FORBIO experiment – Hechtel-Eksel

Investigating the effects of tree species diversity on forest ecosystem functioning

Site “Zedelgem”

Site “Hechtel-Eksel”

Site “Gedinne”

4-species plot

Forest complex “Bosland”

Unplanted
One species
Two species
Three species
Four species

5 species
4 diversity levels
20 sp. compositions
2 replicates

1,5m x 1,5m
Cell of 3 x 3 trees/species
Plots of 36m x 36m
576 trees/plot

Rainfall: 799 mm/year
Mean Temp.: 9°C
Temp. January: 1,4°C
Temp. August: 16,7°C

Monitoring: sapling survival, vitality and growth, litter decomposition, understory vegetation, ...

Late autumn 2012

23 040 trees

Heathland converted to pine plantation in 1908

Dry sandy soil with gravel substrate (Podzol)

pH KCl 3.4
P 110 (mg/kg)
N 0.08 (%)
C 2.9 (%)
C/N 36
Z 56,7 m

Larix kaempferi
Quercus petraea
Betula pendula
Pinus sylvestris
Pseudotsuga menziesii

Planting winter 2012-2013
FORBIO-meeting Jan. 2015
Summer 2016

Rainfall:
Mean Temp.: 9°C
Temp. January: 1,4°C
Temp. August: 16,7°C

pH KCl 3.4
P 110 (mg/kg)
N 0.08 (%)
C 2.9 (%)
C/N 36
Z 56,7 m
Ongoing research

Sapling survival (PhD Thomas Van de Peer)
Mean plot-level survival did not increase with species mixing, and thus, an overall performance-enhancing effect was lacking. However, species-level analyses did show such effects, as some (but not all) species took profit from mixing.

The results furthermore indicate that planting trees in mixtures instead of monocultures limits planting failure and facilitates canopy closure: an insurance value of biodiversity on sapling survival. Planting failure is a major concern in many forestation projects as the initial investment for planting trees affects financial balances. (Results based on the three FORBIO sites, see: Van de Peer et al (2016) Biodiversity as insurance for sapling survival in experimental plantations. Journal of Applied Ecology, 53 (6), 1777-1786)

Sapling growth (PhD Thomas Van de Peer)
After four years, tree growth rates differed strongly between the species, but these growth rates were not affected by species interactions. This is a consistent result across the three experimental sites in FORBIO. After eight years, overyielding was observed in 83% of the mixtures in Zedelgem and Gedinne (data not yet available for Hechtel-Eksel) and was caused by complementarity (in Zedelgem) and competitive dominance (in Gedinne).
(This work is in progress)

Functional traits (PhD Thomas Van de Peer)
Functional traits are increasingly used to understand biodiversity-ecosystem functioning relationships. We measured Specific Leaf Area (SLA, 600 trees) and Wood Density (WD, 300 trees) in all monocultures and two-species mixtures. This data will be used to investigate how species traits (or shift in species traits) contribute to the functioning of diverse tree communities, which particular focus on productivity. (This work is in progress)

Global litter decomposition (Research Ika Djukic)
FORBIO participates in a litter decomposition project covering many tree diversity experiments worldwide. The goal is to investigate long-term litter decomposition dynamic along tree diversity gradients by using a standardized protocol (tea bags). Tea bags are placed in more and less diverse environments surrounding a target tree species and are harvested after 3, 12, 24 and 36 months.

The first results (after 3 months) indicate a strong context-dependency of litter decomposition rates in terms of abiotic site conditions. However, diversity and species composition of a local neighborhood are not yet relevant in this initial stage. (This work is in progress)