

Forest dynamics: fire disturbance and regeneration in forest ecosystems

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During the last decades, natural disturbances in forest ecosystems have received increasing attention. It has been recognized that fire, storms, and insect outbreaks form an integral part of the forest ecosystem. Fire exerts strong control over the species composition and structure of many forests. As a general rule, landscapes with frequent severe disturbances are dominated by young even-aged stands of shade-intolerant species. Conversely, undisturbed old-growth forests consist of shade-tolerant species.

The damage of a fire event depends on fire intensity, which is directly related to flame length. The fire intensity is regulated by vegetation structure as well as by meteorological conditions before and at the time of fire. Arranged according to increasing disturbance severity, we distinguish spot fires, surface fires, and crown fires. Surface fires kill nearly all seedlings while leaving the canopy intact. Whether canopy trees are killed by a surface fire depends on the insulation provided by the bark and the length of time of the heating.

The responses of a forest to disturbance depend on the interaction of disturbance regime, species composition, and site factors. Post fire revegetation of any species is dependent on the mode of regeneration and reproduction. Species that rely on vegetative reproduction can be able to resprout (e.g. *Nothofagus antarctica*) if burned in the juvenile stage, or to resist fire in the adult stage. Disseminal-based species can have highly dispersed propagules (e.g. *Populus tremula*), they can store long-lived propagules in the soil, or pile up propagules in the canopy (e.g. *Sequoiadendron giganteum*). Therefore, colonisation after fire can occur by regeneration from on-site seeds, off-site disseminated seeds, stump sprouts, and root sprouts. The success of a reproduction strategy is first of all affected by the fire severity.

Stand-replacing catastrophic events induce large-scale regeneration of pioneer tree species. However, even when fires occur rarely, they can play a major role in maintaining species diversity. While fire may play a vital role in the invasion of exotic species in some cases, single or sporadic fires normally support a mosaic ecosystem structure. The mixed post-fire stands of *Araucaria araucana* - *Nothofagus antarctica* in south-central Chile and Argentina provide an example of fire acting as a medium of species co-existence.