

Stand Dynamics of Silver Fir–European Beech Forests

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Silver fir (*Abies alba* Mill.) grows in mixed even- or uneven-aged stands as co-dominant tree species usually in a company of Norway spruce and European beech. In some forest communities, it appears as a minor tree species. There are three main types of silver fir forests in central and south-eastern Europe: 1) mixed mountain forests on carbonate substrate in the Alps, 2) acidophilous Norway spruce-silver fir forests, and 3) mixed mountain forests on carbonate substrate outside of the Alps. A representative of the latter is silver fir–European beech forest in Dinaric region (NW Balkan). The region is characterized by an extensive forest matrix, diverse orography, mountain vegetation, long tradition of uneven-aged forestry and therefore relatively well preserved forest stands. Stand dynamics of silver fir population in the Dinaric forests is driven mainly by 1) silviculture activities, 2) ungulate browsing, 3) environmental change (SO₂ emission and climate change), and 4) natural disturbances.

Uneven-aged forestry based on natural regeneration (silver fir has rarely been planted) and mimicking of natural stand dynamics is more appropriate to maintain silver fir in the mixed Dinaric forest if compared to even-aged silviculture. Some silvicultural systems such as a plenter system favour shade tolerant silver fir “on the account” of other native tree species.

Large ungulates, especially roe deer population (*Cervus elaphus* L.) have recently become the major cause for recruitment failure of silver fir into forest stand. Absence of recruitment has already reflected in aging of silver fir population, and indicates the decline of silver fir in the next decades in the region. It seems that under high density of roe deer population, silviculture systems have a limited capacity to maintain silver fir in the mixed stands.

In the 1960s-1980s sharp decline of silver fir across the Dinaric region was evident, followed by a dramatic recovery. Results of dendrochronological methods showed that SO₂ emission explained a larger part of variability in radial growth of fir during the 20th century, but climatic factors were significant, too. Decline of silver fir across the region varied noticeably in regard to orography and climate conditions.

Studies of old growth forests in the region showed that natural disturbance regime is characterized by small scale disturbances, while intermediate disturbances are rarely present - mainly caused by wind, snow or ice storm. The “freestyle” silviculture that applies elements of various uneven-aged systems seems to be appropriate way to mimic natural stand dynamics of silver fir-European beech forests.