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Editorial Open Access

Deadwood Flow Characteristics as an Indicator of Forest Ecosystem Naturalness

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Editorial

Forest naturalness is closely related to structural diversity of forest stands [1]. Deadwood is important for maintenance of biodiversity [2]. Tree mortality as a natural process generates a constant flow of deadwood in forest ecosystems and is a structural driver for ecosystem components. Forest naturalness indicators include deadwood volume, deadwood decay classes, size of large trees, tree species composition, canopy closure, specific epiphytic lichen, moss, and herb layer species as well as other characteristics [3,4]. Disturbance events and competition cause tree mortality and these results in continuous input of deadwood (e.g. coarse woody debris-CWD) in a forest stand. Deadwood has immediate and complex effects on the microsite environment experienced by surviving or newly germinating seedlings. Blocking the sun can reduce drought stress and increase seedling survival on sandy sites while reducing growth by shading on other sites where water is not limiting. Deadwood may also physically obstruct the herbivores to eat seedlings. During decay process deadwood can develop a seedbed for germination that may differ from surrounding soils in temperature, water holding capacity, and penetrability for roots. CWD dynamics (size, decay class, position in the stand) depend on tree species and mortality causes [5]. The amount of deadwood in a natural forest depends on several factors: the fertility of the site, the decaying process of dead trees and disturbances which have effects on the mortality rates and patterns of trees [6].

Forest management has led to reductions in deadwood volume and changes in its quality in managed forests [7,8]. Silvi cultural practices throughout Europe have deeply modified the natural disturbance regime, sometimes for several centuries, and it may take decades for a managed forest to reach the features of a natural forest [9]. Regular thinning of stands, clear-cut harvesting, efficient forest fire prevention etc. have all contributed to a general decrease in CWD in managed forests [6]. Managed forest landscapes are characterized by frequent disturbances with low variability in disturbance size and display more homogeneous tree composition, vertical stratification, age structure, and successional dynamics. The most important changes are decline in the amount of deadwood, lack of large diameter trees, and reduction of the complexity of the tree age and size structure of the stands. These differences are especially notable when managed forests are compared with late-successional stages of unmanaged forests [10].

Management practices differ from natural disturbances both in range and variance; management activities are likely to be more frequent and intense and less variable. In classical silviculture, forests are usually extremely poor in terms of the distribution and amount of deadwood; in particular there is a lack of CWD. Its quantities are normally much lower in managed forests than in unmanaged old-growth forests, as most of the large-sized harvestable timber is extracted. In addition, deadwood in managed stands typically consists only of small twigs and branches and short stumps, with few large logs or snags to be found. In the interests of sustainable forestry and biodiversity conservation, efforts are being made to increase deadwood levels in managed forests [11].

Natural forests, in contrast to managed forests, have higher variation of trees; the stands are formed by trees of various species, age and dimensions, and contain high amounts (volume) of deadwood in different decay stages [12]. Natural structures are created by disturbances, which vary depending on forest characteristics location and regional climate conditions [13]. In natural forests deadwood originates from tree mortality, which is either the result of inter-tree competition or senescence processes, or it is caused by natural disturbances, which can differ in terms of quality and quantity [14]. Disturbances can be driven by abiotic (wind, fire) and/or biotic factors (e.g., insect outbreaks). Natural disturbances such as fire and insect outbreak are often suppressed in managed forests, and landscape patterns are largely shaped by timber management activities [15].

Knowledge of forest disturbance and succession processes is relevant for developing ecologically sustainable forest management strategies including restoration of ecosystem functions. Emulating natural disturbance regimes that result in more diverse forest structure and composition provides the main conceptual framework for alternative management approaches varying from continuous cover forestry to biodiversity restoration. Assessment of deadwood dynamics and characteristics enables better evaluation of naturalness of forest ecosystems.

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