

Cluster planting as a lower cost alternative

Lessons learned from the central European oak cluster planting trials

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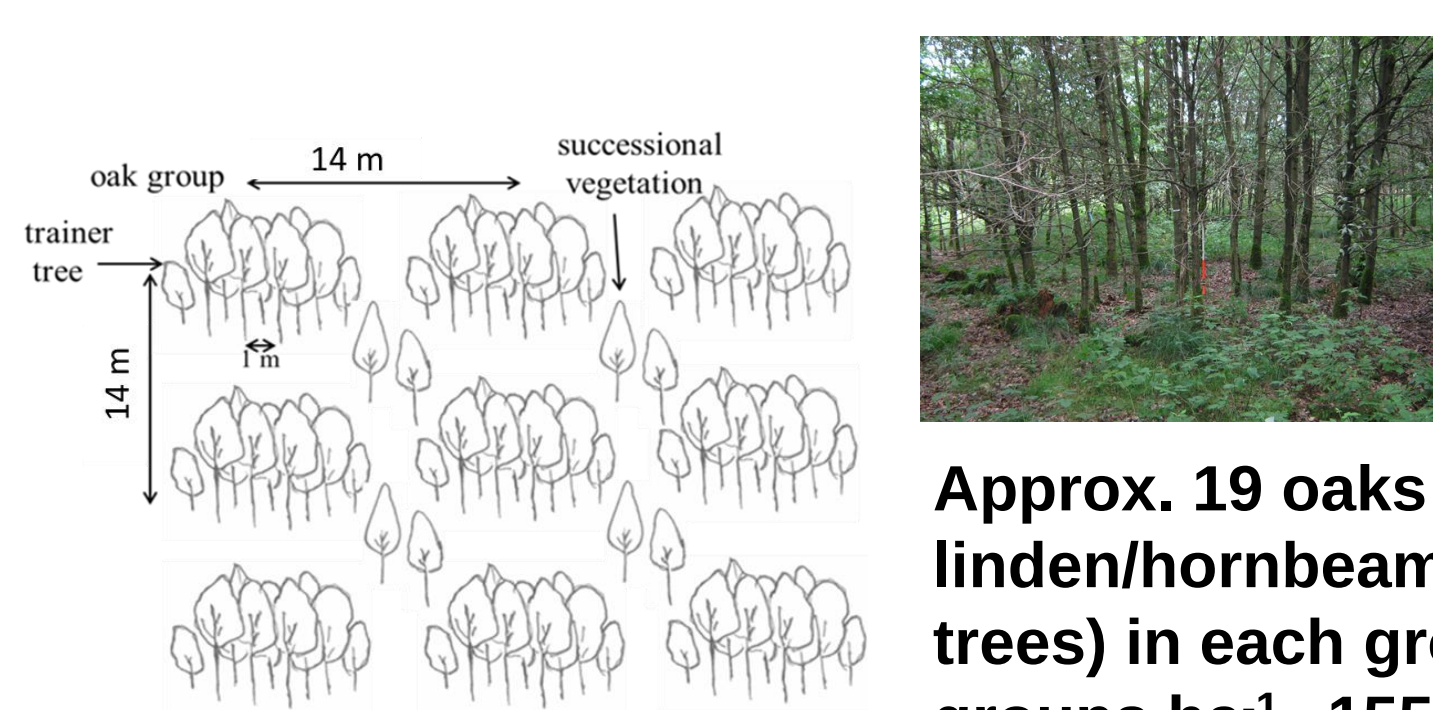
Background

Oak cluster planting was introduced in central Europe as an alternative to the **conventional oak row planting**. The goal was to reduce the planting cost, create diverse, and high-valued mixed forests. Two most common variants of oak cluster planting were widely spaced **group planting** and more denser **nest planting**. Interests on oak cluster planting increased in Germany for restoring wind-thrown sites in 1980s and 1990s.

We will present results from the first comprehensive and comparative assessments between oak cluster and row planting.

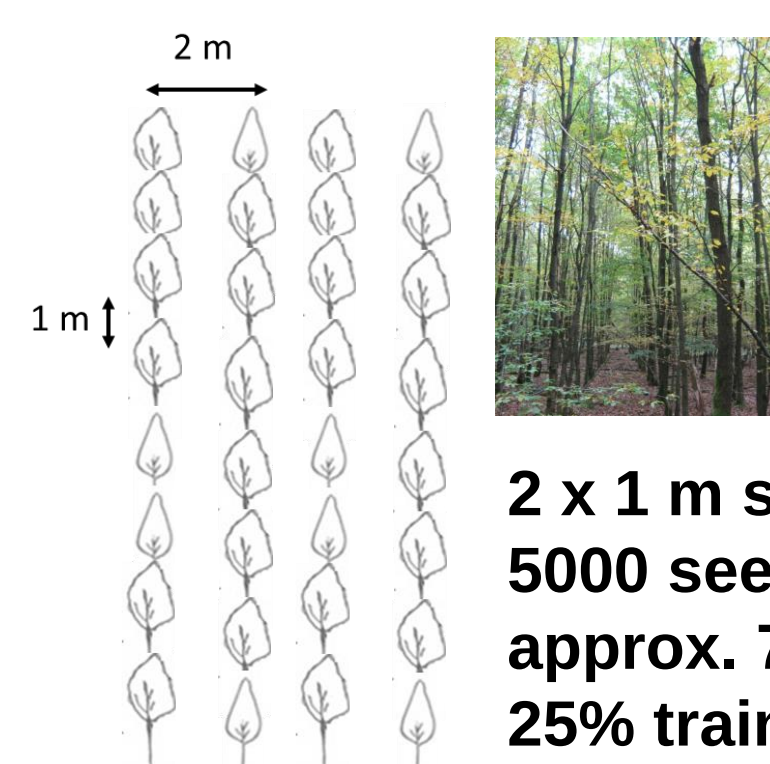
Planting design

Oak group planting



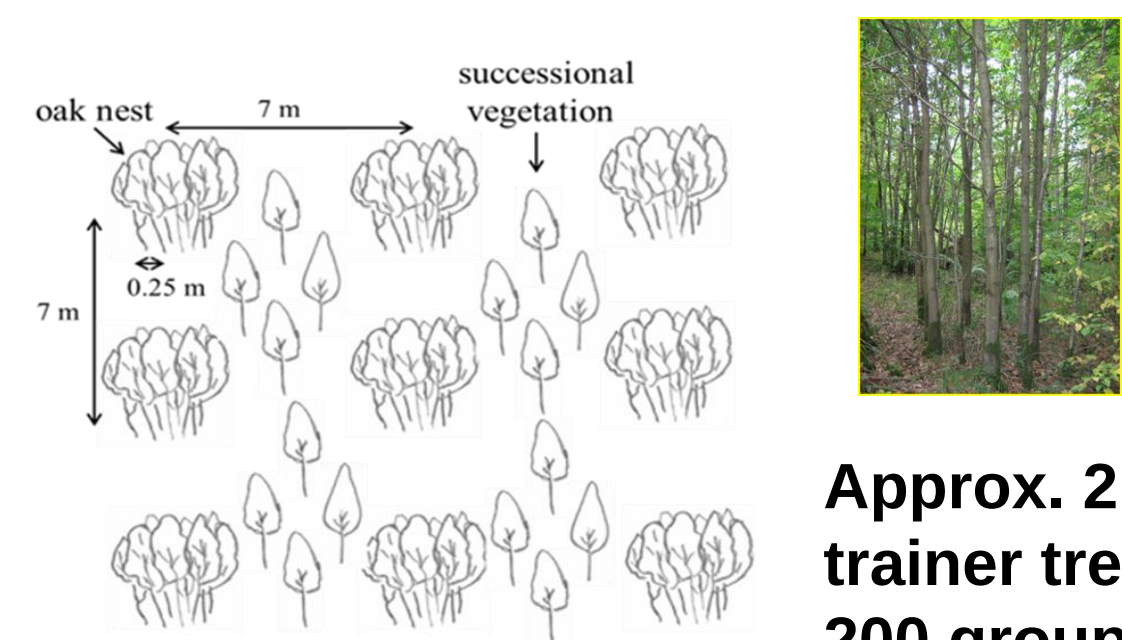
Approx. 19 oaks and 12 linden/hornbeam (trainer trees) in each group, 50 groups ha^{-1} , 1550 seedlings ha^{-1}

Oak row planting



2 x 1 m spacing, 5000 seedlings ha^{-1} , approx. 75% oak and 25% trainer trees

Oak nest planting

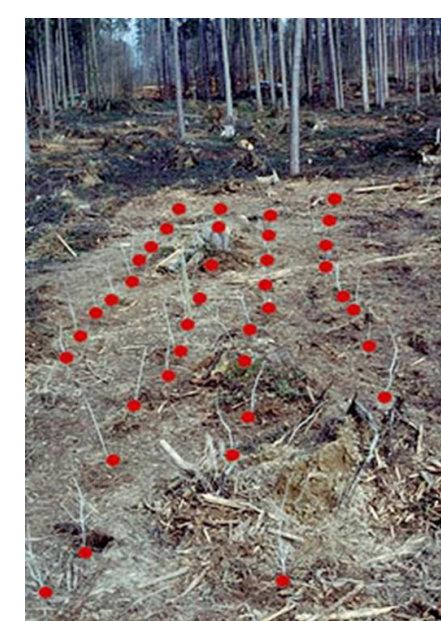


Approx. 21 oaks (no trainer trees) in each nest, 200 groups ha^{-1} , 4200 seedlings ha^{-1}

Site preparation for cluster and row planting at a windthrown site



Slash, broken logs, and mounds were not removed between clusters



Extensive site preparation was required for row planting

Initial planting cost (with browsing protection) in SW Germany

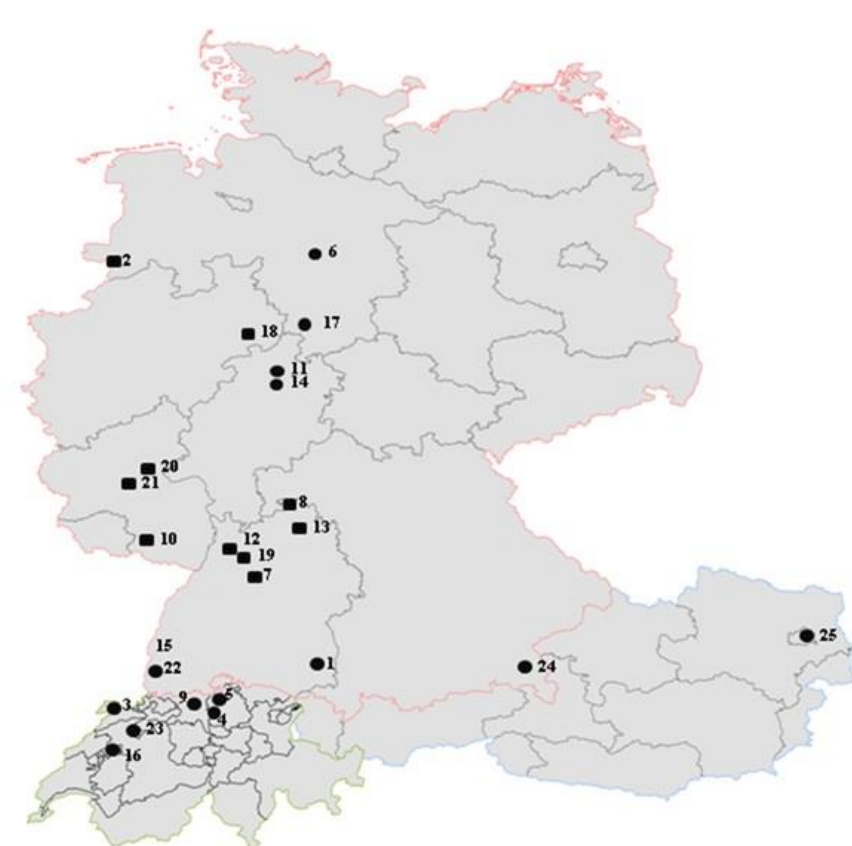
Row planting: approx. 18000 Euro ha^{-1}

Nest planting: approx. 10000 Euro ha^{-1}

Group planting: approx. 6000 Euro ha^{-1}

Aimed to compare:

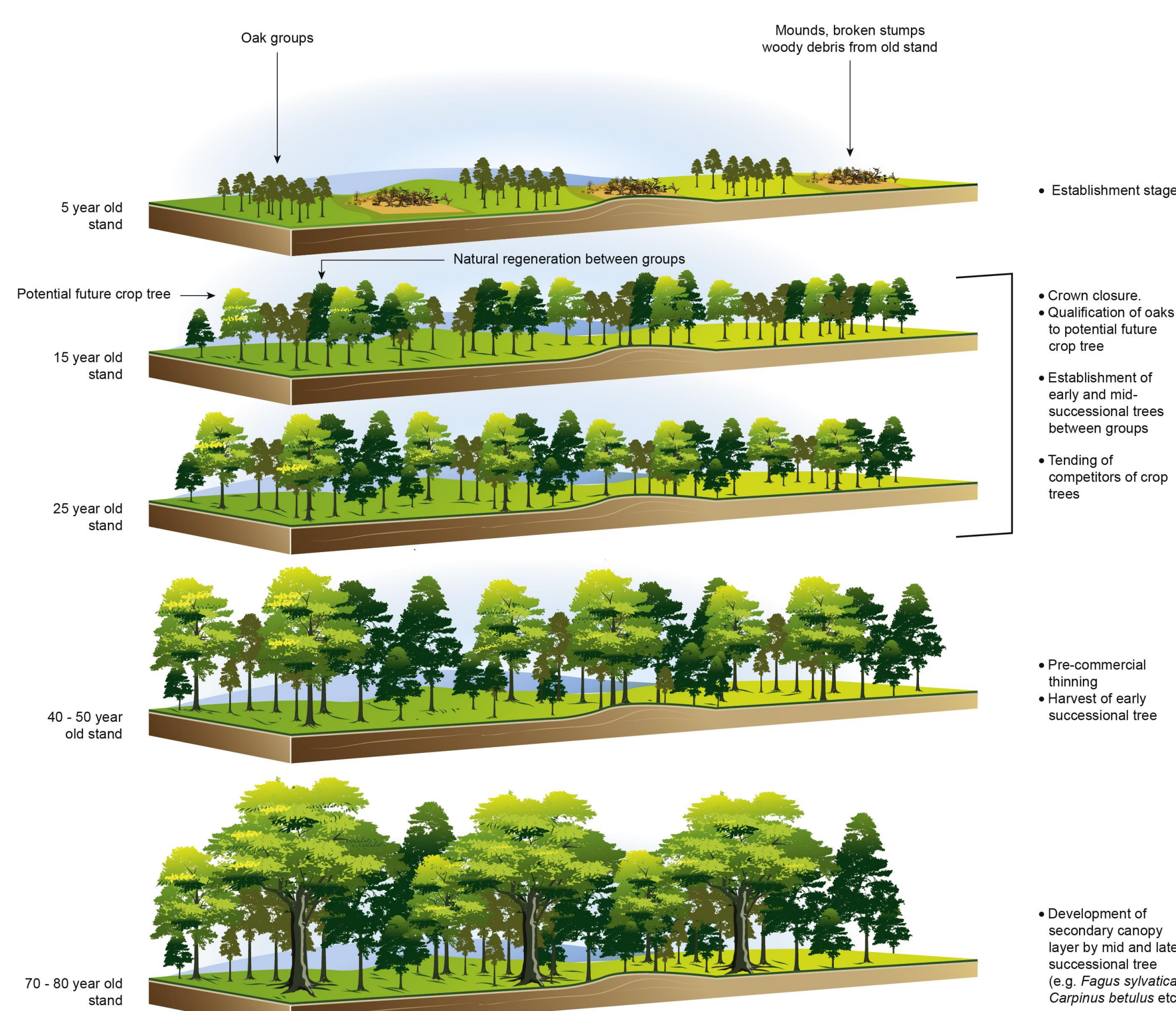
1. tree quality and growth,
2. species diversity and stand basal area,
3. natural regeneration,
4. and spatial distribution of crop trees between cluster and row planting.



Study sites:

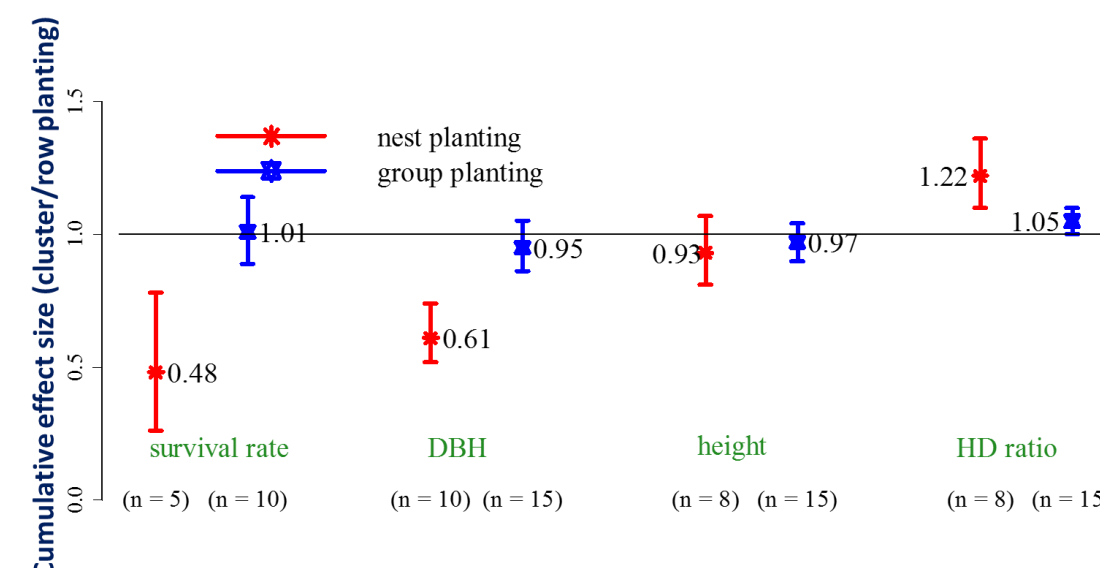
54 stands in 25 sites in Germany, Switzerland and Austria

Potential future development of an oak group planting stand

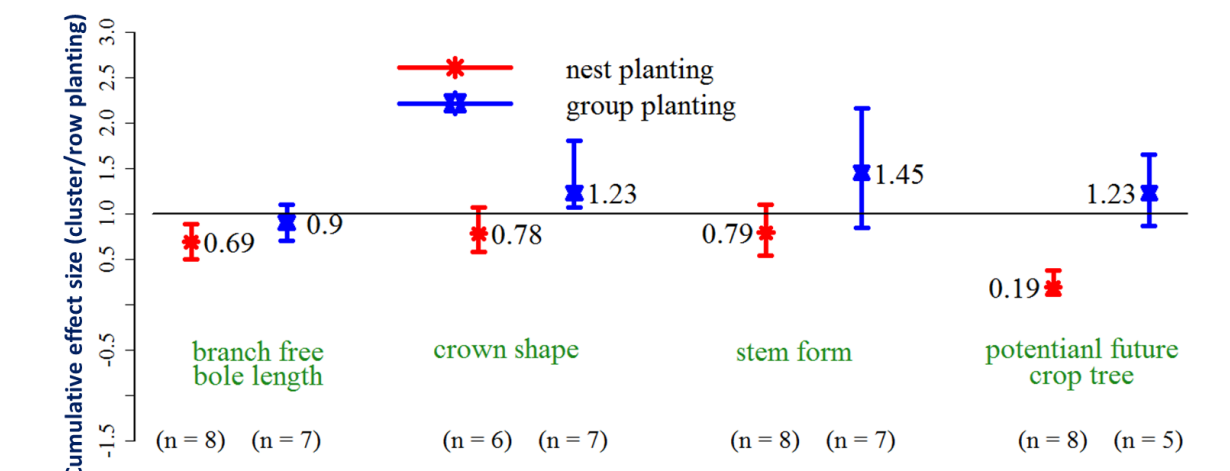


Results

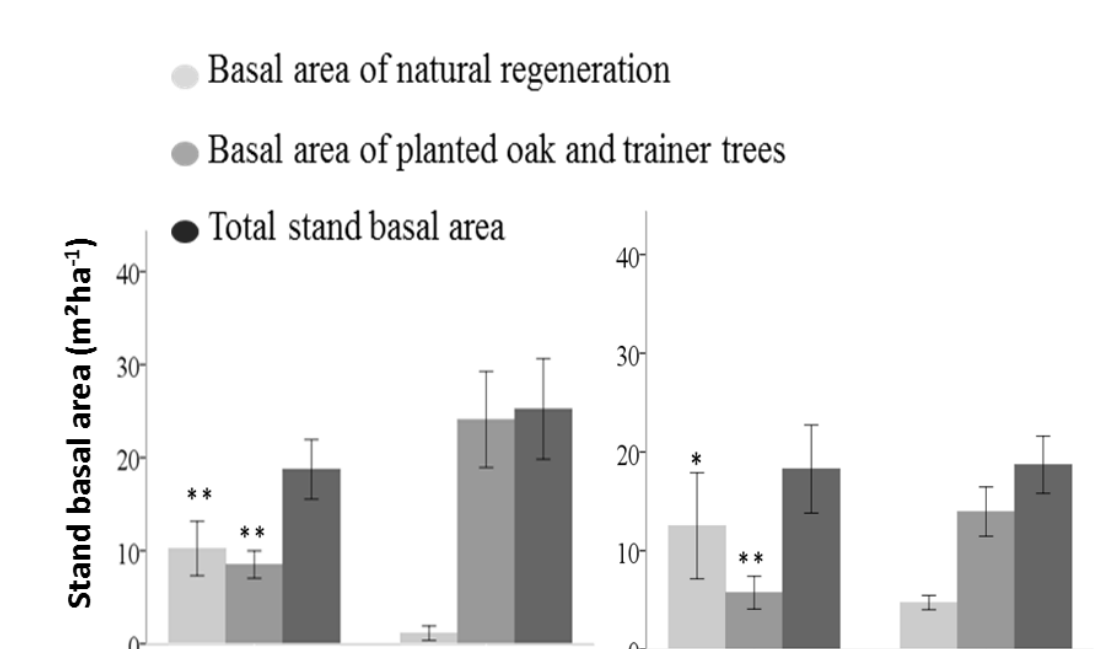
Better growth and higher survival in group planting, but, not in nest planting



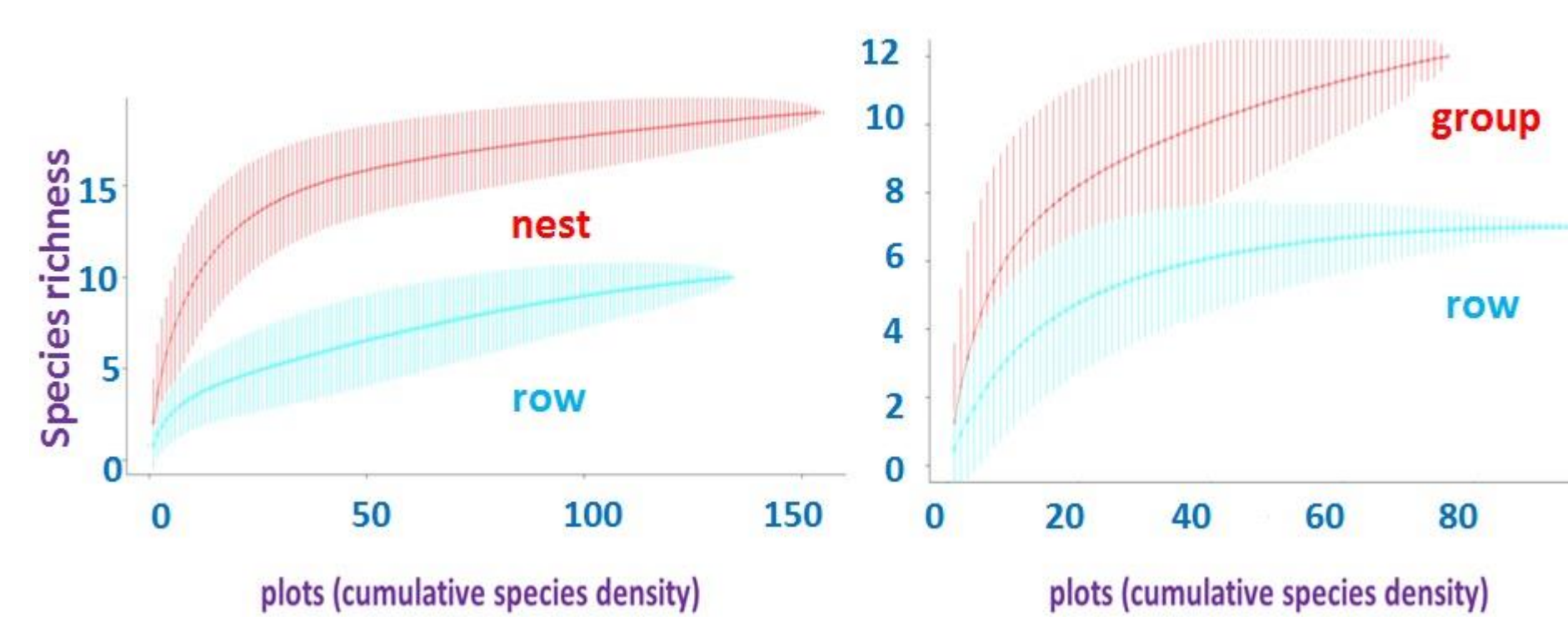
Superior quality of oaks and higher proportion of crop trees in group planting



Stand basal area was comparable between group and row planting due to high natural regeneration between groups



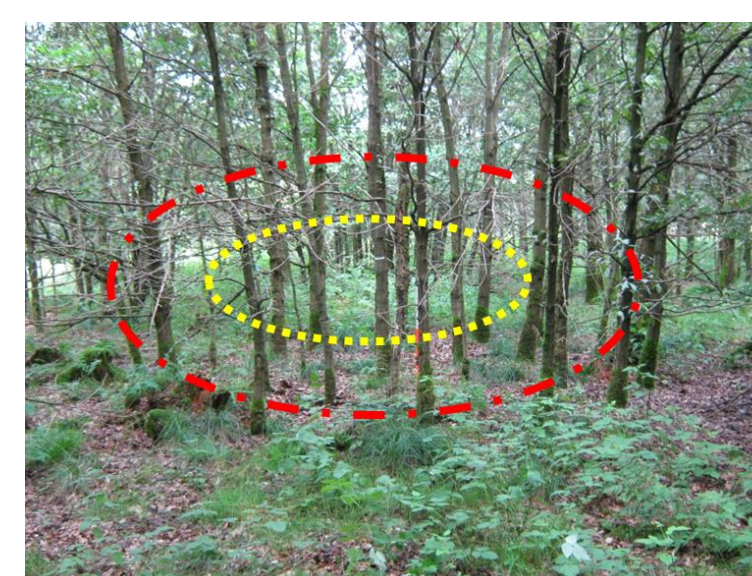
High proportion (38%) of naturally regenerated future crop trees in group planting



Cluster planting had higher tree species diversity than row planting

Future crop trees were more homogeneously distributed in group than row planting

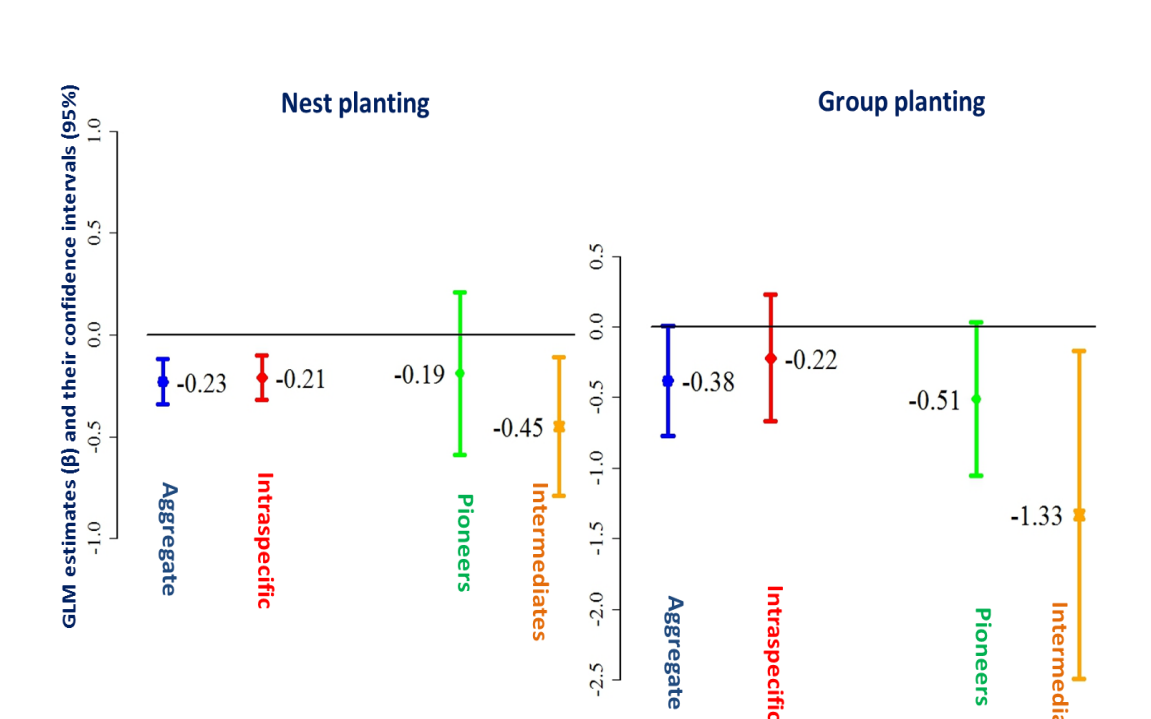
	Observed mean distance (m)	Expected mean distance (m)	Nearest neighbour ratio	z-score	p-value
Group planting	5.5	2.65	2.06	22.6	< 0.01
Row planting	8.3	3.5	2.37	22.2	< 0.01



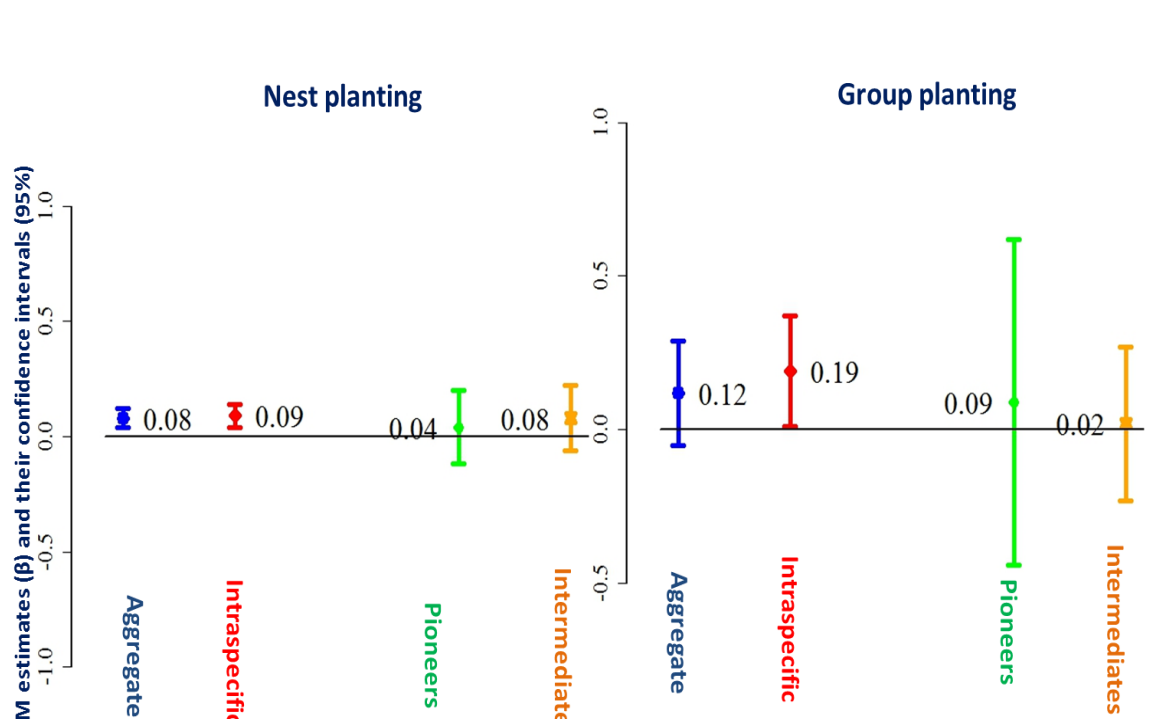
Inner oaks had 64% higher probability to be qualified as future crop tree than outer oaks in groups

Intraspecific interactions facilitated oak quality. Neighbourhood competition had higher negative effect on DBH in nest planting than in group planting.

Target variable: DBH



Target variable: branch free bole length



Conclusions

1. Oak group planting can be used as an alternative to row planting. However, nest planting should not be continued due to high mortality of oaks, poor growth, and inferior quality.
2. Oak group planting fosters high diversity and biomass without reducing the option for high quality oaks.
3. High diversity in crop trees would reduce risk in group planting.
4. Oak group planting significantly reduces initial planting cost. This technique of stand regeneration can be opted where management goal is to create diverse and high quality forests with low costs.
5. Cluster planting approach can restore wind-thrown sites in low cost.
6. Trials of group planting with other tree species should be installed in other regions of the world.