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Understory vegetation in monocultures vs mixed forest – the difference rests in how we mix

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The ′monoculture′ approach to silviculture is increasingly challenged by growing evidence for the benefits of mixed-species stands. Relative to monocultures, mixtures often have higher stand-level biodiversity, with associated benefits for many ecosystem services. However, in order to pursue the potential benefits of mixtures, decisions must be made regarding the desired share of tree species and their spatial arrangement within a stand. However, current evidence is insufficient to inform decision makers as to which mixture approach is most effective at achieving desirable biodiversity and ecosystem service outcomes.
The understory vegetation of northern forests constitutes the bulk of plant biodiversity in these forests. Understory species differ widely in important functional traits such as growth rate, morphology and litter quality, with this diversity underpinning key benefits to society in terms of the ecosystem goods, services, and functions provided. These benefits include habitat and resources for many species, clean water, nutrient and carbon cycling, and the provision of non-wood forest products (e.g. berry production, food for game species). Understory plant communities respond to changes in the spatio-temporal and taxonomic variation of the overstory, and the replacement of monocultures with mixed-species forests may be expected to have effects on understory communities and the resultant goods and services provided.
To test the outcomes of different mixture alternatives on understory vegetation we surveyed understory vegetation in even-aged 30 to 50 year old stands in southern Sweden, using plots which varied from pure Norway spruce (Picea abies) to a pure birch overstory (Betula spp.). Our results indicate that although total tree basal area has a negative influence on the total cover and species richness of vascular plants, this influence is somewhat relaxed with an increasing share of birch in the overstory. The share of birch promoted both vascular abundance and species richness. This effect was, however, only present at low total basal area. For the high basal area levels commonly achieved within spruce dominated forests of this region, even relatively high proportions of birch may provide only small benefits to understory communities. Our results quantify these relationships, and indicate that in order to achieve understory benefits in mixed species forests, the tree species proportion, tree spatial arrangement, and basal area must all be considered. Our results have many implications, including that recent attempts to use green-tree retention to increase the proportion of broadleaf tree species in conifer production stands are unlikely to provide understory benefits if mixed stem-wise, but may have a positive effects if clustered group-wise. We discuss our results in regards to conservation initiatives, and climate change mitigation targets for increased wood production.