Towards an integrated grey-green management of avalanche risk in the Alps: a study case in the NW Italian Alps

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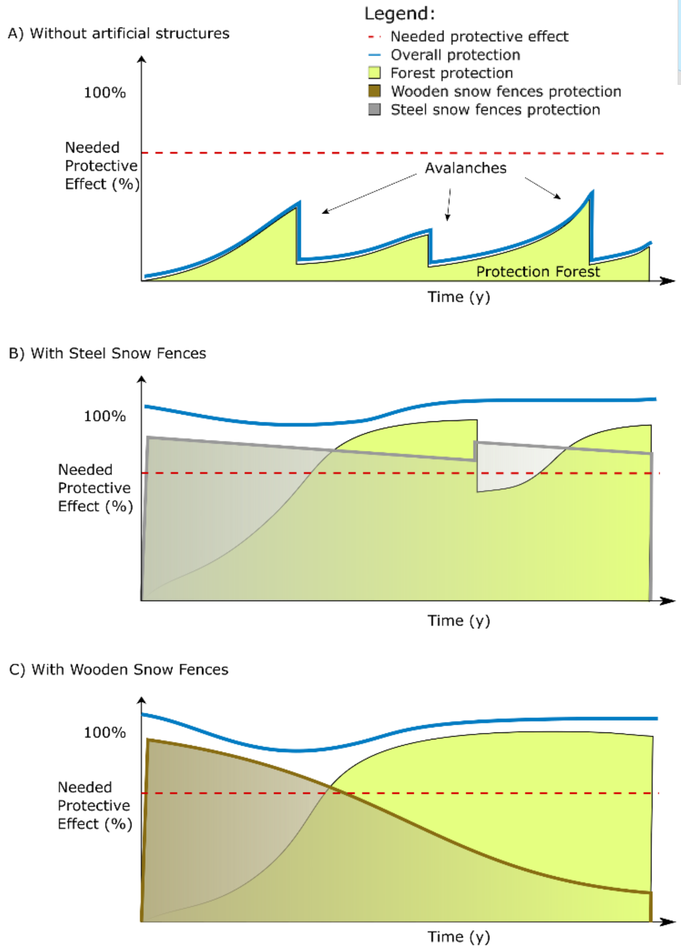
Avalanches are one of the main natural hazards affecting the Alps, therefore the expansion of human settlements and the growth of winter tourism in mountainous areas have led to a growing attention towards **avalanche prevention** and **management**.
The most common mitigation measures adopted so far are steel snow nets or snow fences, which prevent the detachment of the snow pack in the avalanche starting zones.

Aim

The aim of this work is to assess whether **steel** or **wooden** protective structures are more convenient, taking into account the influence of the rising tree-line, caused by the abandonment of pastures and climate change.

Study area

The study area is located in the Aosta Valley (Italy), where two historical avalanches were mapped and 783 m of **steel snow fences** have been placed in the starting zone of the two avalanches.



In the field surveys, the natural **forest regeneration** was measured and the results showed a mean density of 1500 plants/ha among the structures. With this result in mind we carried out an **economic evaluation** to assess whether, in this area, due to the high presence of natural regeneration, the use of wooden structures instead of steel ones would have been preferable. The economic evaluation, carried out using both project values and bibliographic data, showed how wooden structures would have been way more convenient, with a cost reduction of almost 83%. This reduction is especially due to the lack of dismantling costs for the wooden fences, that are left to degrade naturally, avoiding the stress caused to the young plants by the dismantling operations.

	Steel fences	Wooden fences	Cost difference
Construction costs (€)	861 300	195 750	-77.28%
Planning costs (€)	86 130	19 575	-77.28%
Maintenance costs (€)	8 613	9 788	+13.64%
Dismantling costs (€)	353 360	-	-100%
Total costs (€)	**1 309 403**	**225 113**	**-82.81%**