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# Monitoring post-disturbance forest regeneration dynamics at multiple scales

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Improved monitoring and management of post-disturbance environments is required worldwide to face alterations in fire regimes, associated with increasing size, frequency and severity of events, due to climate and land-use changes. This is particularly critical at climatically stressing sites and within ecosystems whose main species do not present specific fire adaptations. Understanding how to increase the resilience of these ecosystems and promote post-fire regeneration processes thus becomes a major goal.
The research is carried out in Aosta Valley (NW Italy), where a stand-replacing fire burned 260 ha of forest in 2005. Salvage logging was carried out within most of the burned area; alternative post-disturbance management practices were also experimented, differing in their potential impact on natural regeneration.
We contrasted recruitment patterns for each management option, analyzing the influence of biotic and abiotic factors.
Regeneration strategies were compared in terms of timing and efficiency of the restoration process. A particular focus was devoted to Populus tremula sprouting dynamics through a time series chronosequence derived from different remote sensing sources (satellite, airborne LiDAR, UAV).
The effect of microclimatic conditions resulting from presence/absence of shelter objects (deadwood) on seedling recruitment was investigated, also by measuring soil temperature and humidity through the growing season.
The performed analyses allowed assessing regeneration dynamics ranging from microsite to the whole landscape. Facilitation provided by both standing and downed deadwood creating safe sites for germination proved to be crucial for successful regeneration of seeder species. Aspen, showed a high rate of encroachment, whose spatio-temporal pattern was determined by different environmental variables.
Post-fire management greatly affected the capacity of the ecosystem to restore, acting on biological legacies and altering the variety and abundance of microsites.
New technologies providing high resolution information and able to acquire geographic data “on demand” (i.e. UAV) demonstrated great potential for monitoring post-disturbance recovery dynamics of vegetation.