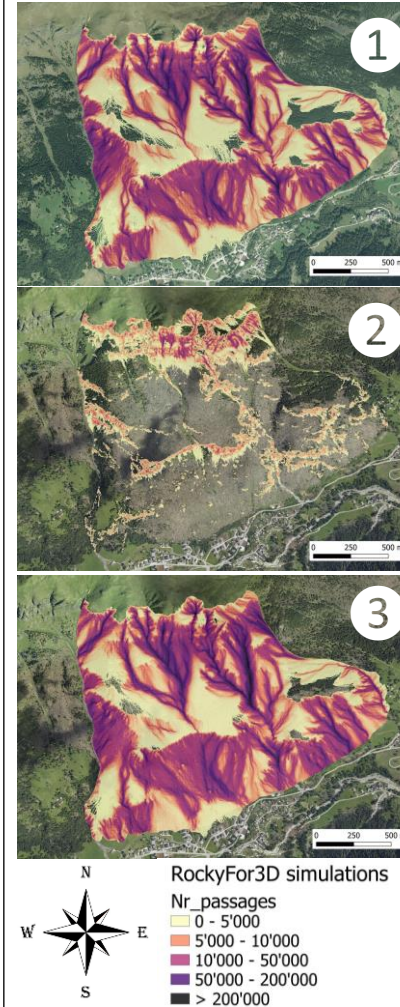


Figure 2. Rockfall simulations – Rockyfor3D

RESULTS & DISCUSSION

Protective efficiency in the different scenarios

Salvage
logging

Before the
storm

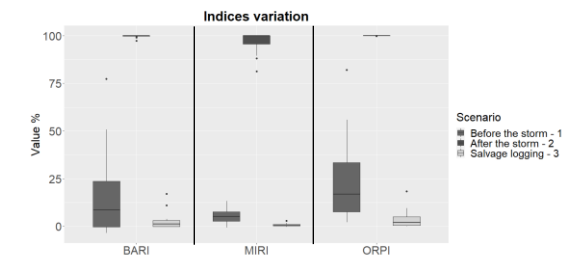
After the
storm

Role of biological legacies → barrier effect and energy
reduction of falling rocks

Avoid salvage logging in protection forests hit by a
windstorm

FUTURE CHALLENGES

How long will the effect of biological legacies last?



Scenario	Protective efficiency	ORPI median	ORPI min	ORPI max
Before the storm	Low PE	16.87	2.07	55.88
After the storm	High PE	99.99	99.74	99.99
Salvage logging	Low PE	1.90	0.19	18.36

Figure 3. Indices computation results in the different scenarios

REFERENCES

[1] Dupire S; Bourrier F; Monnet JM; Bigot S; Borgniet L; Berger F; Curt T; 2016. Novel quantitative indicators to characterize the protective effect of mountain forests against rockfall. *Ecol. Indic.*