Does inclusion of N-fixing trees in eucalypt plantations increase soil C sequestration?

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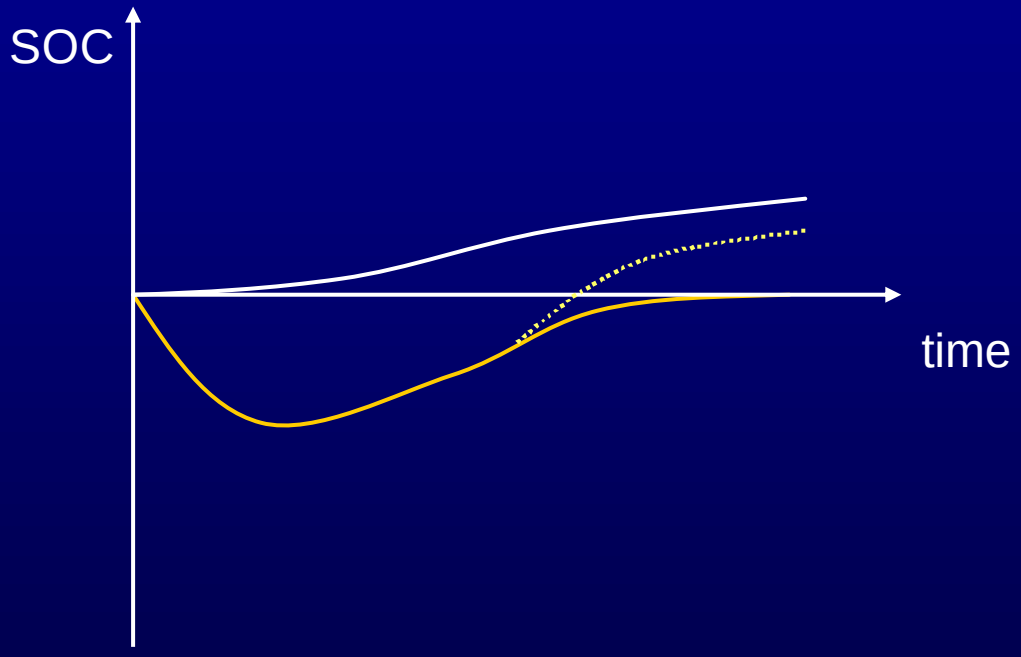
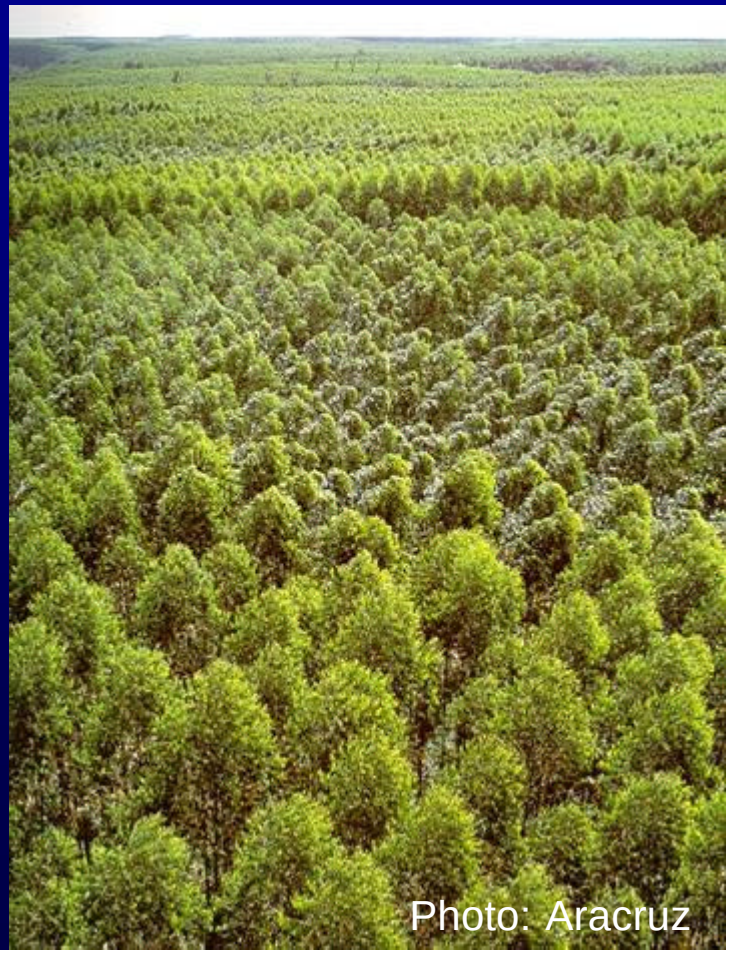
Background

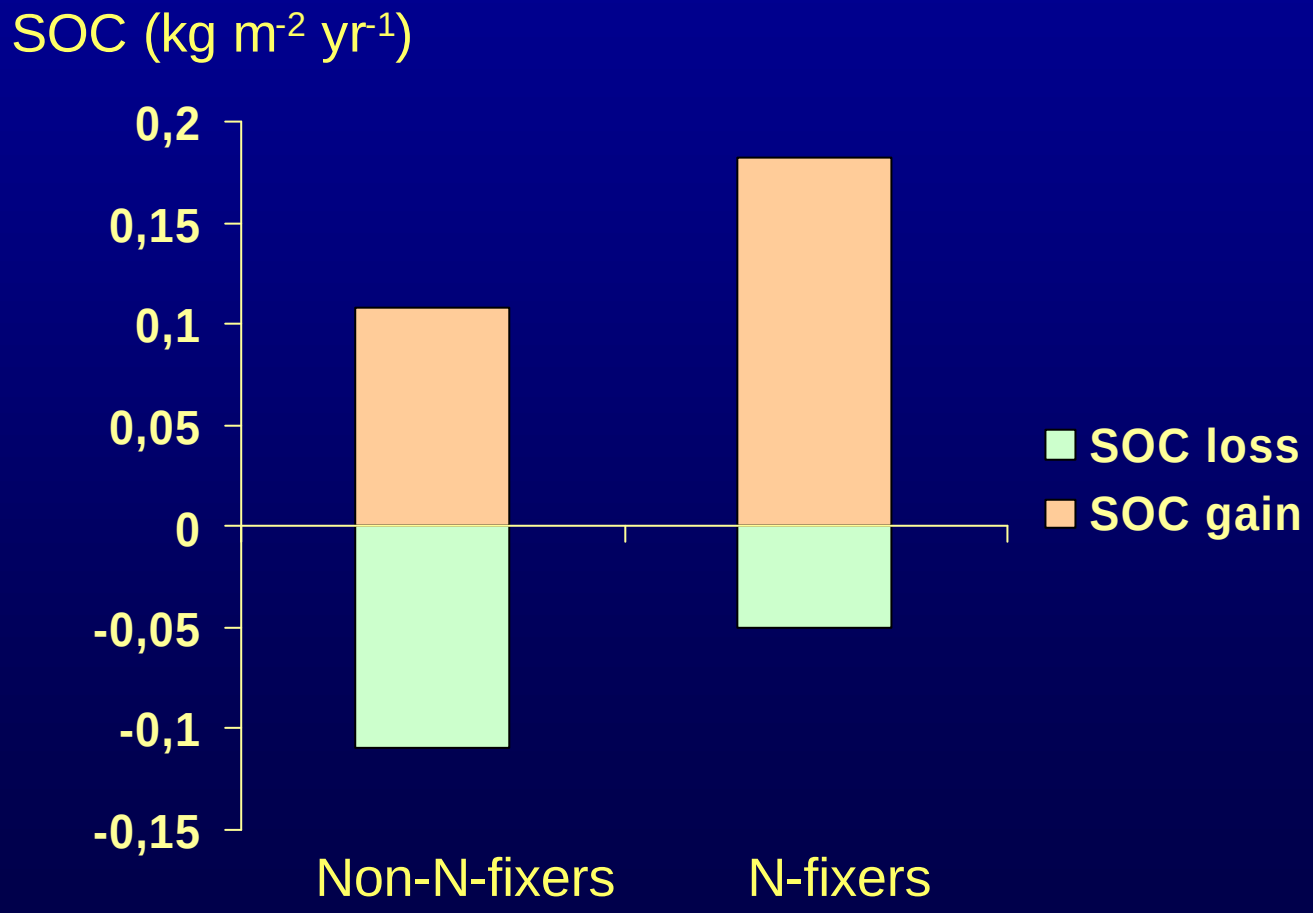
Soil organic carbon following afforestation





Background - continued

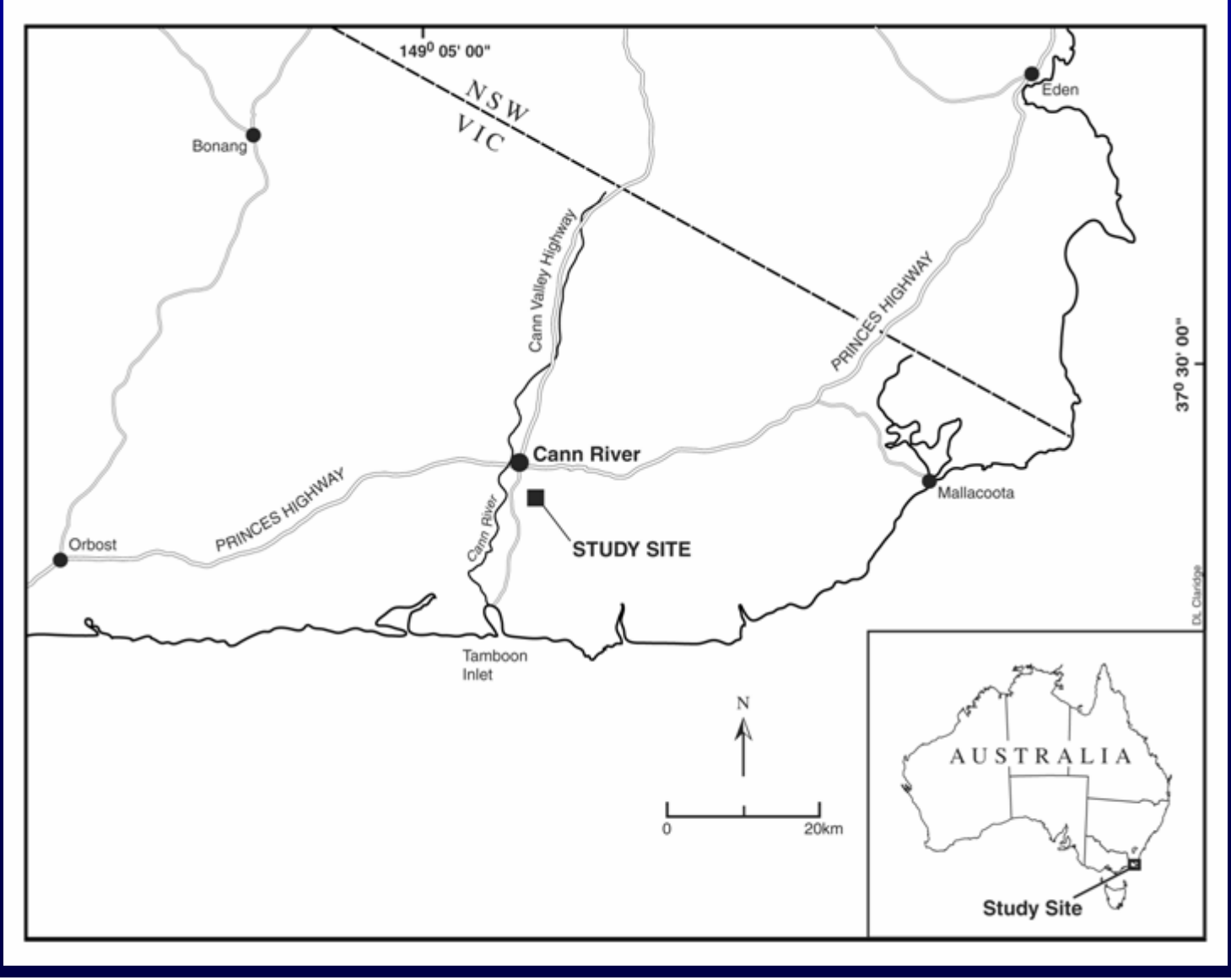
SOC gains and losses following afforestation with eucalypts and N-fixers (*Resh et al. 2002*)



Research questions

- Does the admixture of N-fixing *Acacia mearnsii* or N-fertilisation lead to greater soil organic C sequestration in *E. globulus* plantations ?
- Does admixture of N-fixing acacias change the distribution of SOC across fractions of different decomposability (physical OM fractions) ?

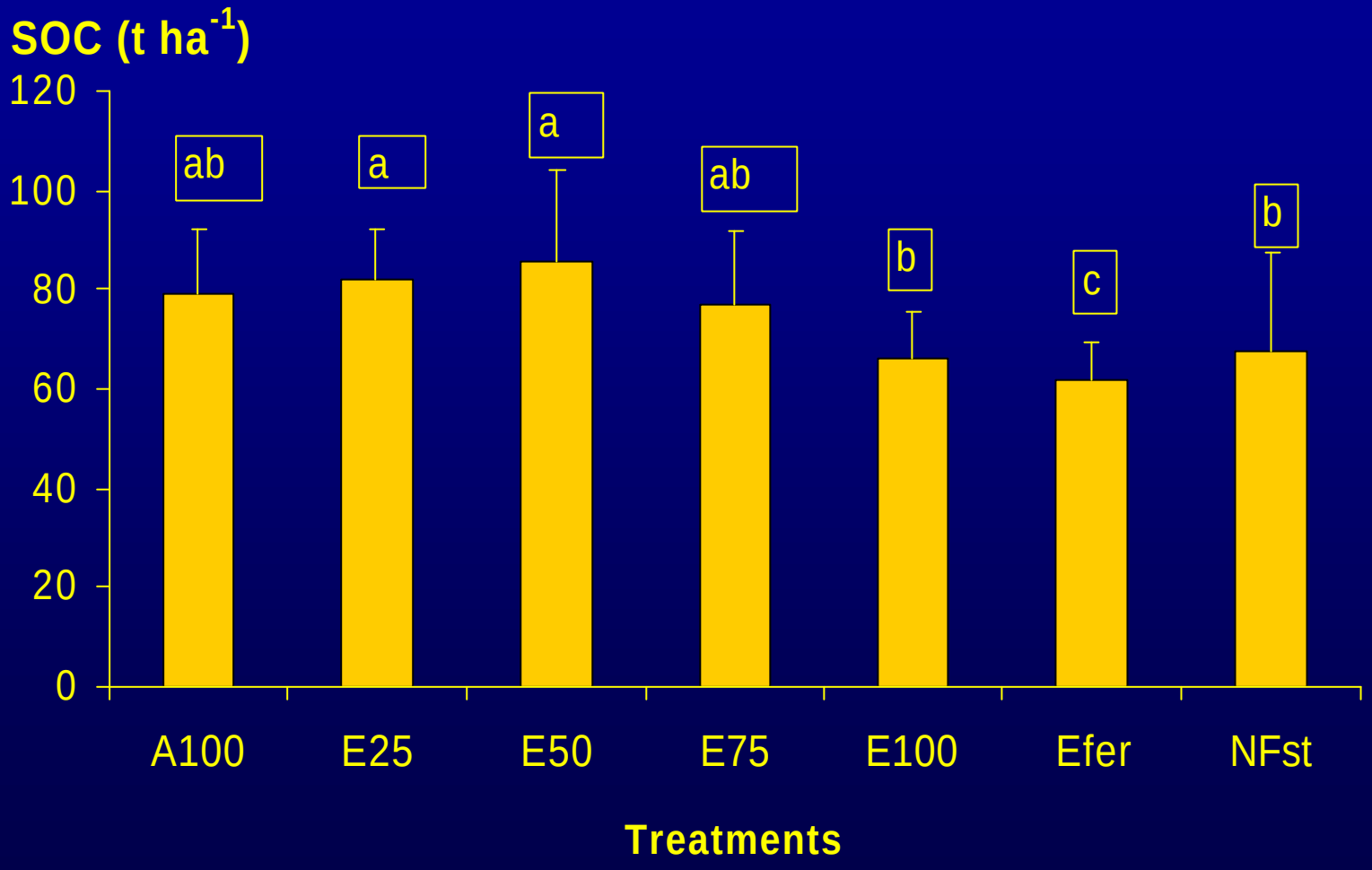
Location of trial in south-east Australia



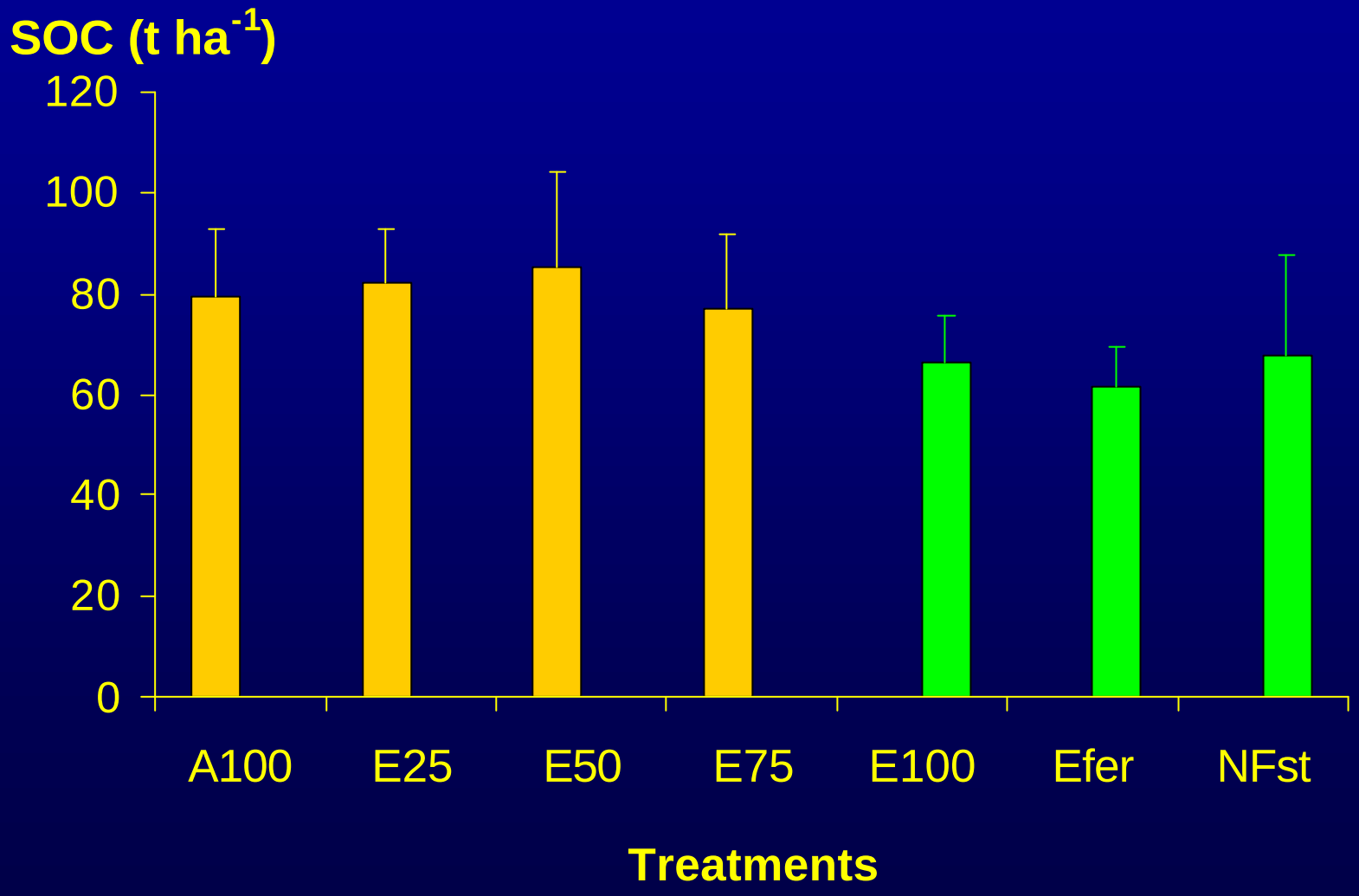
Experimental design

Sampling of micro-topography

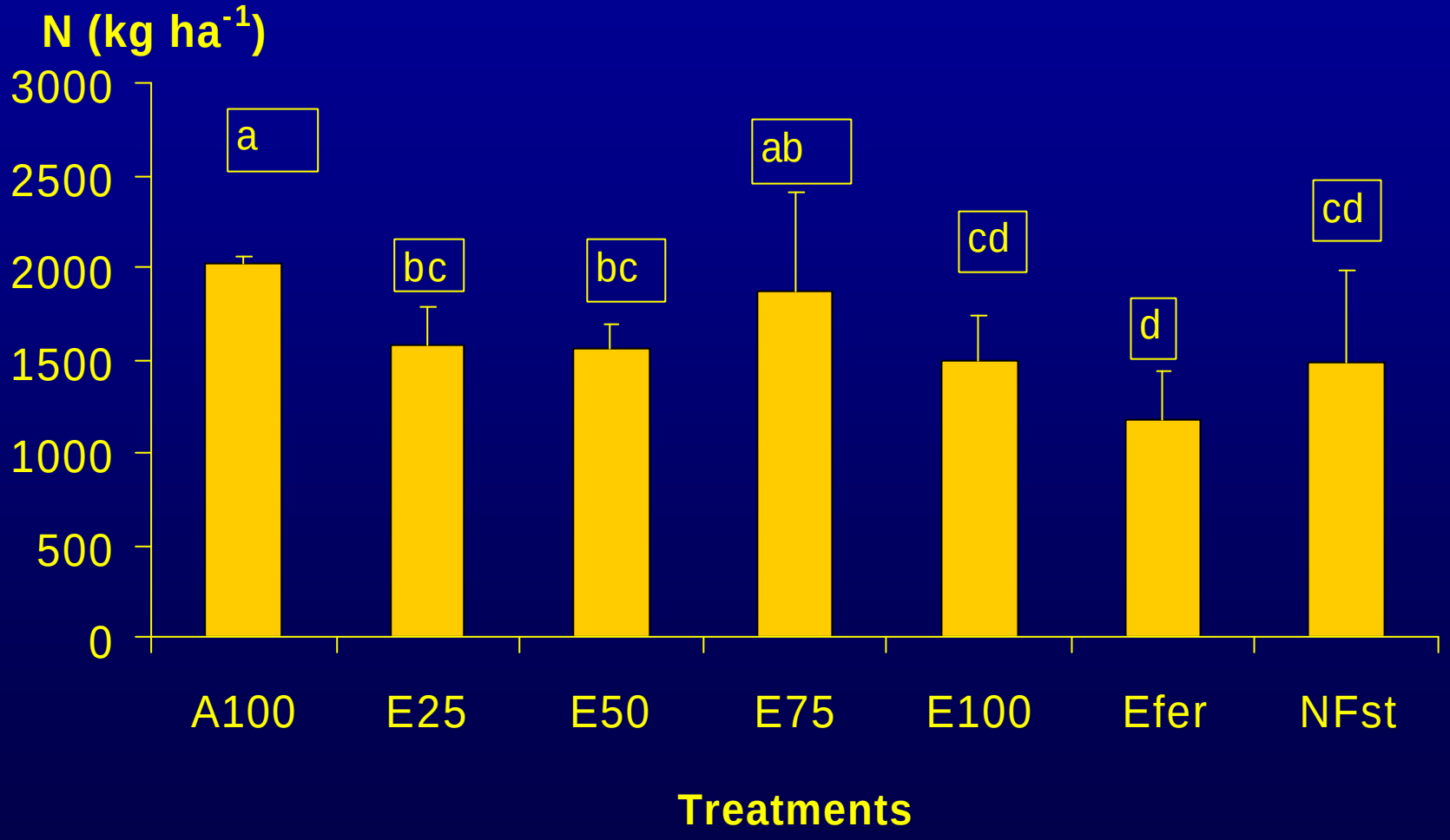
Soil organic carbon (0-30 cm)



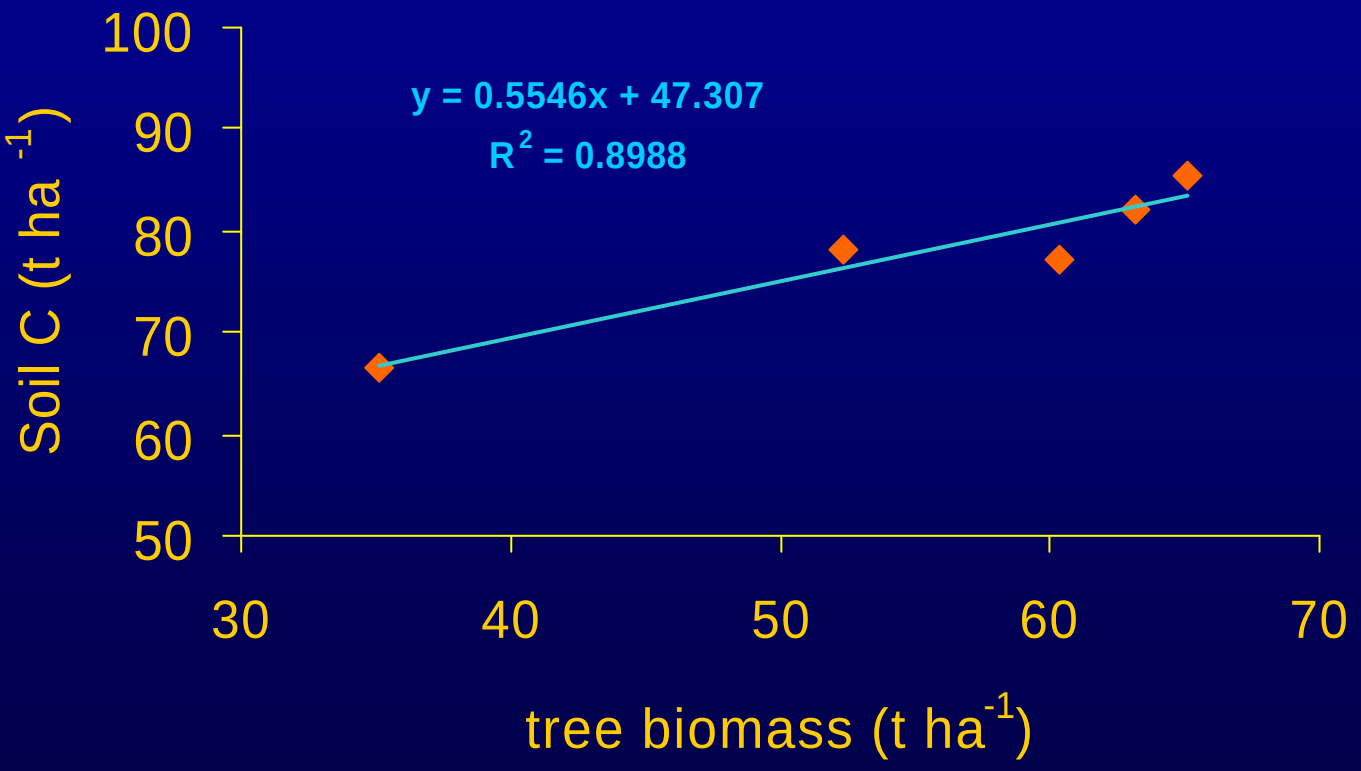
Soil organic carbon (0-30 cm)



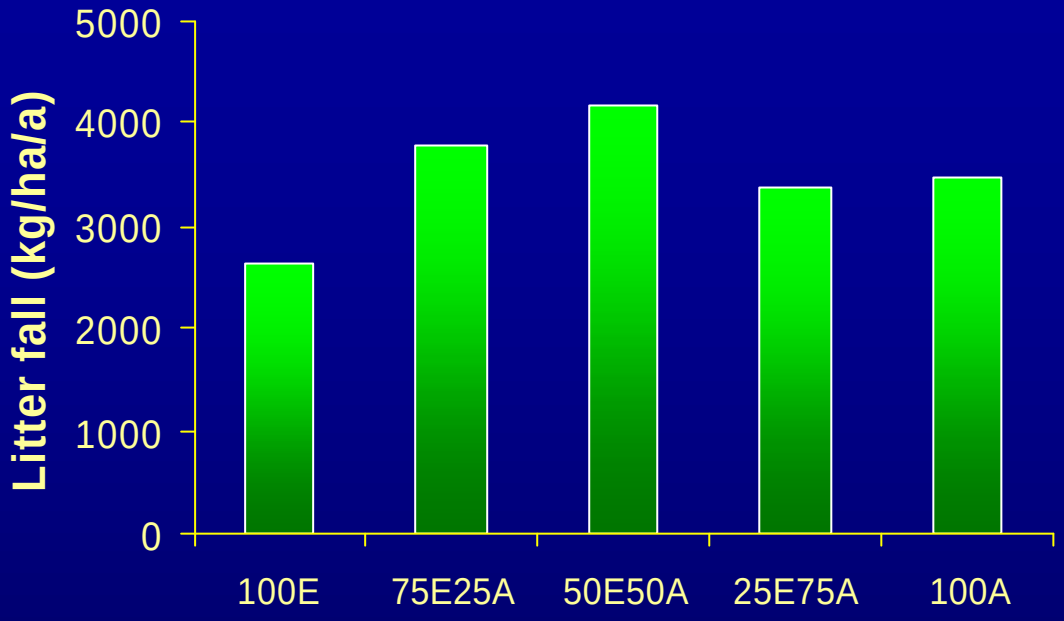
Soil nitrogen (0-30 cm)

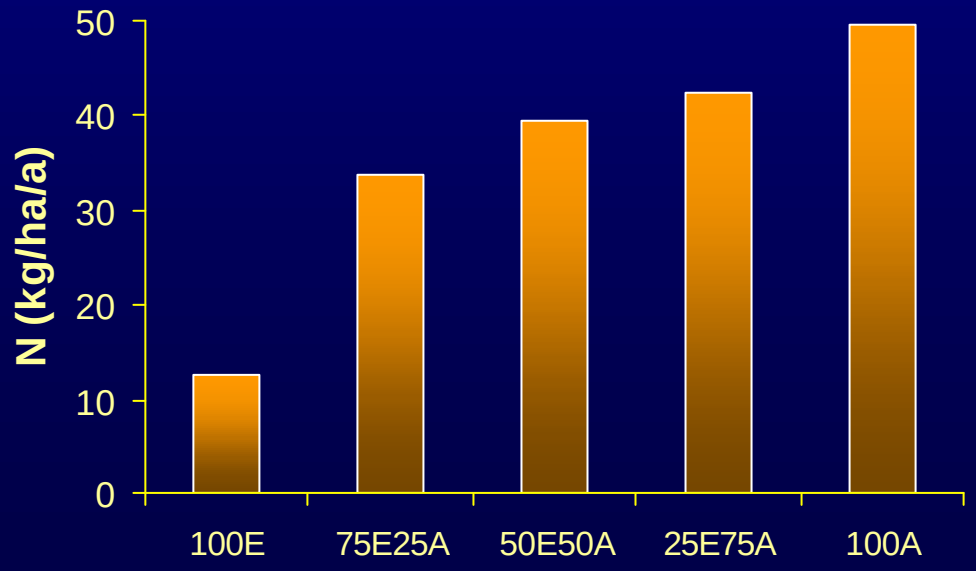


Relationship between above-ground biomass and soil organic C

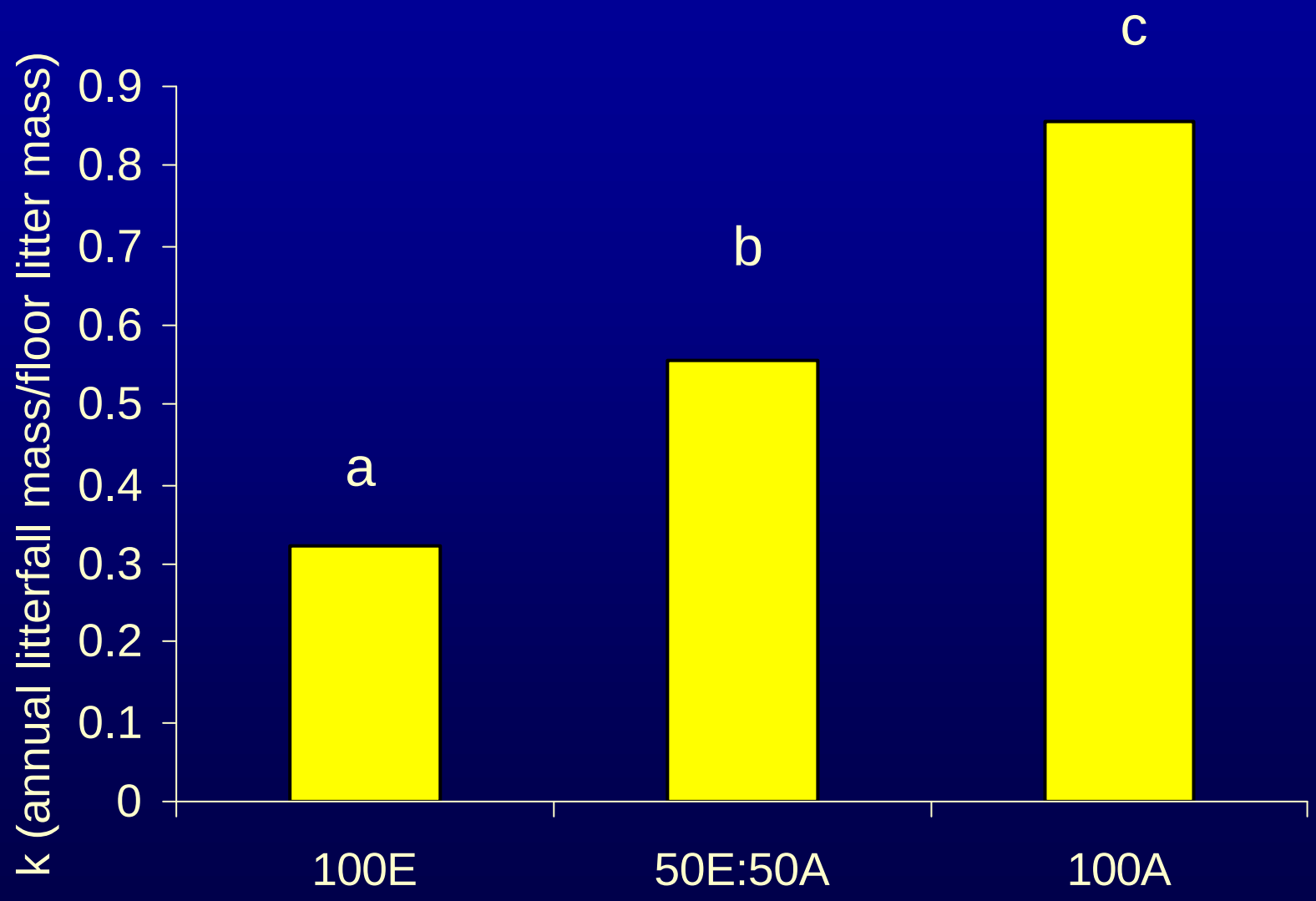


Litterfall and N cycling

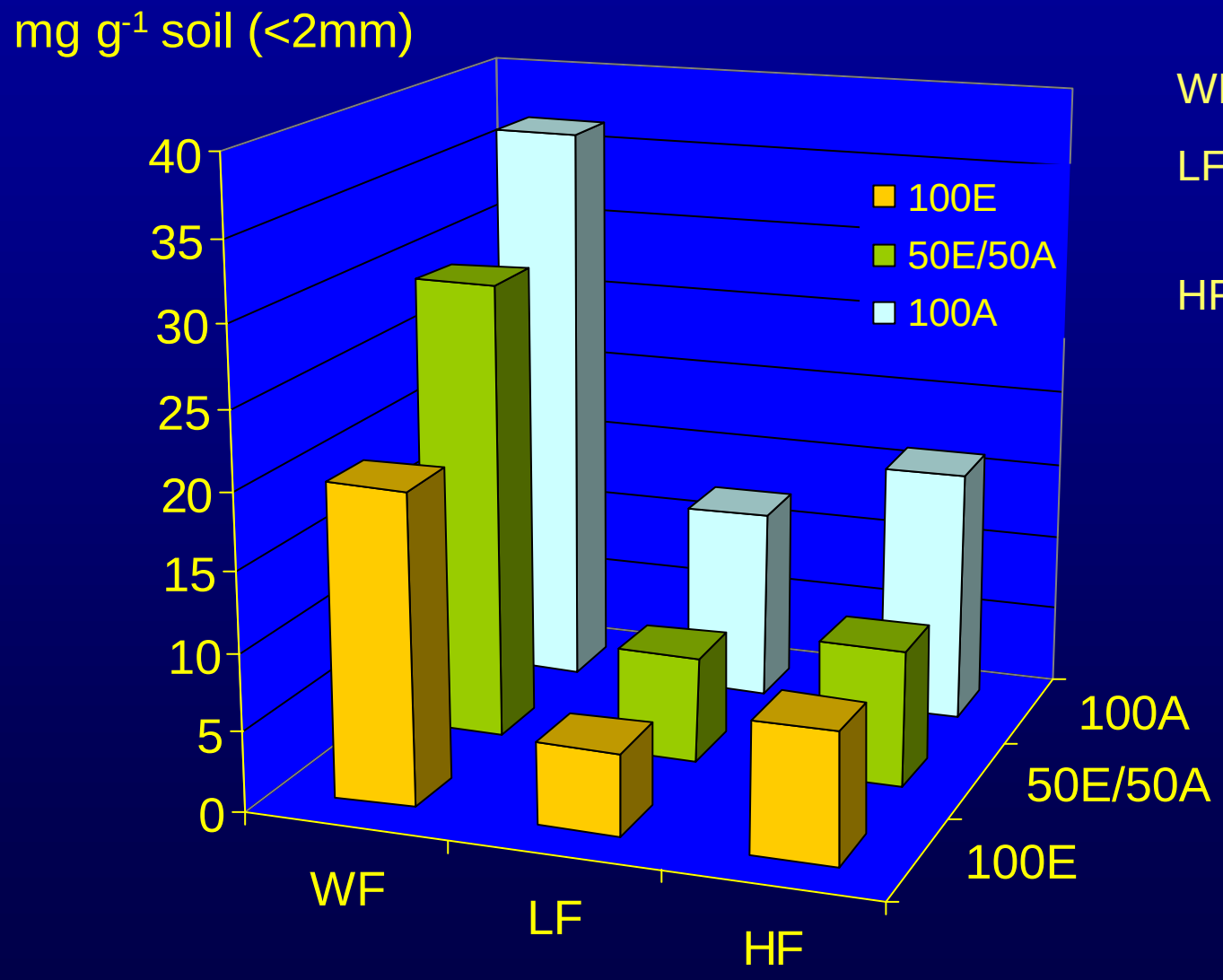




Rates of litter decomposition (k)



Density fractions of OM in 0-5 cm depth

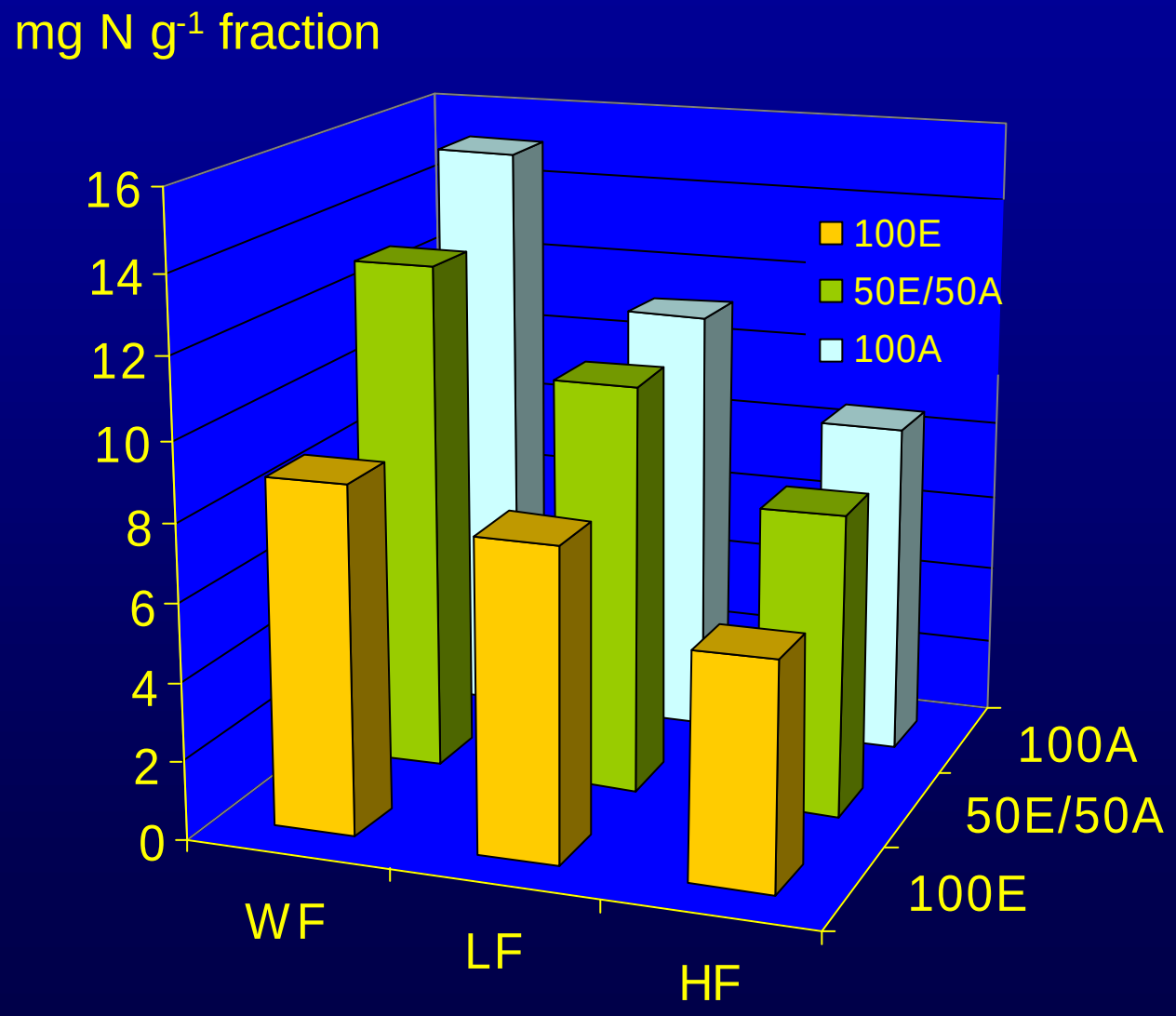


WF = water floatable

LF = light fraction (1.0 <d<1.3)

HF = heavy fraction (d>1.3)

N concentrations in OM density fractions

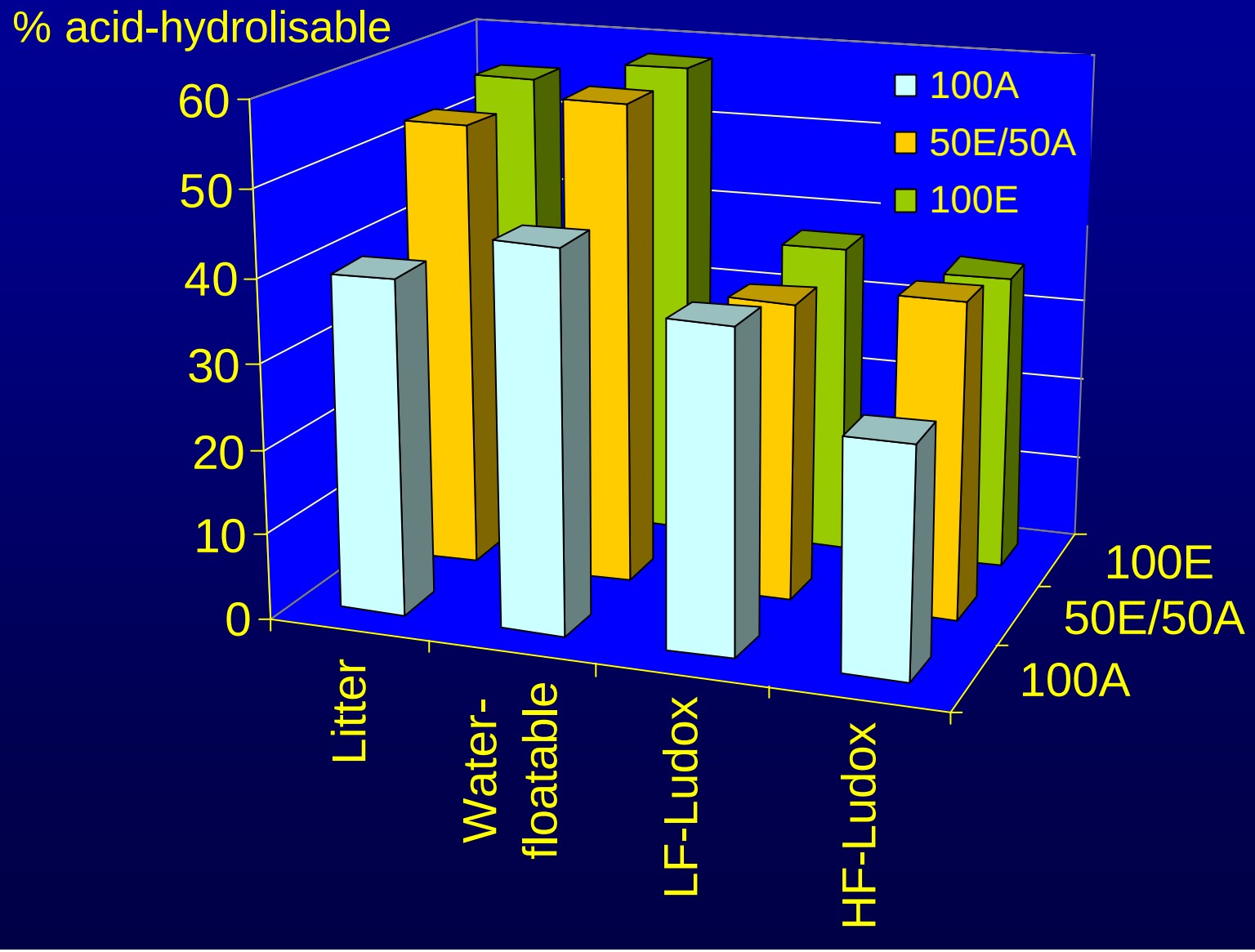


WF = water floatable

LF = light fraction
(1.0 <d<1.3)

HF = heavy fraction
(d>1.3)

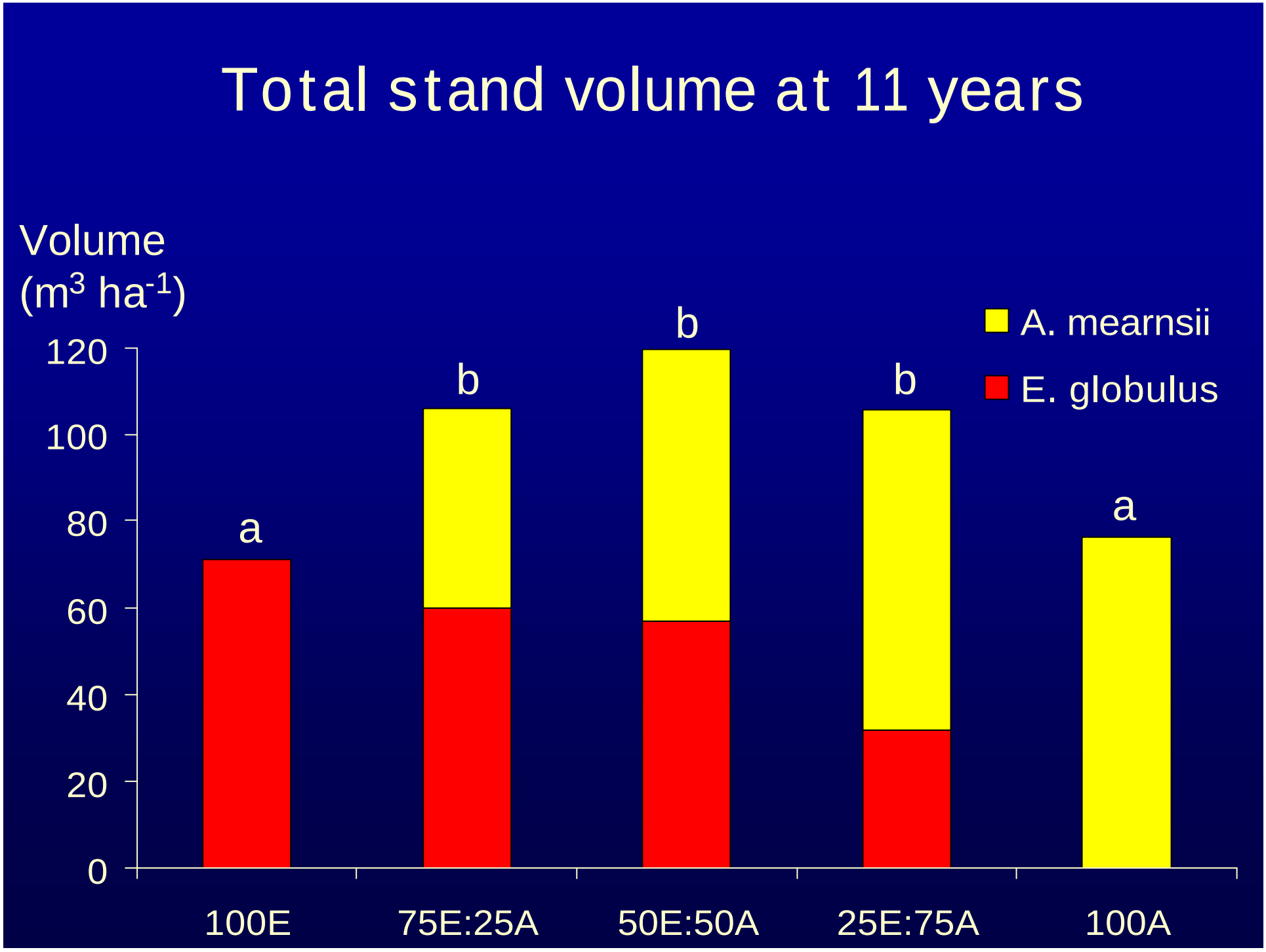
Decomposability of organic matter fractions



Summary

- All treatments with N-fixing acacias store greater amounts of soil organic carbon (SOC) after 10 years
- SOC storage is not related to the percent of N-fixing trees.

Total stand volume at 11 years



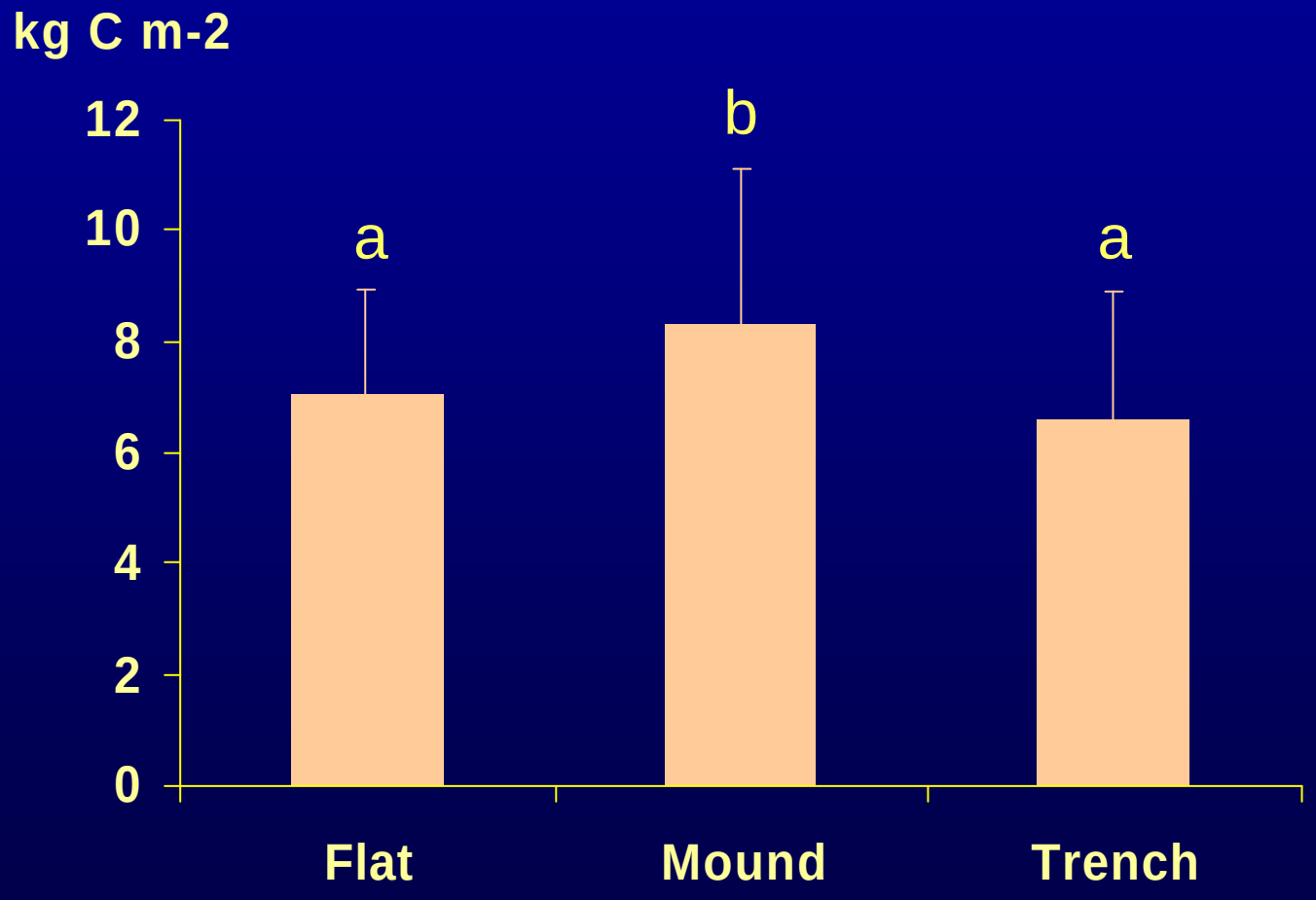
Summary

- All treatments with N-fixing acacias store greater amounts of soil organic carbon (SOC) after 10 years
- SOC storage is not related to the percent of N-fixing trees.
- Surface litter of acacias decomposes faster than that of eucalypts. More of it is incorporated in mineral soil, and it appears to be more resistant to decomposition at later stages.

Conclusion

- Inclusion of acacias in eucalypt plantations may be a suitable option to increase SOC sequestration or to reduce SOC losses following plantation etablishment (in addition to increasing aboveground productivity).

Effect of microsites on SOC



Relationship between litterfall and soil organic C