stands remain rather limited. Competition for resources can be proportional to the size trees (symmetric competition) or more than proportional (asymmetric competition). It is hypothesized that in dry and nutrient-limited conditions competition is symmetric whereas in milder situations competition is asymmetric. In this presentation we investigate the mode of competition (asymmetry versus symmetry) in mixed versus pure stands of European beech and Scots pine. Data from a transect of triplets of both species across Europe was used. A triplet is a set of three plots representing two pure stands and one mixed stand of the corresponding species. Mixing effects, i.e. if the mode of competition of species growing in mixtures differs from that found in pure stands, and modifications of the mode of competition due to changing environmental conditions are assessed using size-growth relationships. Our hypothesis is that symmetric competition is dominant in dry years whereas the strength of the competition is modulated by mixing effects. First results indicated that the mode of competition is site-specific with divergent mixing effects across Europe.

Complementarity in mixed stands of Norway spruce (*Picea abies* L. Karst) and European Larch (*Larix decidua* Mill.): the contribution of stand characteristics

Hubert Sterba[1]; Gerald Dirnberger[1]; Tim Ritter[1]
[1]University of Natural Resources and Life Sciences, Vienna, Austria (hubert.sterba@boku.ac.at; gerald.dirnberger@boku.ac.at; tim.ritter@boku.ac.at)

Interactions between complementarity and stand and site characteristics have been found in many investigations. However, mixed stands of Norway spruce and European larch are among the least-investigated mixture types. Twelve plots, sized between 0.25 ha and 1.6 ha, were established within stands of varying age and proportion of European larch and Norway spruce, at altitudes between approximately 880 and 1330 m above sea level located in the northern part of the eastern intermediate Alps in Austria. Tree coordinates, diameter at breast height, tree height, crown height, and crown projection area were measured for all trees within the plots. All trees were cored at breast height, and from a sub-sample of about 200 felled trees, equations for leaf area and for the five-year volume increment were developed. We found a clear interaction between age and the volume increment of a species per its fraction of the stand area (growth efficiency). In mixed young stands, the growth efficiency of both species was less than the reference from the pure stands, while in the older stands especially spruce had a much higher growth efficiency in the mixed stands. Furthermore, we found that the Clark Evans index (i) explained more variance than the species proportion and (ii) revealed an additional influence of stand density on the complementarity of the species.

Fine-root soil exploration and exploitation in mixed and monospecific forest stands across Europe

Janna Wambsganss[1], Friderike Beyer[1], Gregoire Freschet[2], Michael Scherer-Lorenzen[4], Jürgen Bauhus[1]
[1]Chair of Silviculture, University of Freiburg, Freiburg, Germany; [2]Centre d'Ecologie Fonctionnelle et Evolutive, Montpellier, France; [3]Institute of Geobotany, University of Freiburg, Freiburg, Germany (janna.wambsganss@waldbau.uni-freiburg.de; friderike.beyer@waldbau.uni-freiburg.de; gregoire.freschet@cefe.cnrs.fr; michael.scherer@biologie.uni-freiburg.de; juergen.bauhus@waldbau.uni-freiburg.de)

Mixed-species forests have often been shown to enhance above-ground ecosystem properties and functions. Despite the significance of fine roots for tree and ecosystem functioning, the role of tree species diversity for below-ground functions driven by fine roots such as nutrient exploitation remains largely unknown. Therefore, the objective of this study was to assess the effect of tree species diversity on fine-root soil exploration and exploitation for 13 different tree species along an environmental gradient at four study sites in Finland, Poland, Romania and Italy. We hypothesized that: (1) owing to niche differentiation among species, the overall exploration and exploitation of soil volume by fine roots would be higher in mixed species stands than in monospecific stands; (2) such complementarity effects would be greater at sites with less favorable environmental conditions such as soil water availability and nutrient status. Soil cores were taken at the level of tree neighborhoods in mature tree species mixtures consisting of three tree species and corresponding monospecific stands in four major European forest types. Morphological, architectural and chemical fine-root traits were measured, in addition to total fine-root biomass. Roots were sorted by species and a functional classification approach was applied to distinguish absorptive from transport fine roots by root order. Initial results show effects of different tree species diversity levels on the measured fine-root traits. If corroborated by further analyses, such changes in fine-root traits related to soil exploration and exploitation could indicate enhanced resource uptake in mixtures and thereby positive effects on overall ecosystem functioning.

Did belowground N transfer in mixed plantations of *Acacia mangium* and *Eucalyptus* meet the Stress Gradient Hypothesis?

Ivanka Rosada de Oliveira[1], Ranieri Ribeiro Paula[2], Bruno Bordron[3], Alexandre Vicente Ferraz[4], José Leonardo Moraes Gonçalves[1], Iraê Amaral Guerrini[5], Agnès Robin[1,6], Jean-Pierre Bouillet[1,6]
[1]Escola Superior de Agricultura "Luiz de Queiroz", Universidade de São Paulo Piracicaba, Brasil; [2]Universidade Federal do Espírito Santo, Jerônimo Monteiro, Brasil; [3]Embrapa Florestas, Colombo, Brasil; [4]Instituto de Pesquisas e Estudos Florestais, Piracicaba, Brasil; [5]Universidade Estadual Paulista Júlio de Mesquita Filho, Botucatu, Brasil; [6]CIRAD, Montpellier, France (ivanka.ivi@gmail.com, ranieriripaula@gmail.com; bruno.bordron@gmail.com; alexandre@ipef.br; jlmgonca@usp.br; iguerrini@fca.unesp.br; agnes.robin@cirad.fr; jeanpierre.bouillet@cirad.fr)

Belowground interactions in mixed forest plantations remain poorly understood as that of short-term nitrogen (N) transfer from N-fixing trees to non-N-fixing trees (Non-NFT) depending on nutrient availability. We investigated if this facilitation process met the Stress Gradient Hypothesis, which predicts that under stressful environmental conditions competition decreases and facilitation increases. A 15N pulse-labelling study was conducted in a five-year-old mixture of 50% Eucalyptus grandis x *E. urophylla* and 50% Acacia mangium with the hypothesis of higher N transfer from acacia when no fertilization was applied. A complete randomized block design was set up with three replicates of fertilized and non-fertilized mixture. In each treatment of each block, a labeled solution of potassium nitrate (98 atom% 15N-NO3) was injected into the stem of an Acacia tree with the same basal area as the average of the stand. The x (15N) was monitored over two months in each labeled acacia and four neighboring eucalypts. For both species, young leaves and fine roots were sampled at 7, 14 and 30 days after injection. After 60 days, the x (15N) was determined in the wood, bark, branches, total foliage and fine rootsof the 6 labeled acacias and 12 eucalypts trees. The preliminary results showed that complete absorption of the labeled solution occurred between 28 and 60 days after labeling depending on Acacia trees and treatments. The dynamics in the proportion of Eucalyptus N derived from transfer will give insights into how this process may promote N nutrition of non-NFTs growing in unfertile tropical soils.