

Forest stand management regimes under changing environmental conditions



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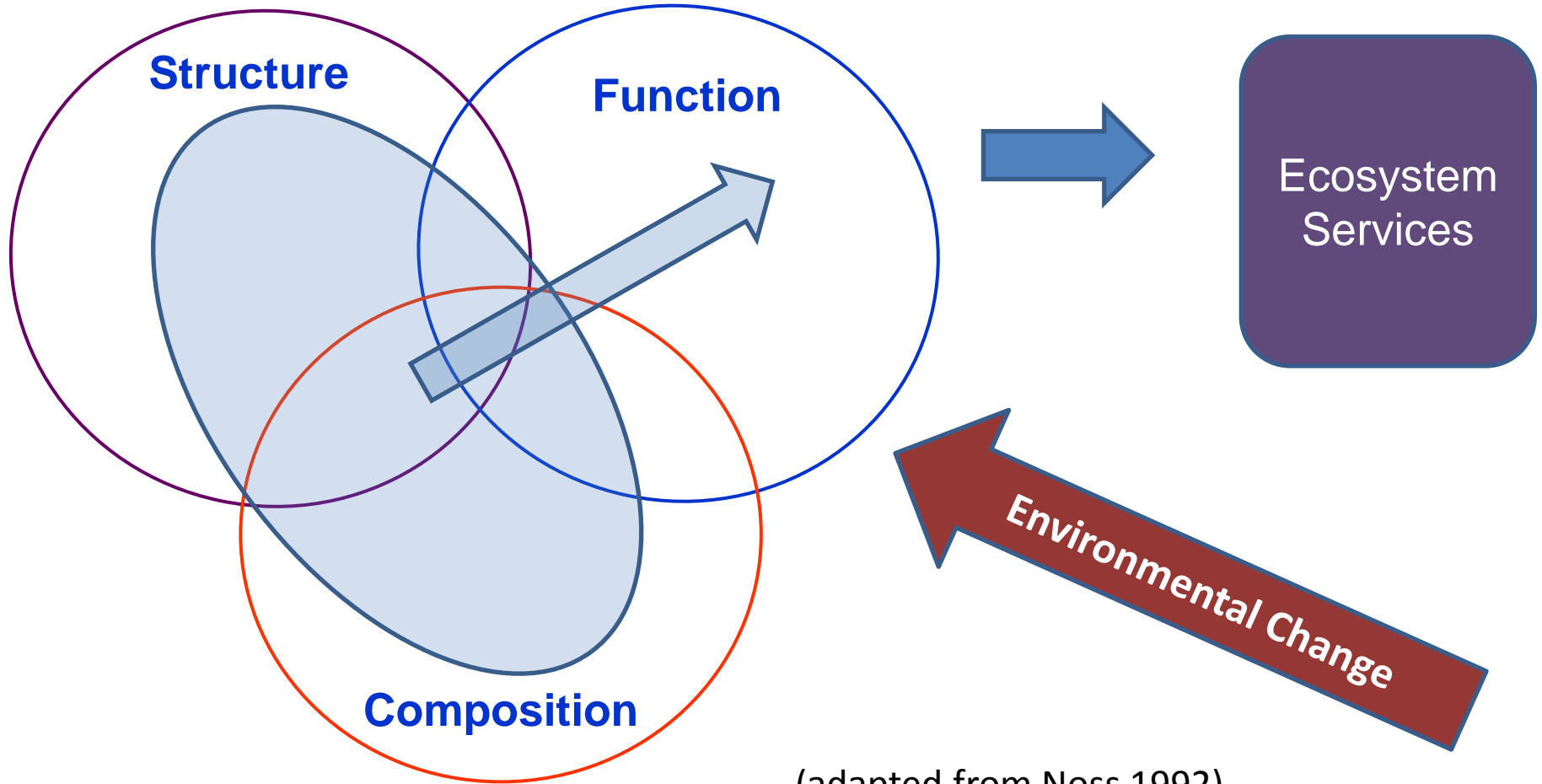


Content



- Sources of uncertainty and how to consider them
- Stand management options and their evidence basis
- Major knowledge gaps and how to address them

Uncertainty regarding ecosystem functioning

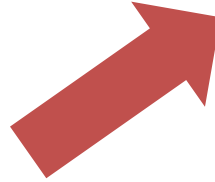
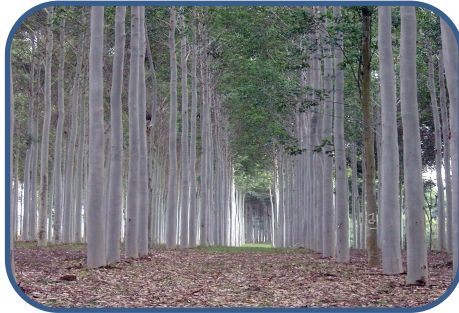


(adapted from Noss 1992)

Considering complexity

Complexity (stand & landscape)

Short rotation,
privately owned

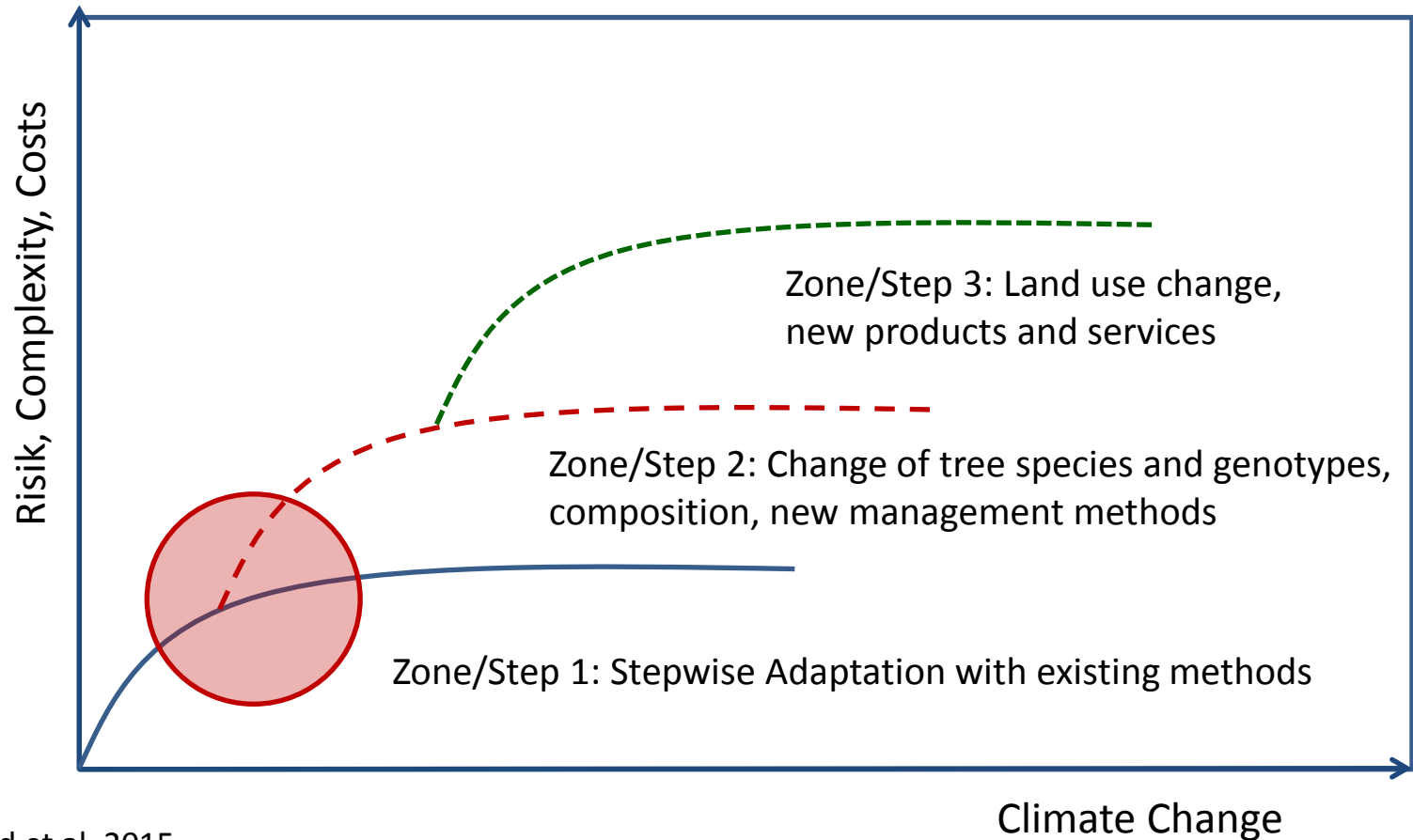


Long rotation,
diverse ownership



Uncertainty (societal expectations, climate change)

What can we do in the short term and what we need to do in the long term?



Overview of stand management options



- Establishment: Site preparation and weed control (new forests)
- Stand density management (existing stands)
- Structural and compositional changes (existing and future forest)
- Species changes (future forests)

Overview of stand management options



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Intensive silviculture for restoration of native forests (to alleviate or even eliminate the environmental stresses)

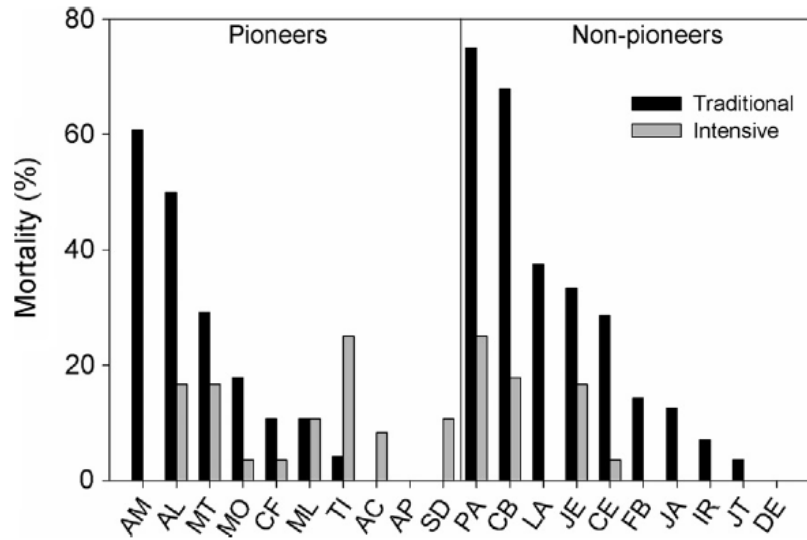


Fig. 1. Mortality of the 20 tree species under traditional and intensive silviculture, 2.5 years after planting. Bars represent the sum of mortality for each species across the experiment.

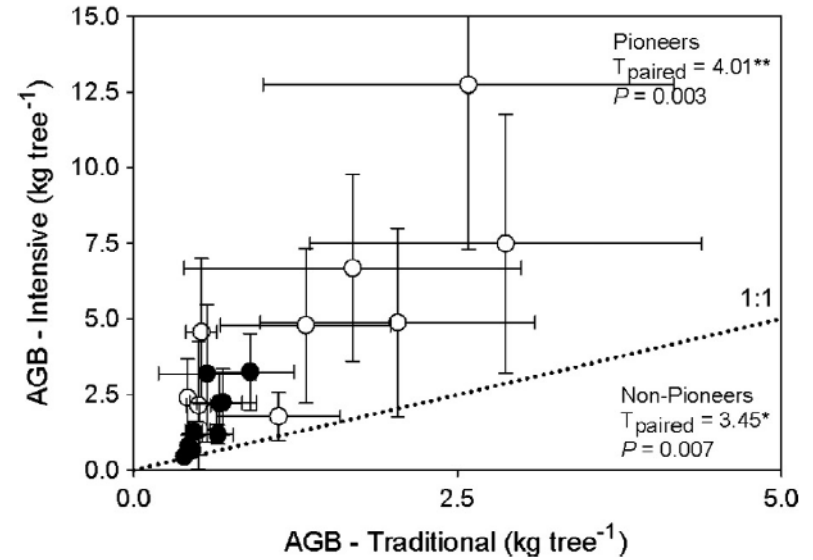


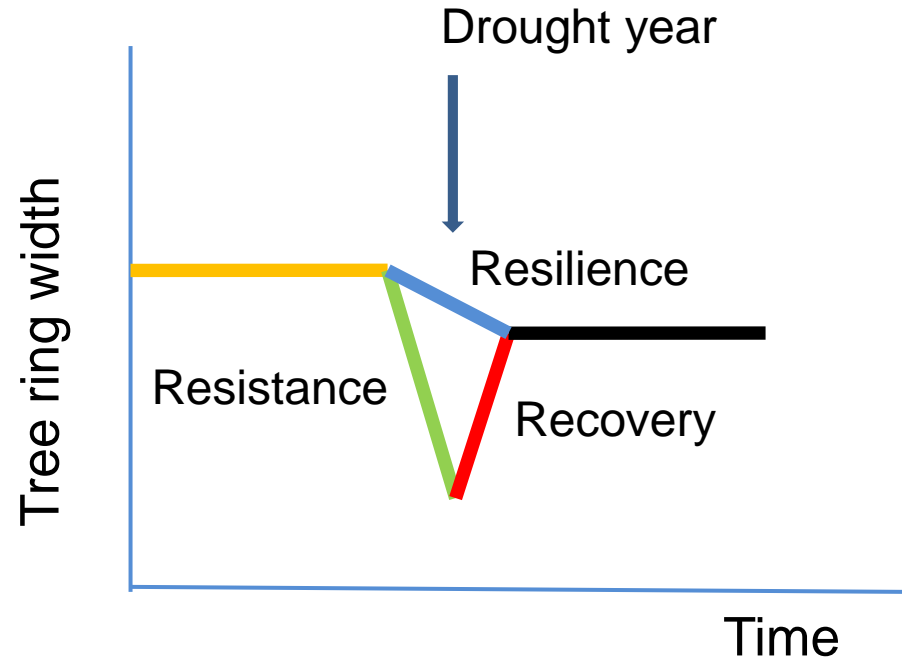
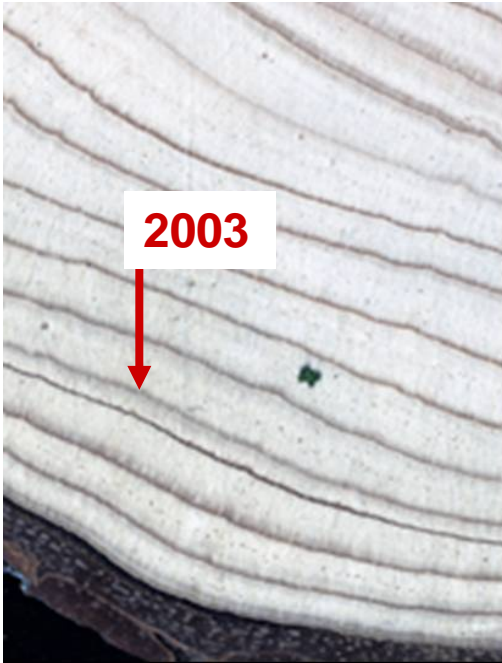
Fig. 2. Aboveground biomass of the 20 tree species under traditional and intensive silviculture, 2.5 years after planting (Top, bars represent the average with standard deviation). There was a positive effect of intensive silviculture on aboveground biomass (AGB) for the 20 planted species (Bottom, circles represent the average with standard deviation, open circles represent pioneers and closed circles represent non-pioneers).

Strong weed control and higher levels of fertilization significantly reduced mortality (-15 %) and increased tree biomass (13% to 7 fold) in restoration plantings with 20 native tree species in the Atlantic forest, Brazil (Campoe et al. 2014).

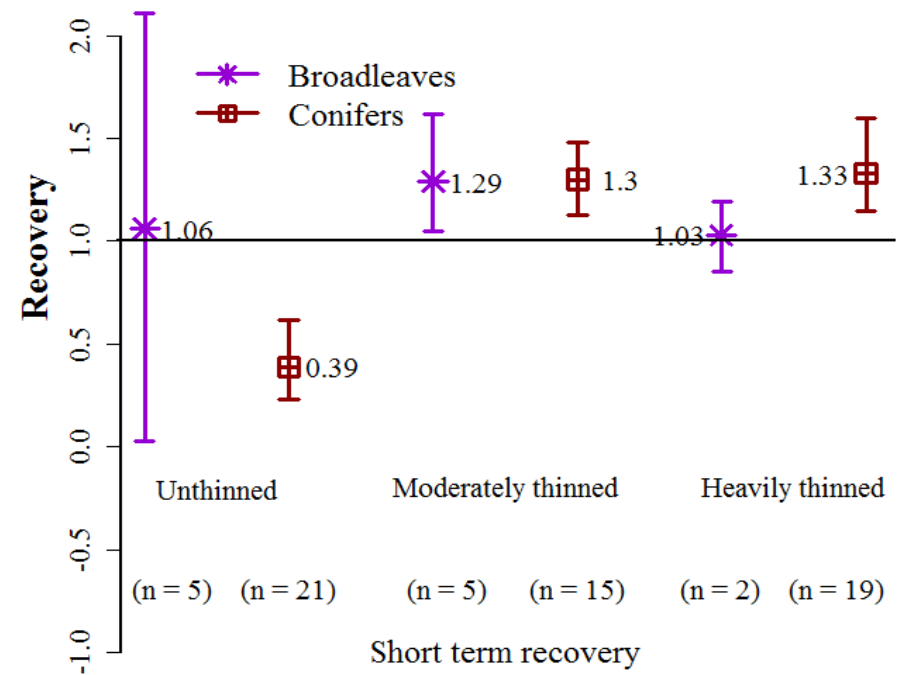
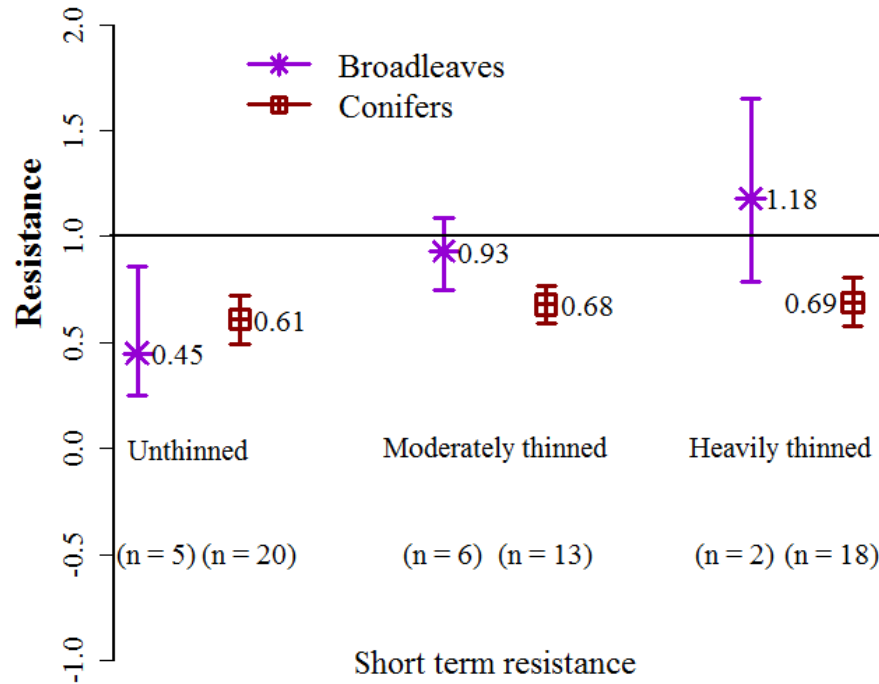
Two year old *Eucalyptus dunnii* with
and without herbicide

Methods are available to establish
trees quickly to reduce risks

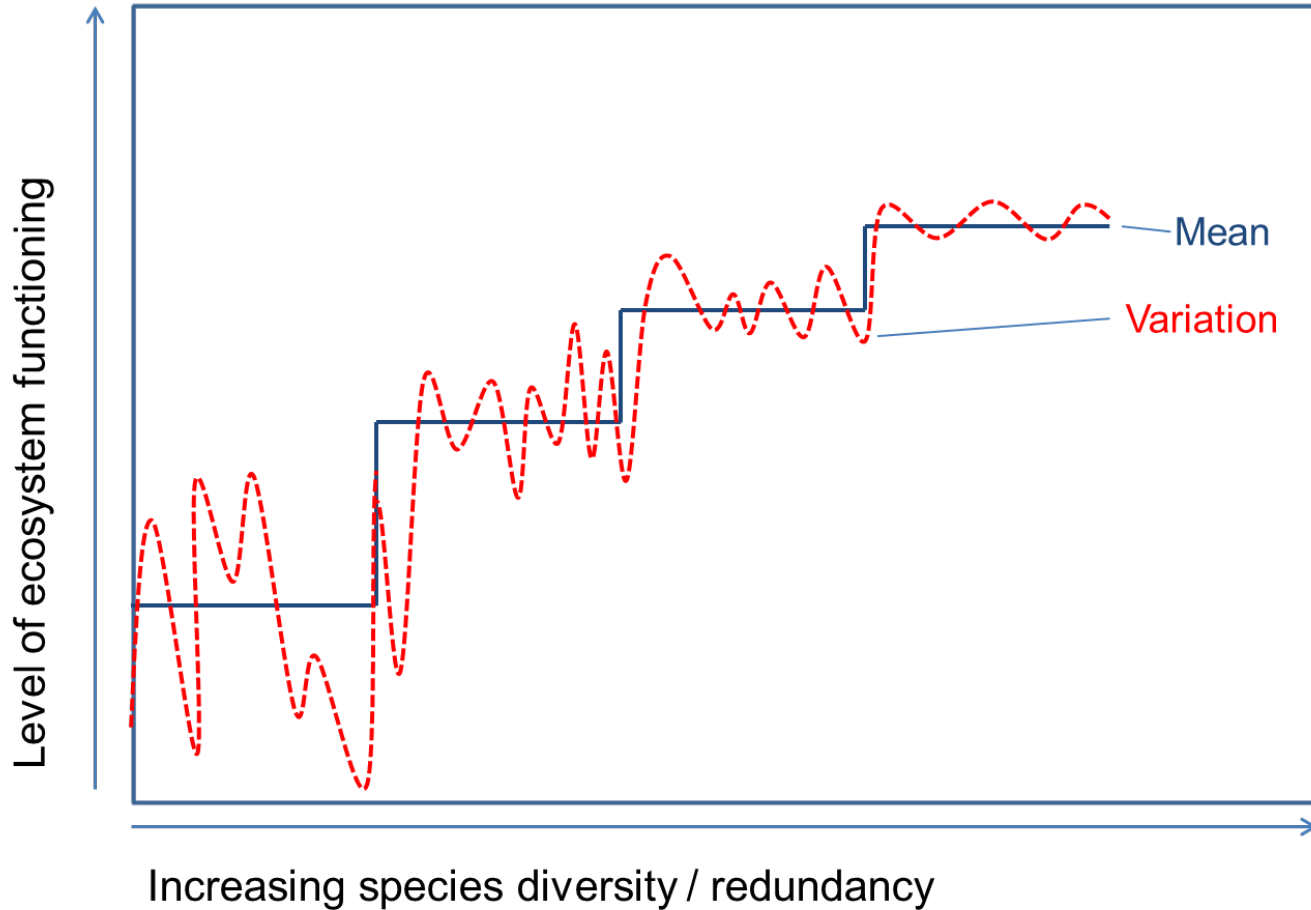
Increasing Resistance and Resilience through increasing growing space of individual trees - Thinning



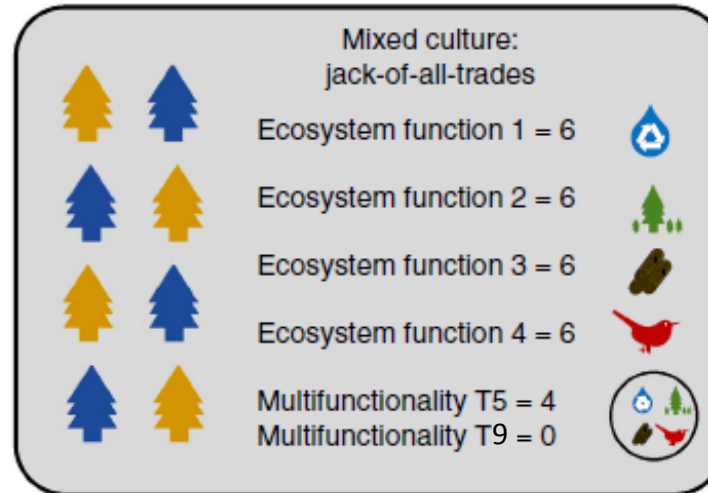
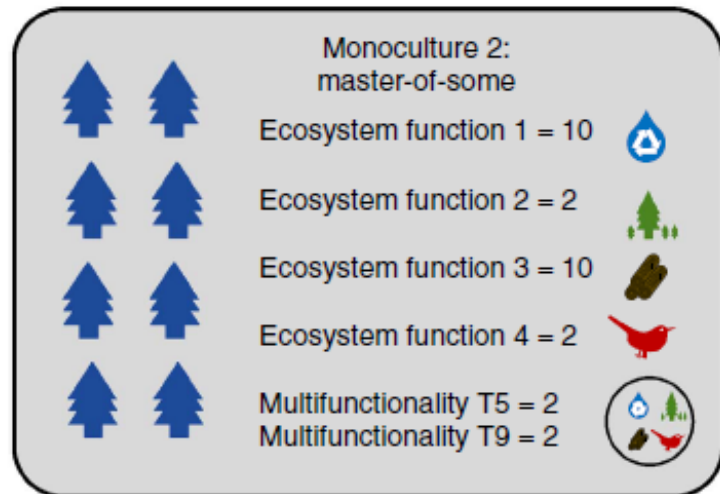
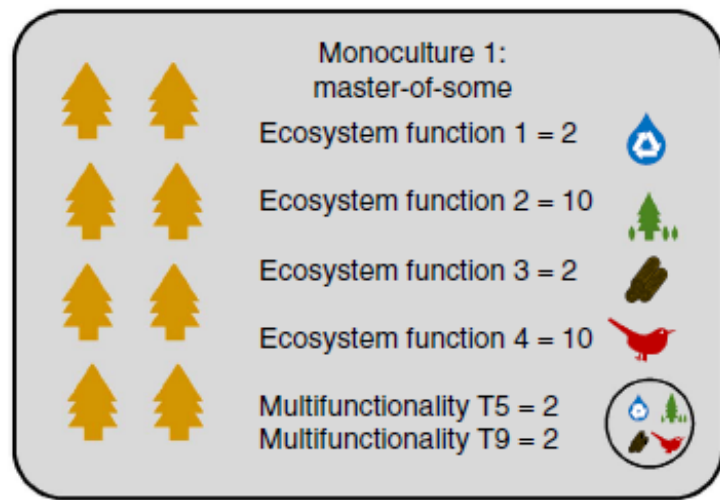
Thinning effects on drought responses of broadleaves and conifers



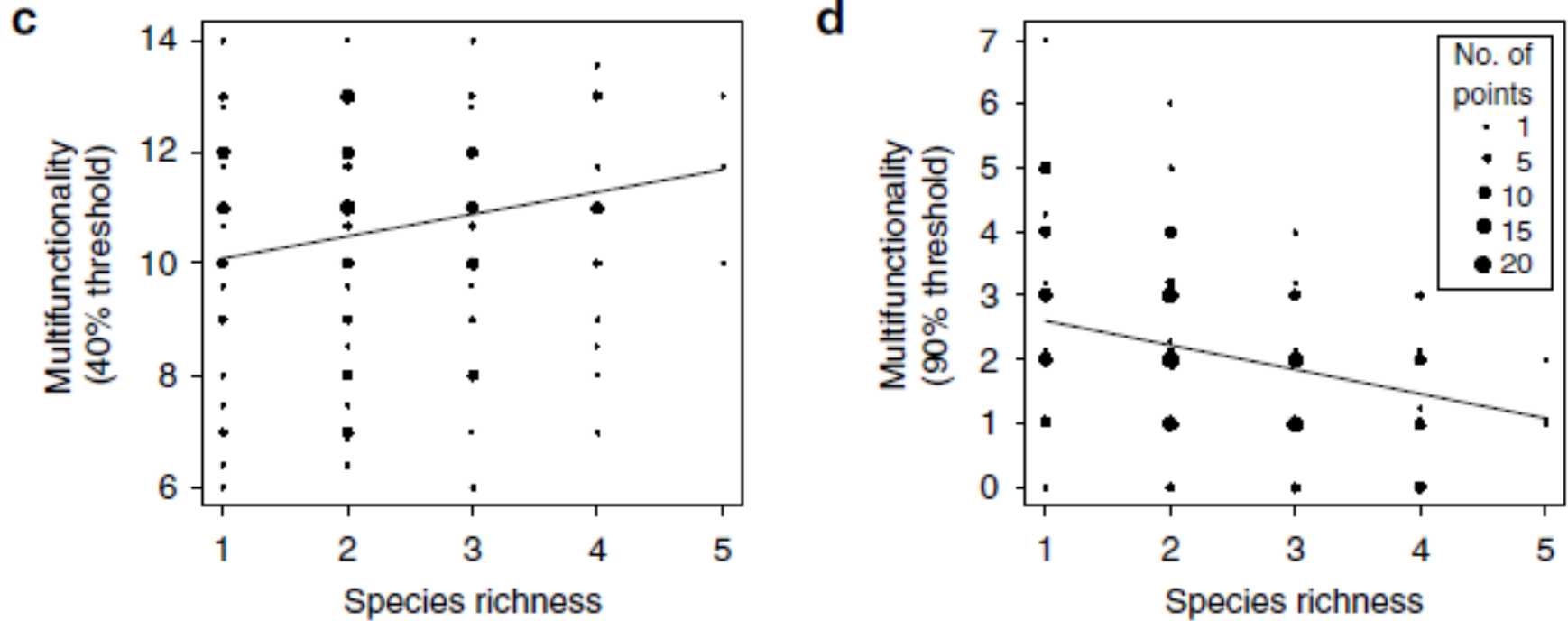
Proposed relationship between biodiversity and ecosystem functioning



“Jack-of-all-trades” effect of mixtures

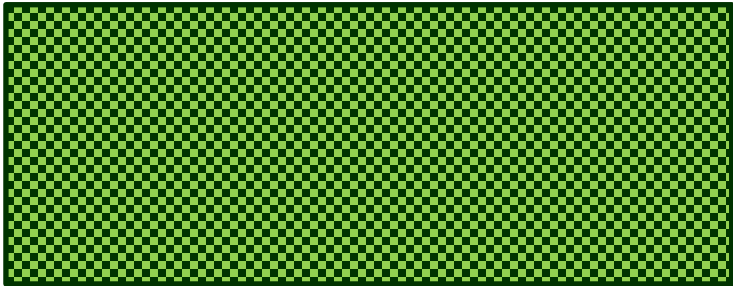
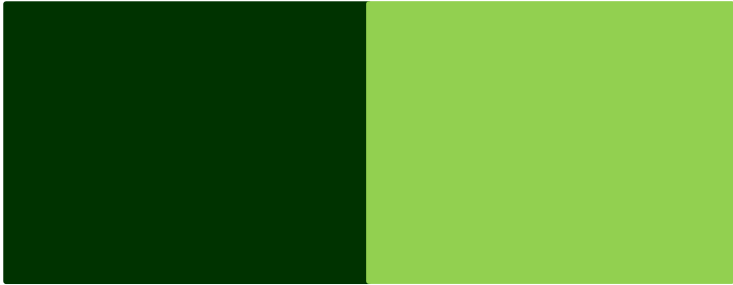


“Jack-of-all-trades” effect of mixtures



The multifunctionality value (number of functions above a 40% (left) or 90% (right) threshold value) as a response to species richness across 209 forest plots in Europe; Van der Plas et al. 2016. *Nature Communications* 7, 11109

Are mixed species forests more resistant and resilient to stress and disturbance?



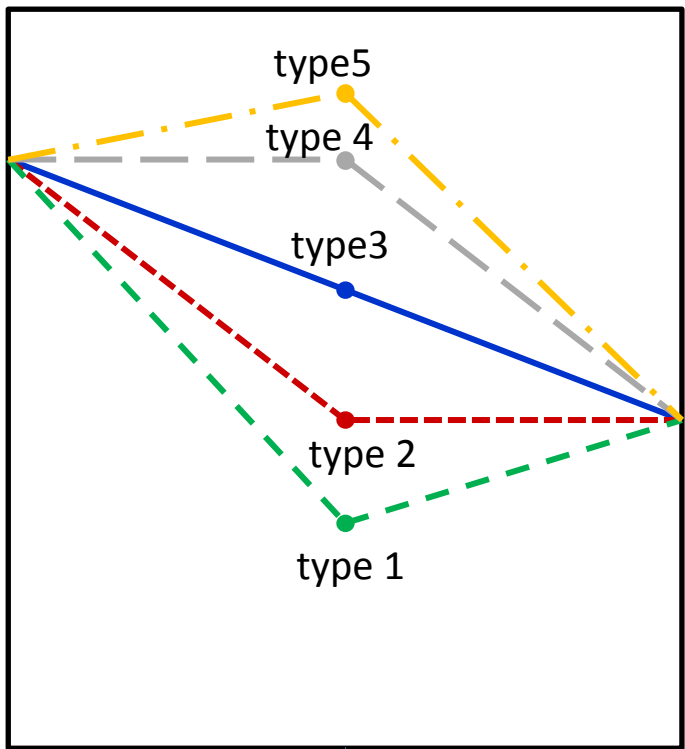
Are mixed species forests more resistant to stress and disturbance?

Impact on
species A

Impact on
species B

Stress/Disturbance

Resistance



100% A
0% B

50% A
50% B

0% A
100% B

Drought

Wind/Storm

Fire


Specialist insect herbivores

Generalist insect herbivores

Specialist pathogens

Generalist pathogens



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- An aerial photograph of a forest landscape. The forest is a mix of evergreen and deciduous trees. The deciduous trees are in various stages of autumn, showing shades of orange, red, and yellow. The evergreen trees are dark green. The forest is dense and covers a hillside. The sky is not visible, and the overall tone is somewhat muted and atmospheric.
- Spatial arrangement of species within mixtures
 - Generalised understanding of interactions among species across different site conditions
 - Silvicultural guidelines for treatments over time

Pretzsch, H., Forrester, D.I., Bauhus, J. (2017)
Mixed-Species Forests - Ecology and Management.

Conclusions



- Evidence basis for establishment practices is very solid, but best practices are often not applied
- Evidence basis for stand tending to increase ecological stability is good, but largely confined to mono-specific stands
- Mixed-species forests are a promising approach to deal with future uncertainties and risks, but the information basis for their management is weak

Hope to see you in Freiburg



125TH ANNIVERSARY CONGRESS 2017

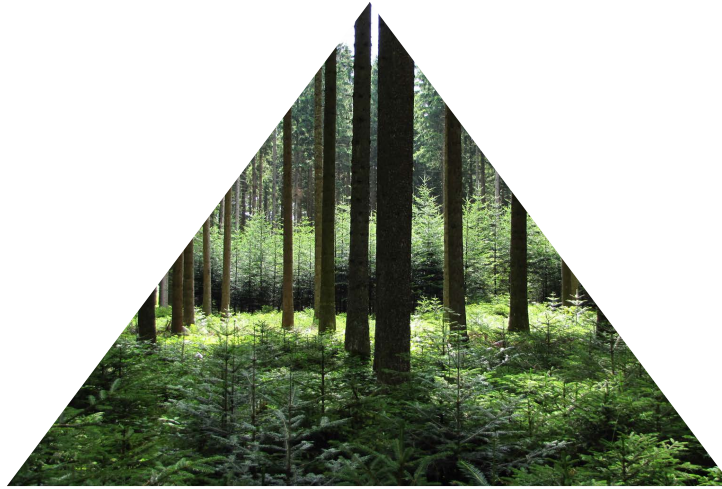
18–22 September 2017
Freiburg, Germany



Focus of traditional silvicultural systems

Productivity

(Regeneration, Stocking, Genetics)



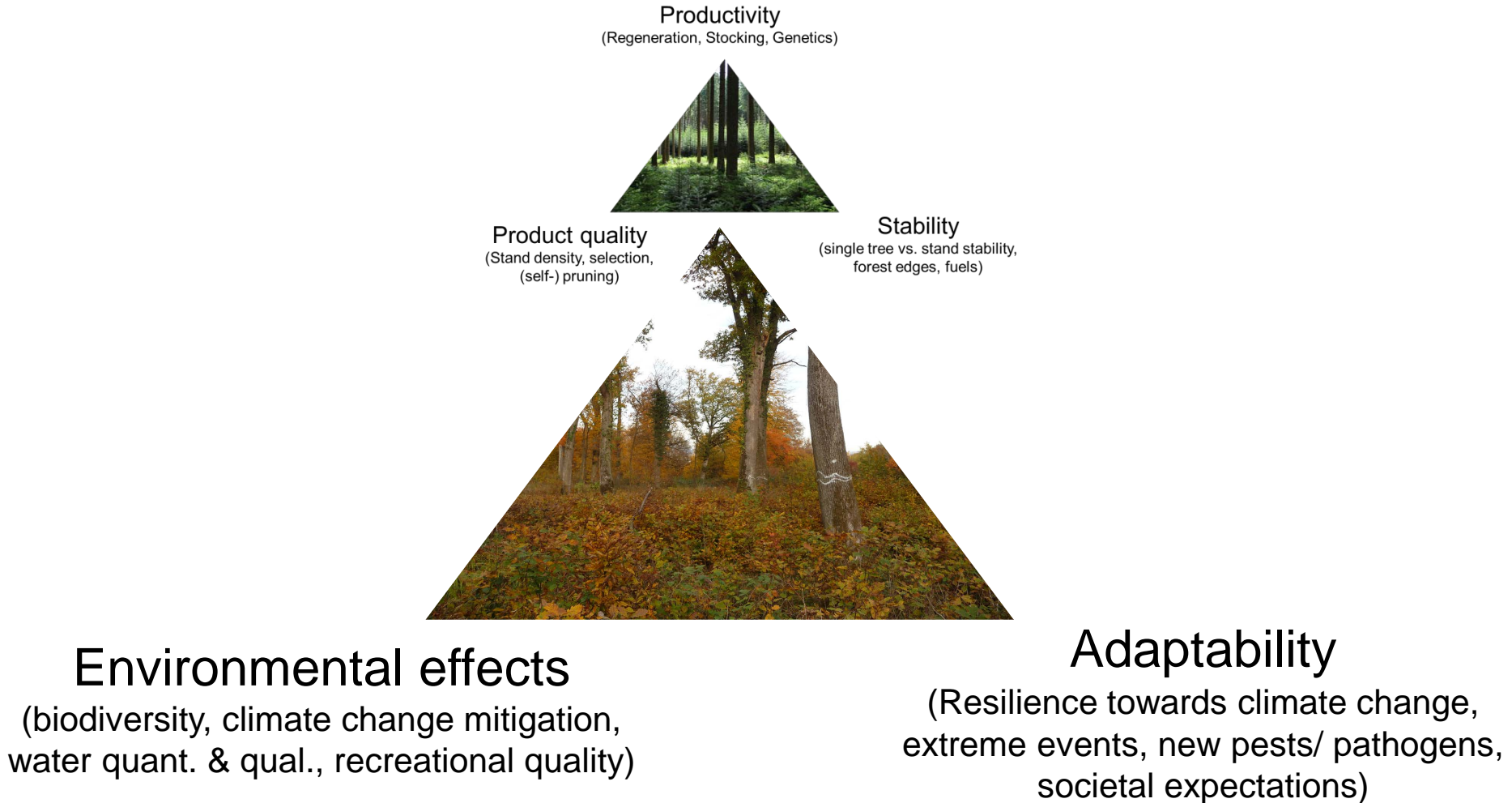
Product quality

(Stand density, selection,
(self-) pruning)

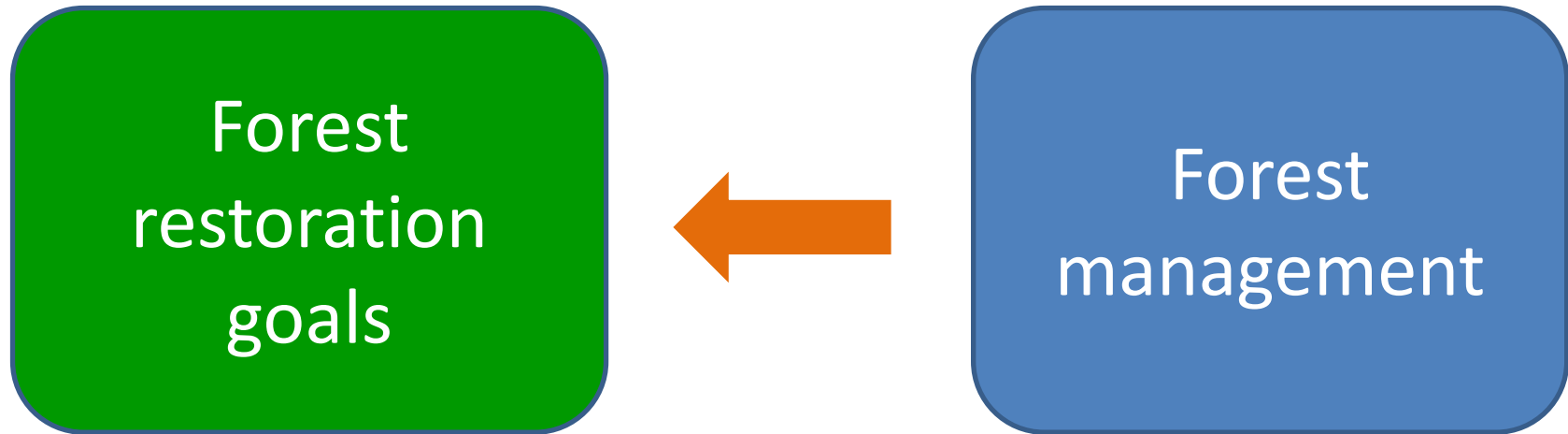
Stability

(single tree vs. stand stability,
forest edges, fuels)

Current focus of silvicultural systems



No management without goals



Avoiding mistakes of the past, e.g. rubber in Brazil



Reducing risks



Eucalypt and Native species

