

Prevalence of interspecific competition in a mixed poplar / black locust plantation Under adverse climate conditions

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UMR
Silva

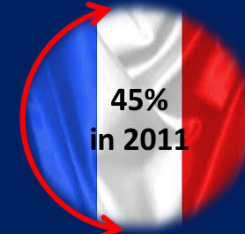
Context

Current geopolitical and environmental context:

- Rarefaction of fossil fuels
- Need to reduce CO₂ emissions

➔ Promotion of renewable energy sources

➔ Biomass



➔ Forest = 1st supplier

➔ + dedicated production systems such as Short Rotation Coppices (SRC) on agricultural lands



Tree plantations dedicated to biomass production

→ Currently not attractive because not optimized

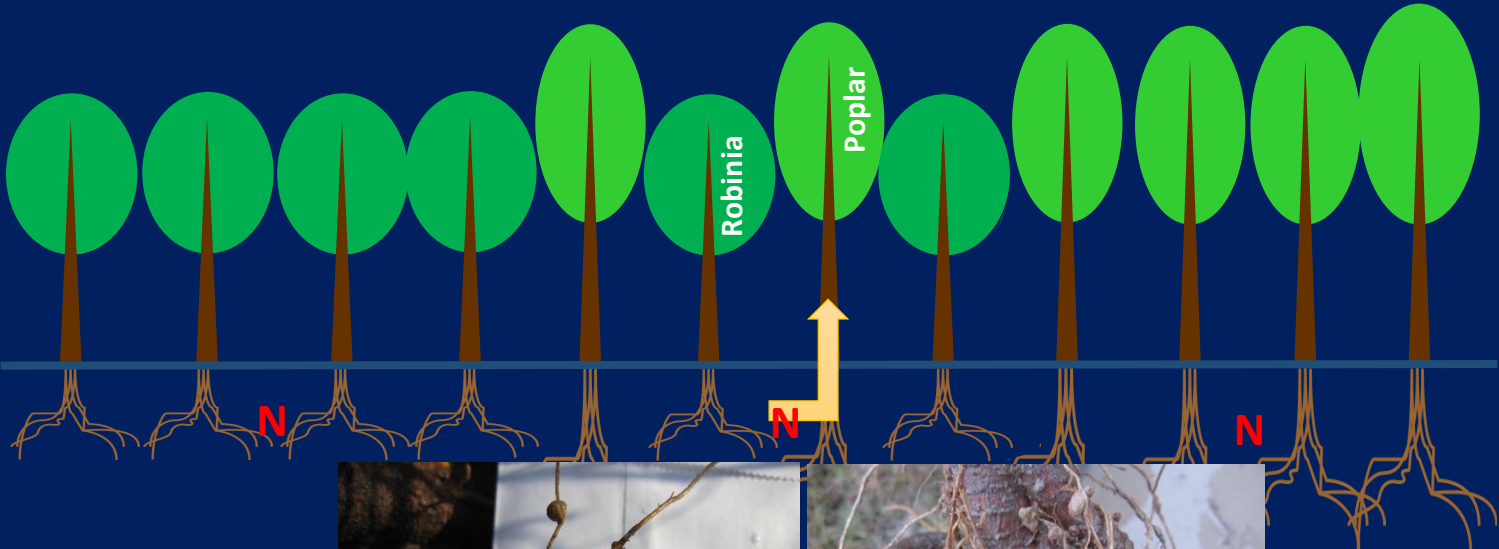


Hypotheses

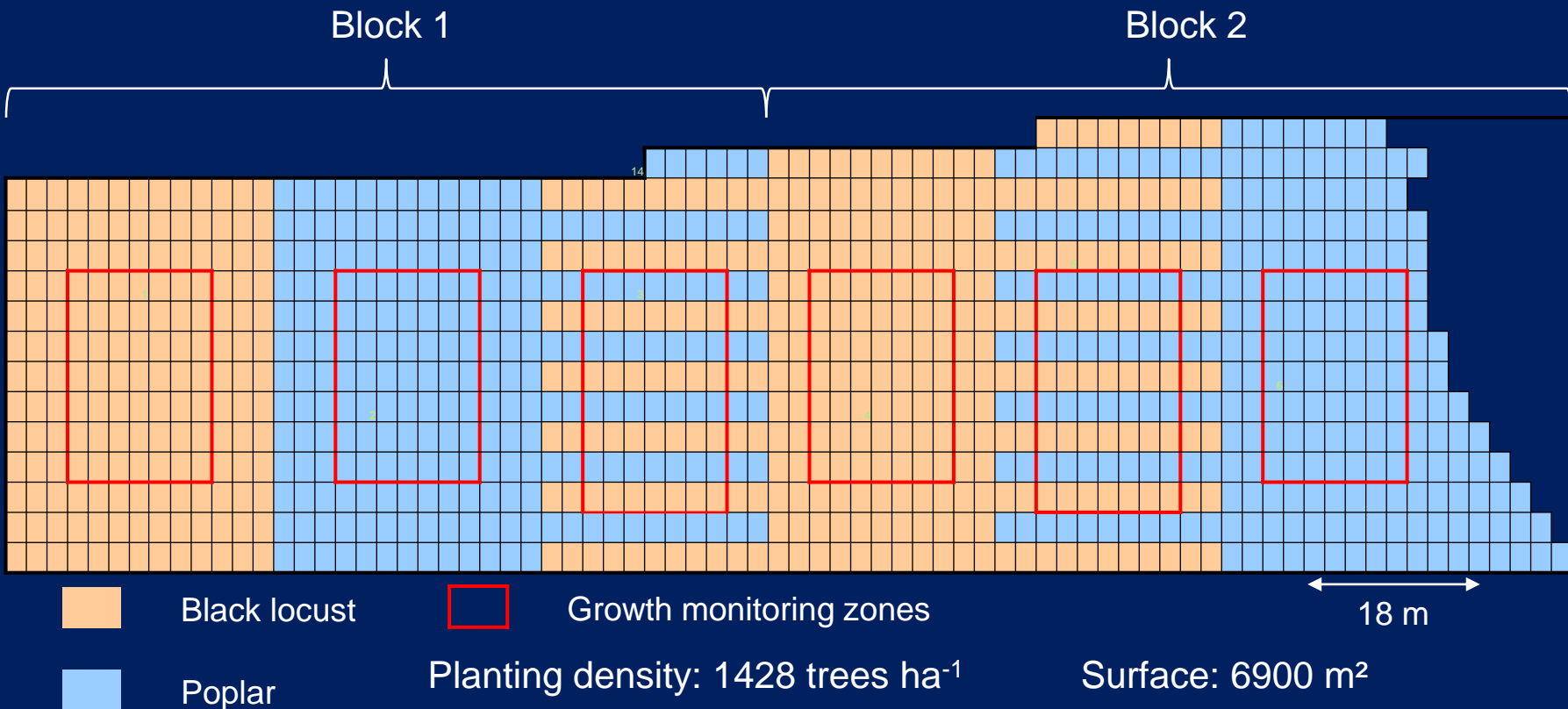
Black locust monoculture

Mixture poplar / black locust

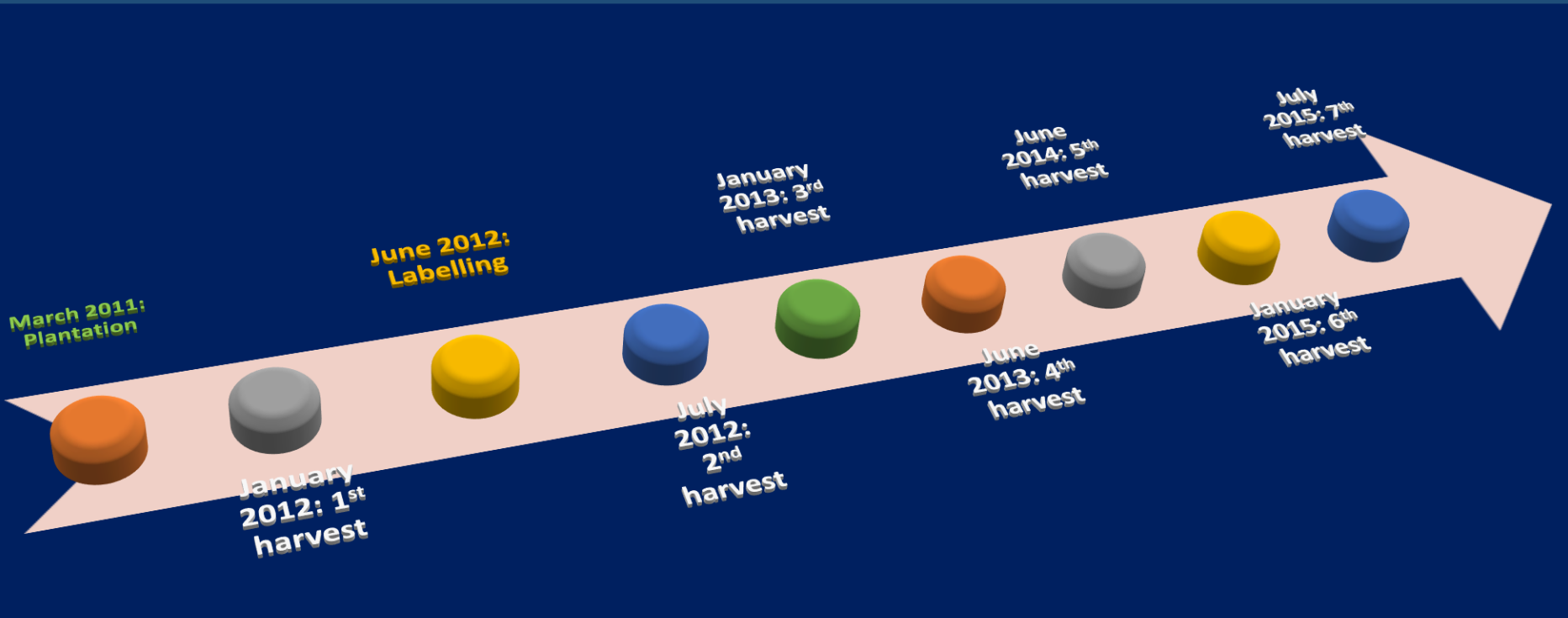
Poplar monoculture



Experimental plantation

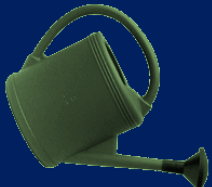


Chronology



Nitrogen fixation

Nitrogen derived from N₂ fixation (Ndfa) by black locust



$$\%Ndfa = \frac{100(\delta^{15}N_{non_fix} - \delta^{15}N_{fix})}{(\delta^{15}N_{non_fix} - \beta)}$$

	Isotopic dilution		Natural abundance ($\beta = -1.3\text{‰}$)	
	Monoculture	Mixture	Monoculture	Mixture
Two-year old	76 % (23 kg ha ⁻¹)	79 % (18 kg ha ⁻¹)	77% (24 kg ha ⁻¹)	79% (18 kg ha ⁻¹)



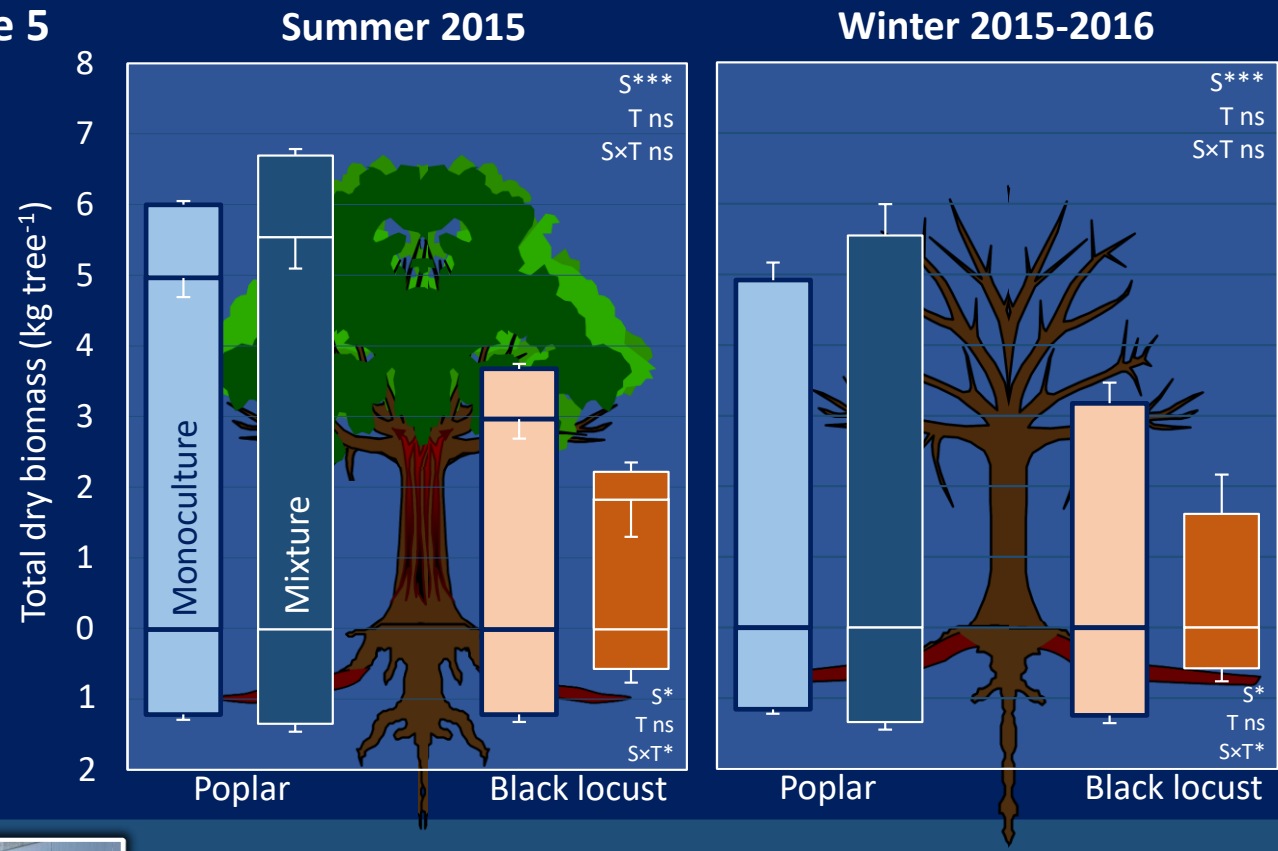
β = Isotopic fractionation occurring during N₂ fixation

Experimental β = -1.4‰



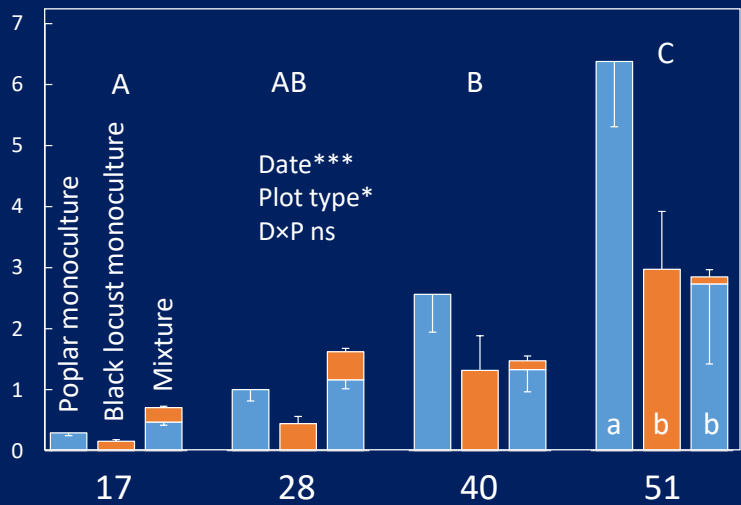
Production

Biomass at age 5

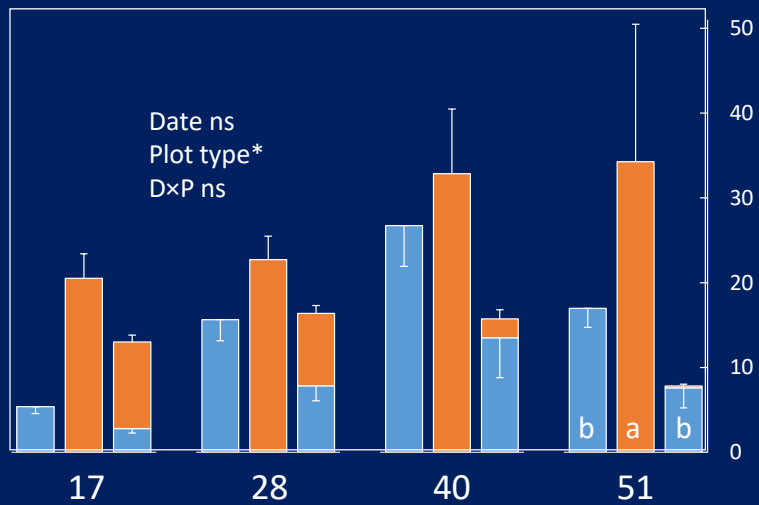


Production

Yield (Mg ha⁻¹)



Nitrogen (kg ha⁻¹)

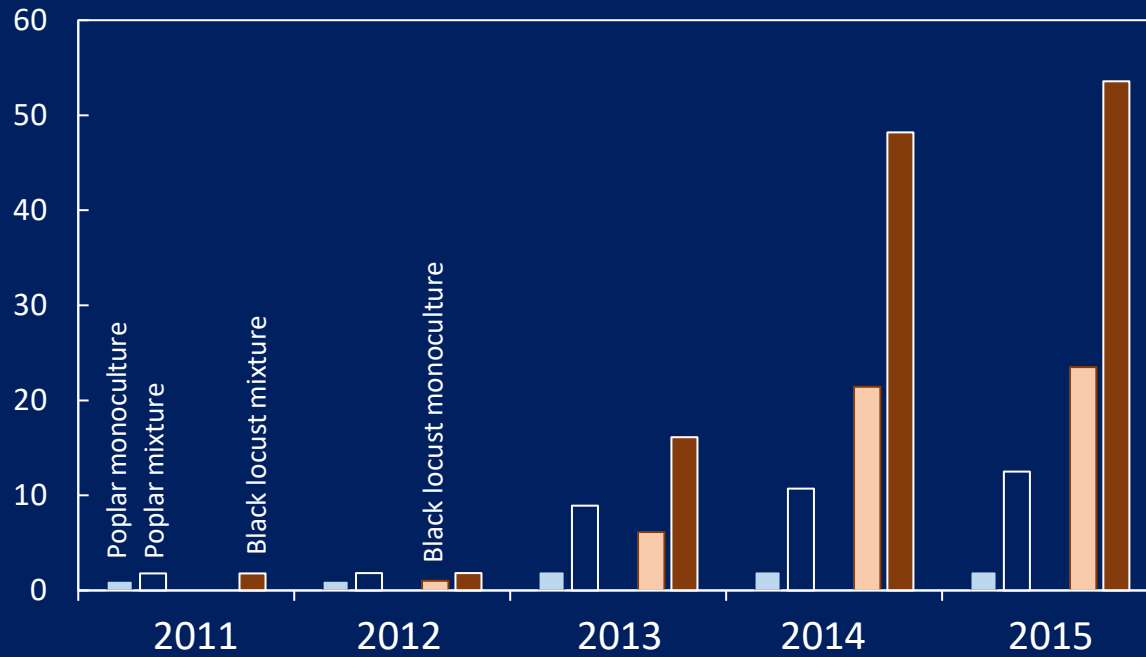


Months since plantation



Time course

Mortality (%)



In conclusion...

High mortality and low production as compared to values reported in literature

➔ **Non optimal conditions for both species**

Negative effects exacerbated in the mixture

➔ **Negative interactions prevailing under adverse climate conditions**

Antagonist ecological habits of the two species

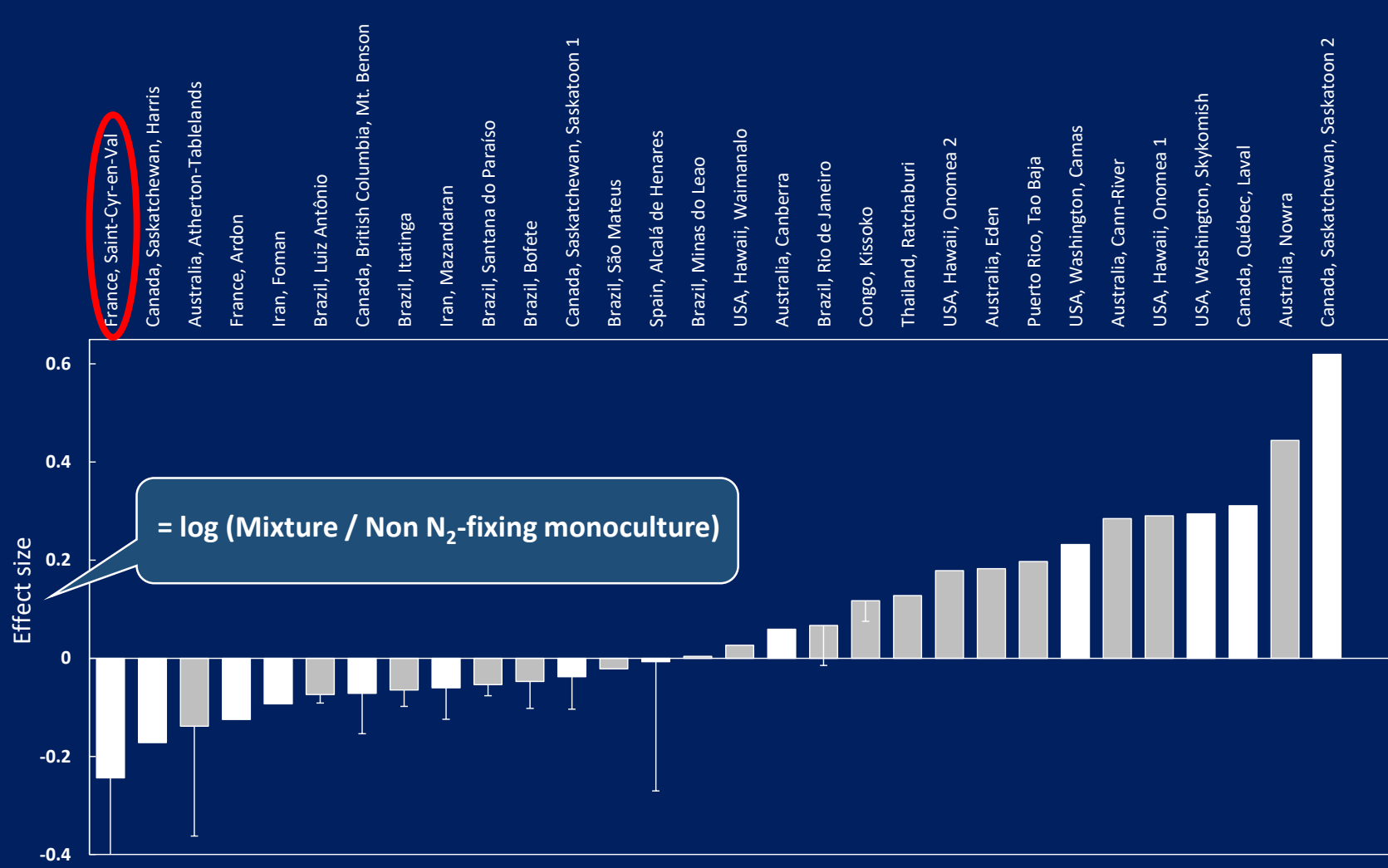
➔ **What about the poplar / alder association, two riparian species?**

➔ **What about the association with herbaceous N₂-fixing species?**

➔ **We clear it all and start again!**



And as compared to literature?

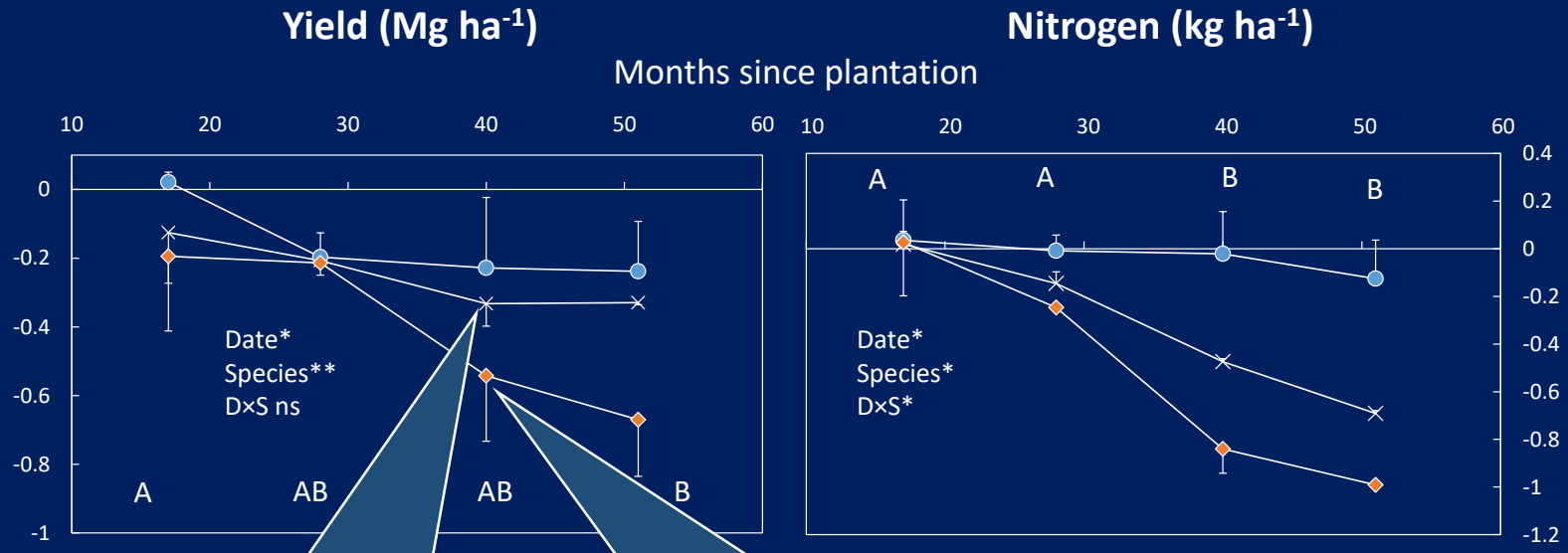




Merci!!!



Interactions



$$RCI = X_{50R50P} / X_{100R}, X_{100P} - 1$$

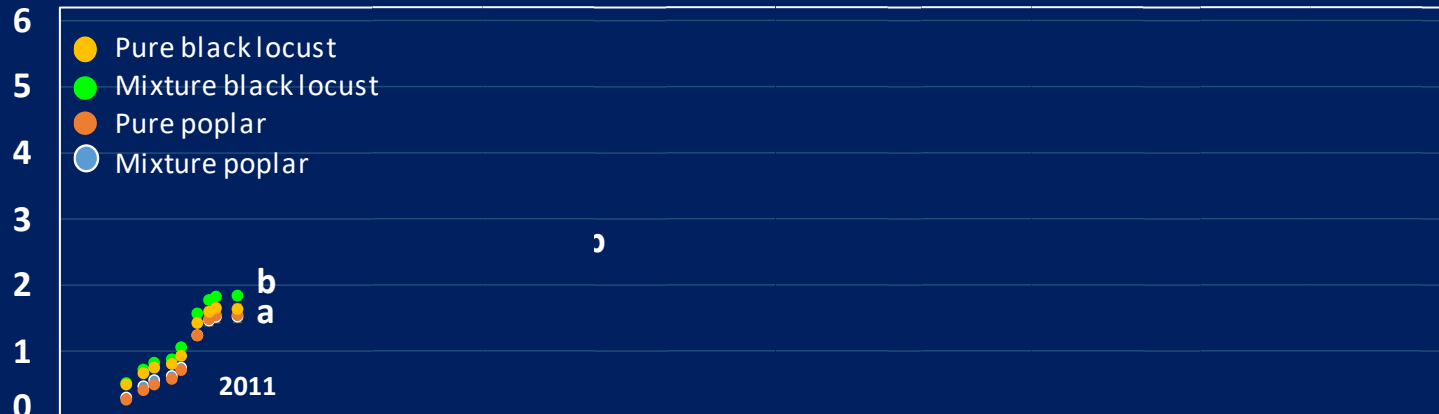
$$RCI = 2 \times X_{50R50P} / X_{monoculture} - 1$$

Grace 1995



Time course

Heights of dominant stems (m)



Soil water content at -10 cm (%)

