PROPAGULE BANKS IN AQUATIC WETLAND ECOSYSTEMS: DISTURBANCES AS A KEY PROCESS

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Seed- and propagule- banks

- Dispersal in time (Poschlod et al 1998)
- Community resilience after disturbances (Brock et al 2003)

Disturbances

- Stochastic events that destroy biomass and disrupt ecosystem function (Grime, White & Pickett)
- In aquatic ecosystems :

Droughts

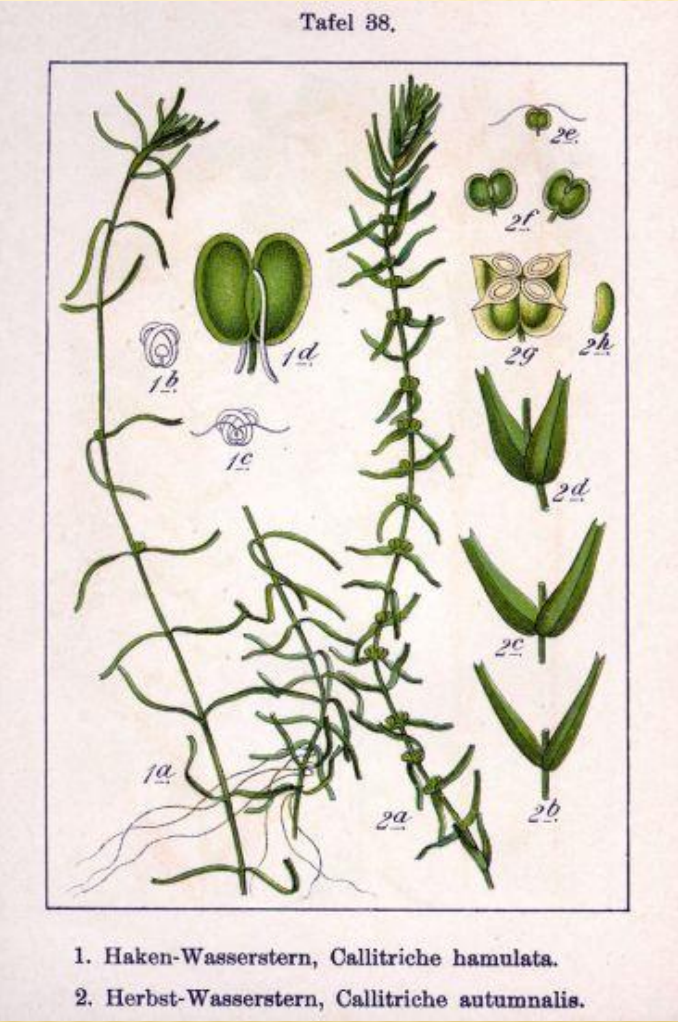
Inundating floods

scouring floods

But also ploughing, digging…

Disturbances select for a ruderal strategy (Grime 2002)

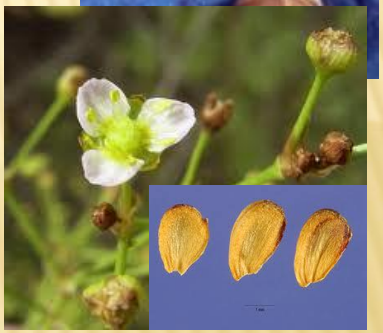
Short life span



Light seeds

Abundant propagules

Aquatic plant propagules



- Seeds: potentially long life span, reserves
- Fragments: short life span, no reserves
- Seasonal propagules: short life span, reserves
  - Dormant apices, bulbs, tubers

- Rhizomes, runners: > 1 year life span, reserve
  - Clonal growth forms

What is the effect of disturbances on reproduction and multiplication ?

Disturbances

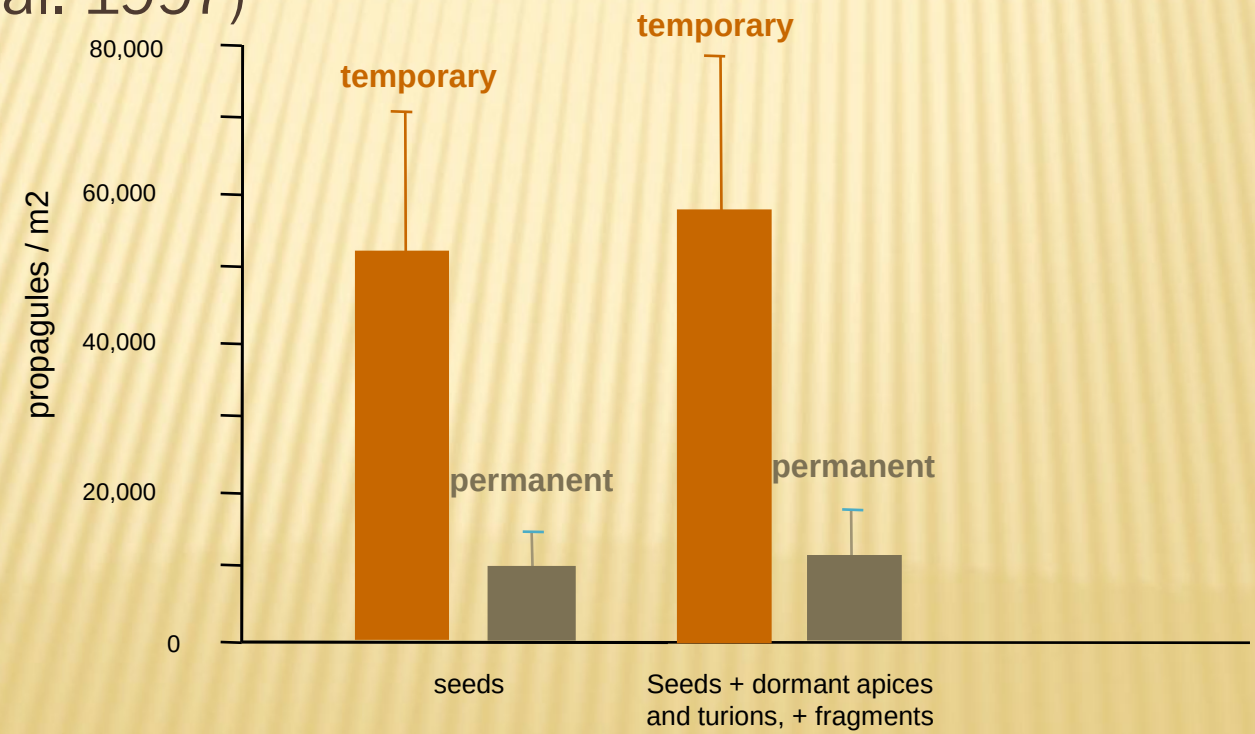
Reproduction

Multiplication

X ?

Drought are associated with higher propagule density in the bank

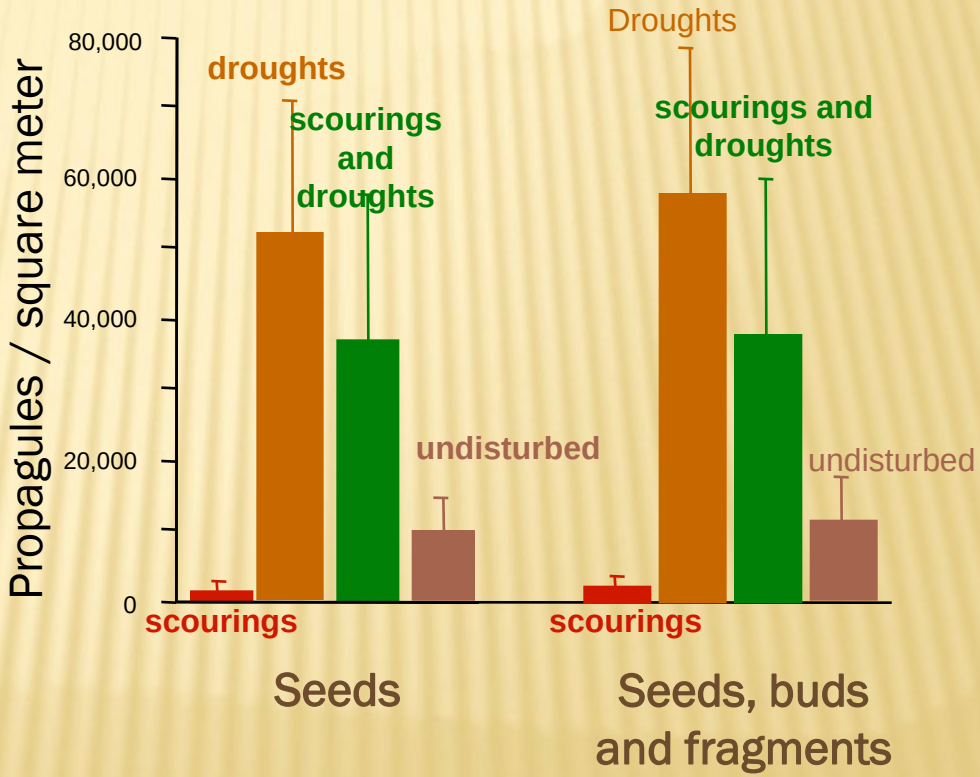
- succession of ecophases (van der Valk, 2005)
- drought allows flowering of amphiphytes
- some hydrophytes may flower when dewatered (Volder et al. 1997)



Combroux & Bornette 2004

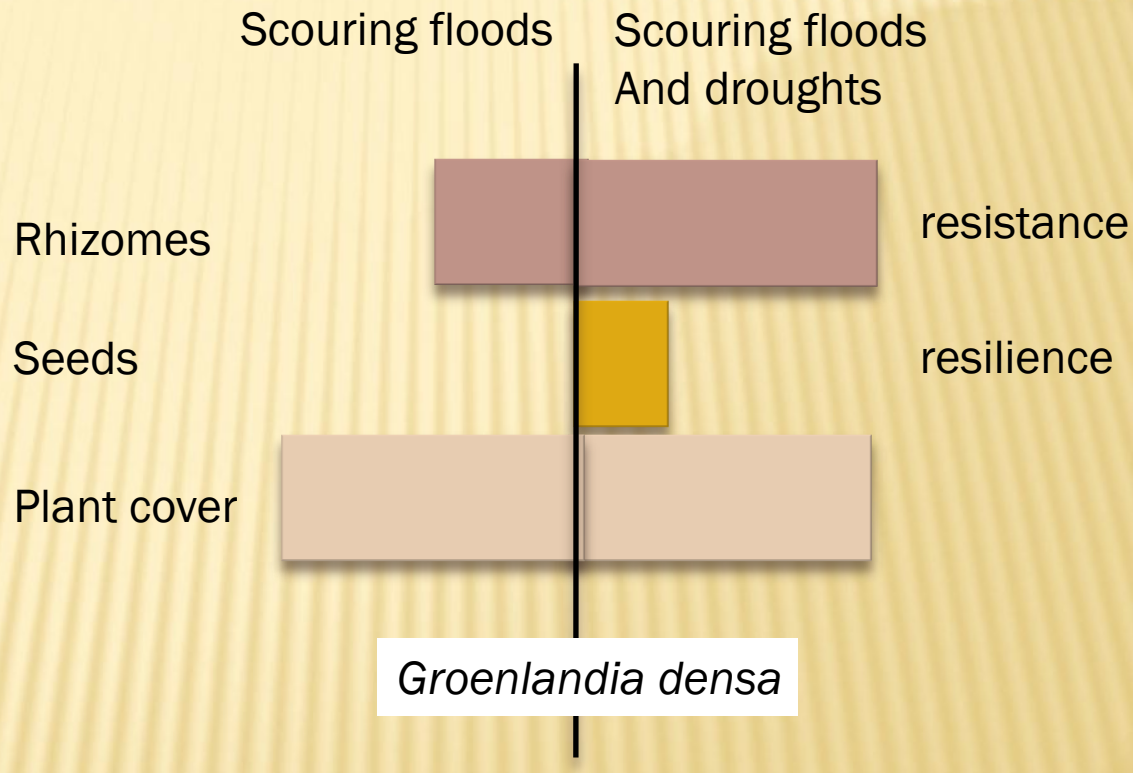
Scouring floods may impede reproduction of ruderals by decreasing flowering success

Average number of scouring floods during the flowering period : 1,12 to 3,2 depending on the species



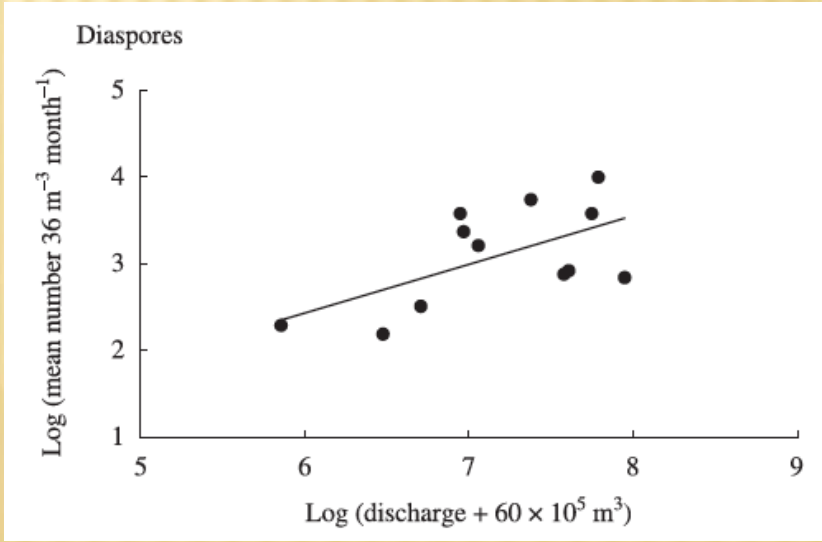
Combroux et al 2004

Change in disturbances may induce shifts in reproductive strategies



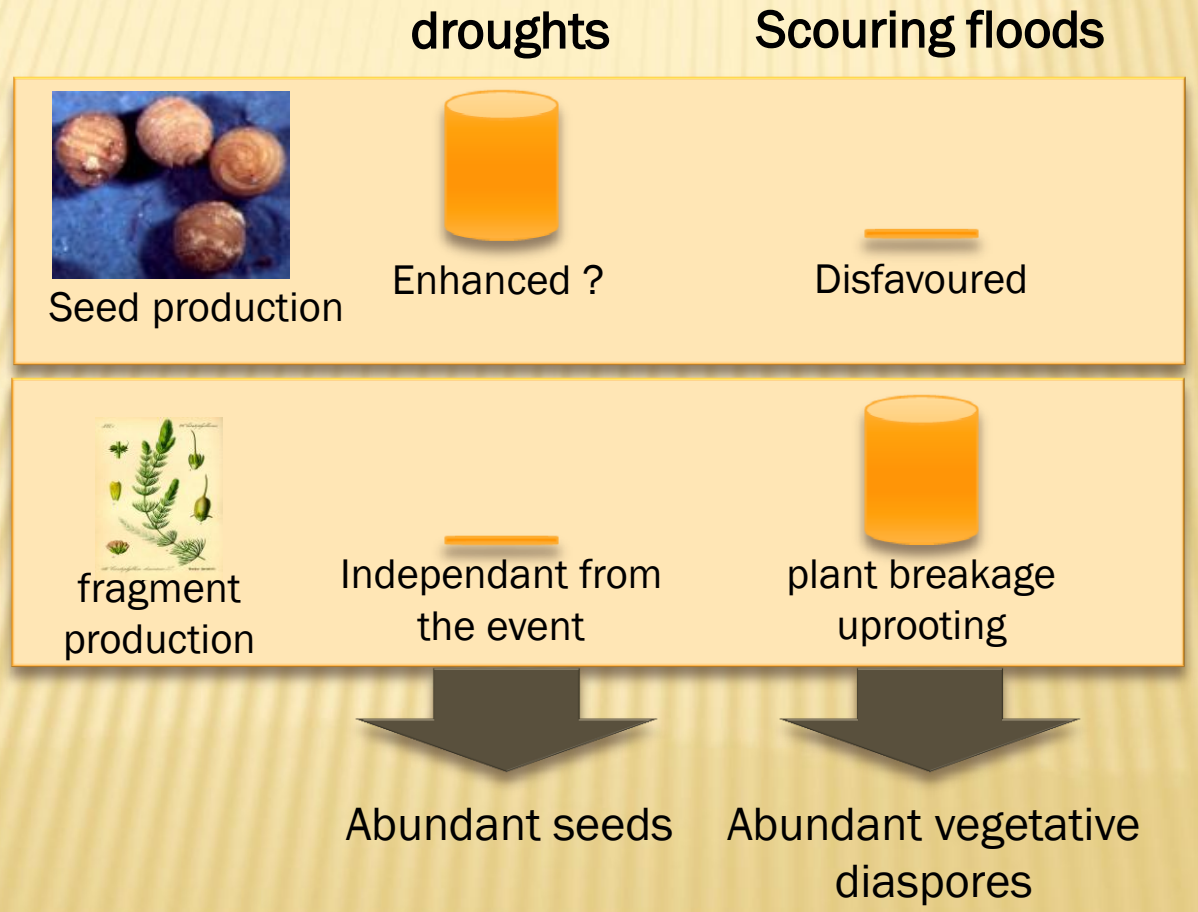
Combroux et al 2001

Scouring floods also promote the production of vegetative propagules through plant fragmentation



Boedeltje et al 2004

Disturbances promote reproduction and vegetative multiplication



What is the effect of disturbances on dispersal?

Disturbances

Dispersal

X ?

Scouring floods promote dispersal

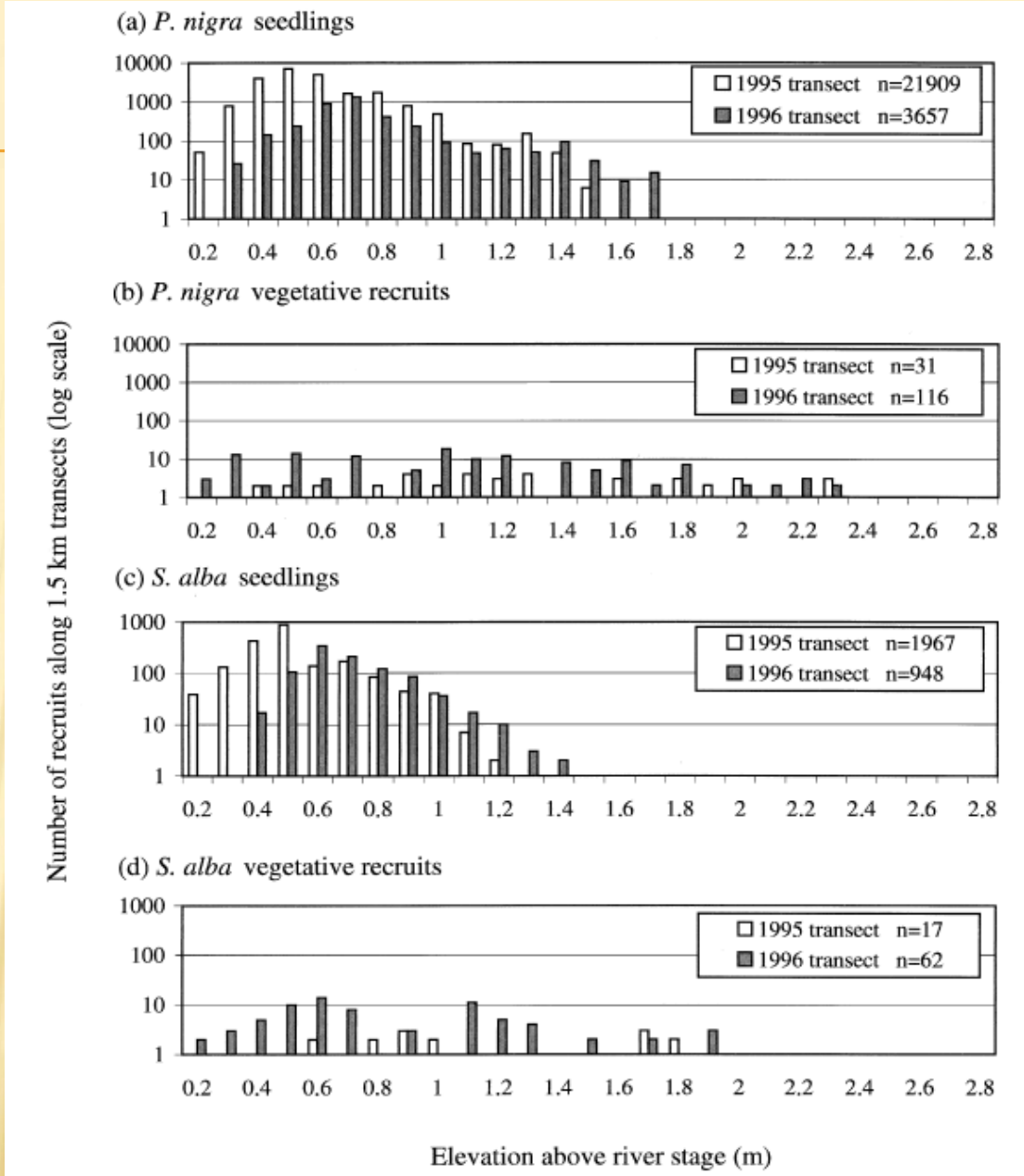
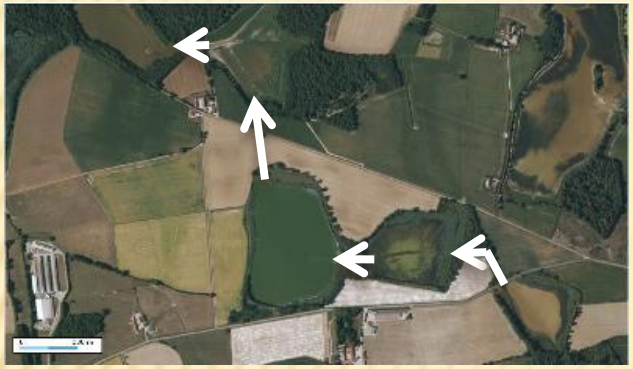
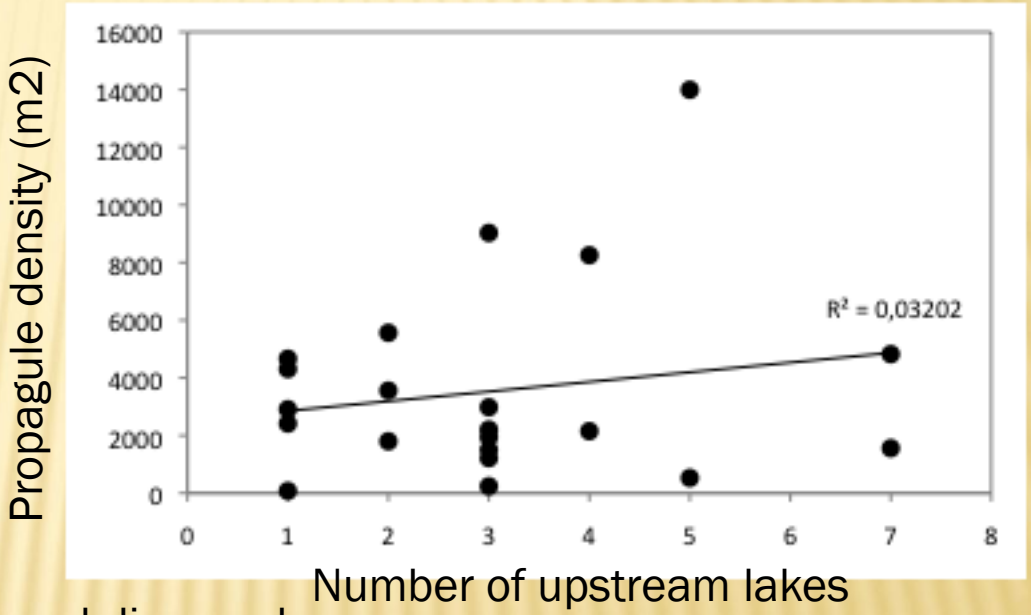


Figure 2. Total number of *P. nigra* and *S. alba* seedlings and vegetative recruits of the year found along 1.5 km transects in 1995 and 1996 against elevation above river stage.

Barsoum 2002

Droughts have no effect on dispersal

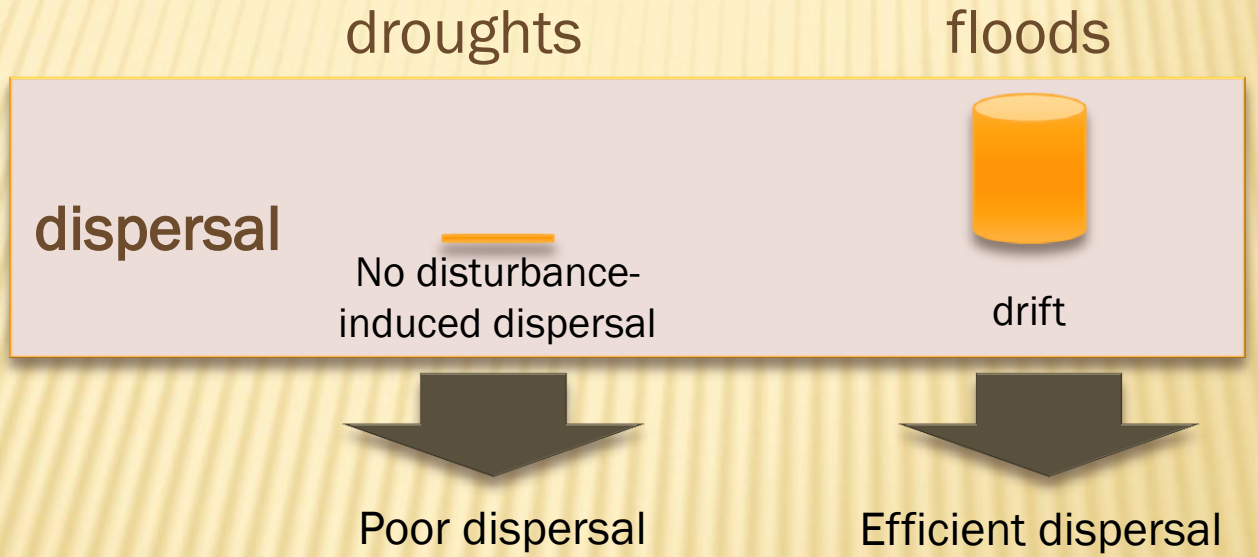




No interaction between disturbance and dispersal :
increasing number of disturbed lakes upstream
does not increase seed density downstream
(hydrological connectivity homogeneous)

Arthaud et al (in press)

Floods promote dispersal of both sexual and vegetative diaspores



What is the effect of disturbances on regeneration niches ?

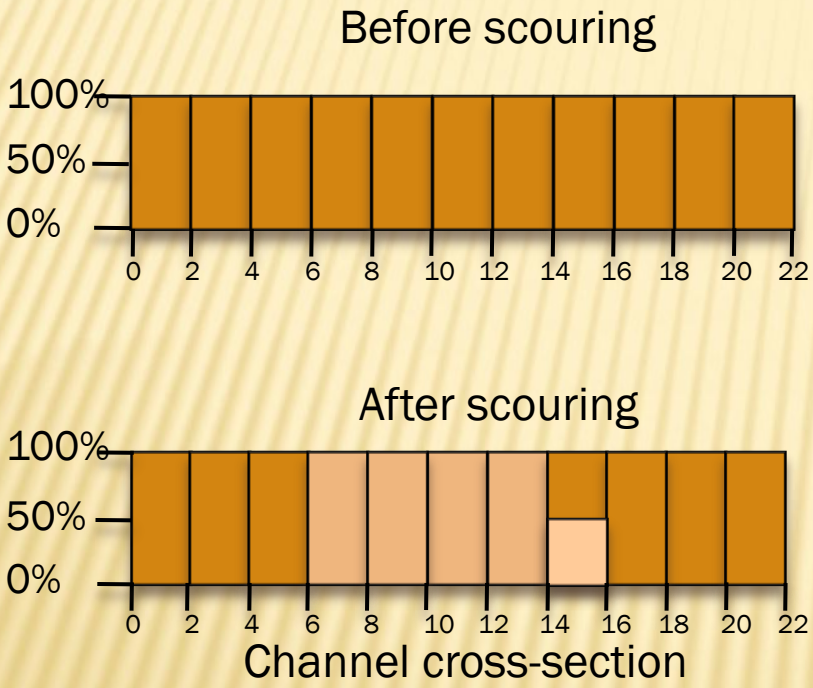
Disturbances

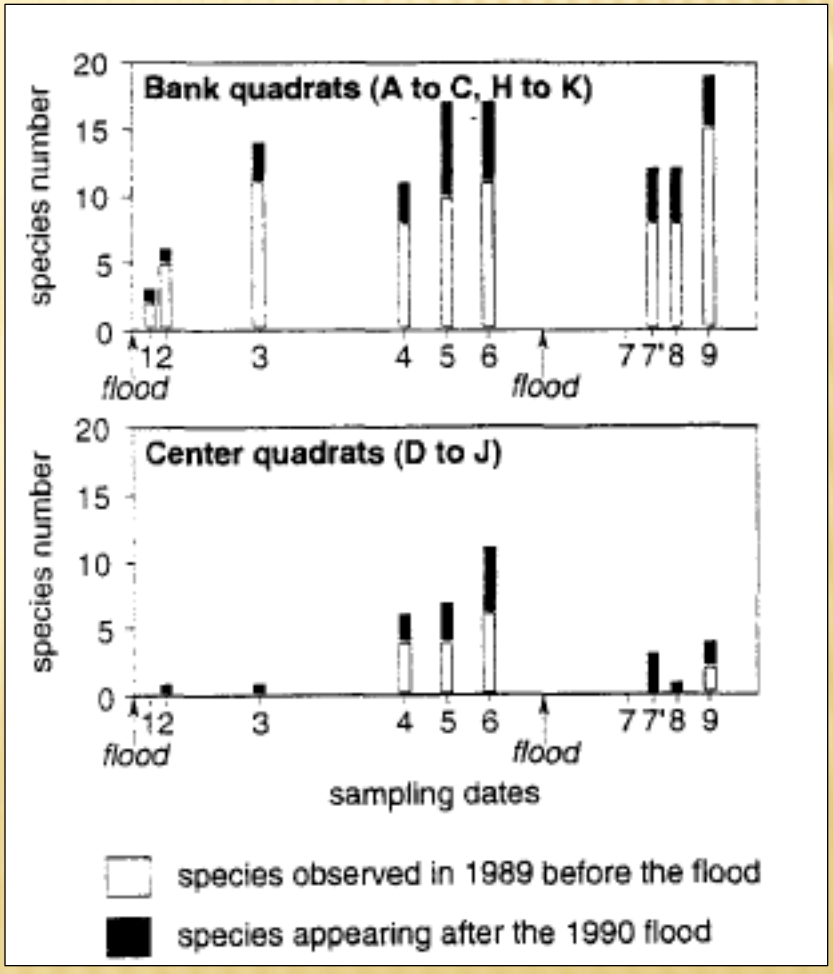
Spatial and temporal niche availability

X ?

Abiotic niche

- Grain size



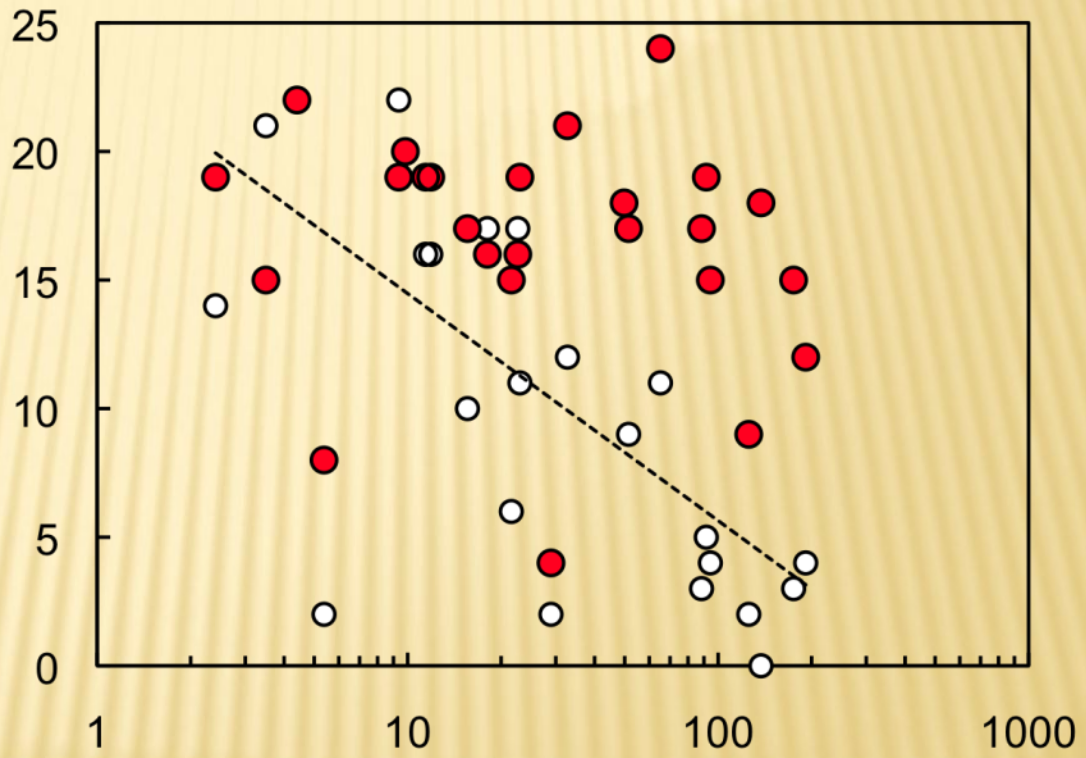


Heny et al 1996

Biotic niche : competition and recruitment

○ established vegetation :
rho = - 0.68 p=0.002

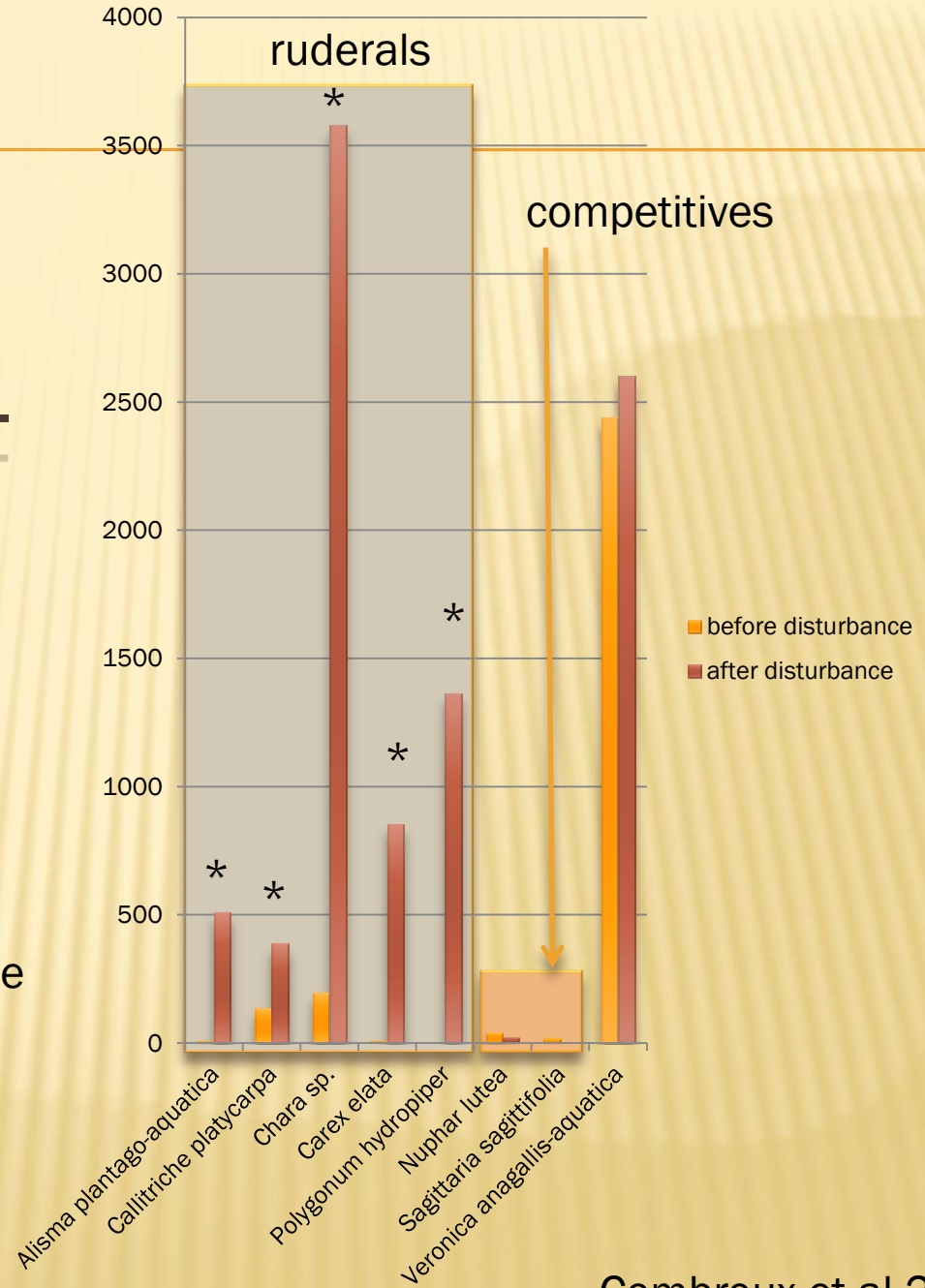
● propagule bank :
rho = -0.35 p= n.s.



Species richness in the propagule bank was not correlated to phytoplankton biomass.

Arthaud et al Freshwater Biology 2012

Biotic niche: blooms of ruderals after major disturbance resplenish the seed - bank



Effect of a restoration disturbance on seed bank (soil dredging)

Combroux et al 2002

Temporal stability during the recruitment phase

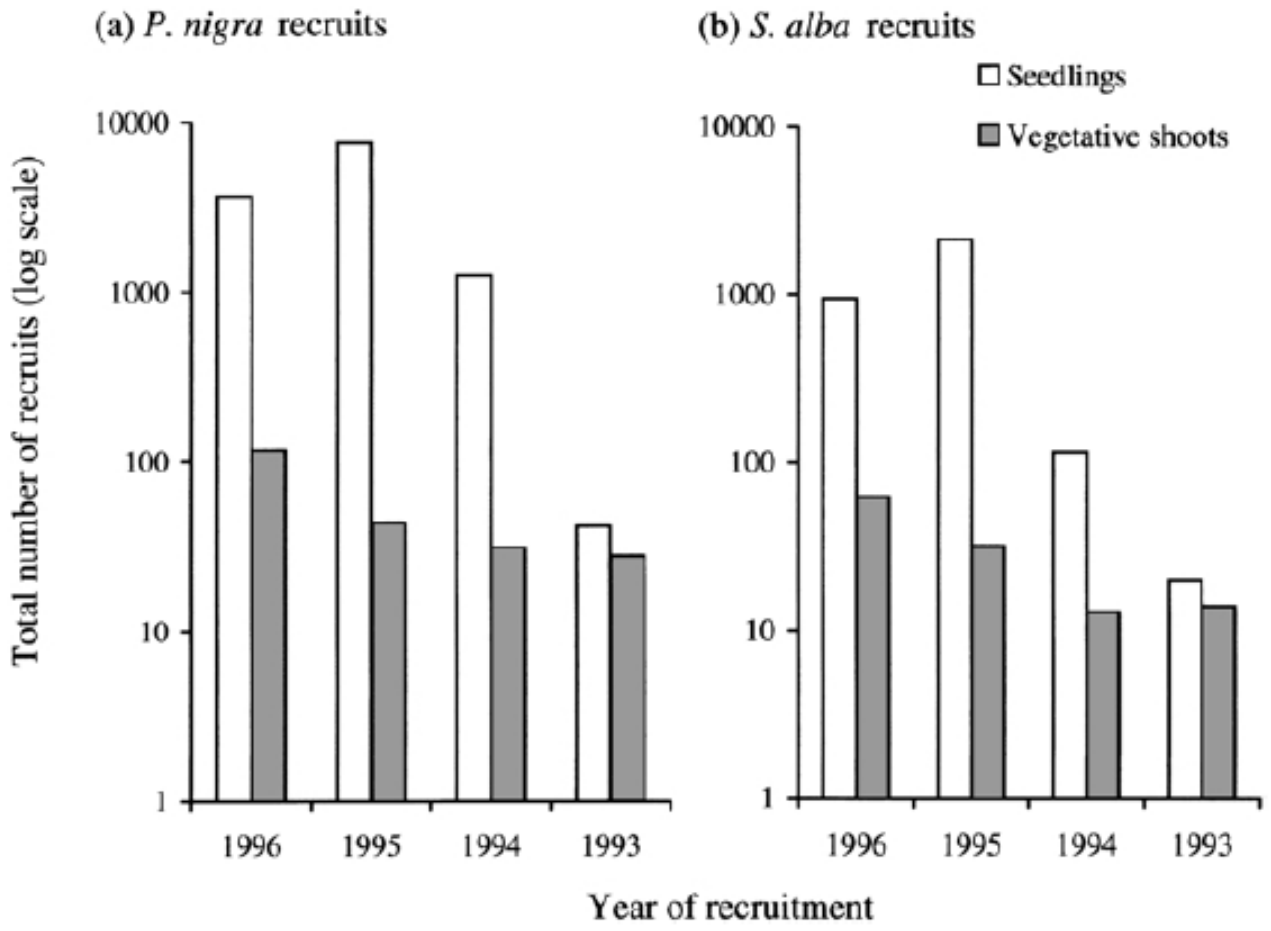
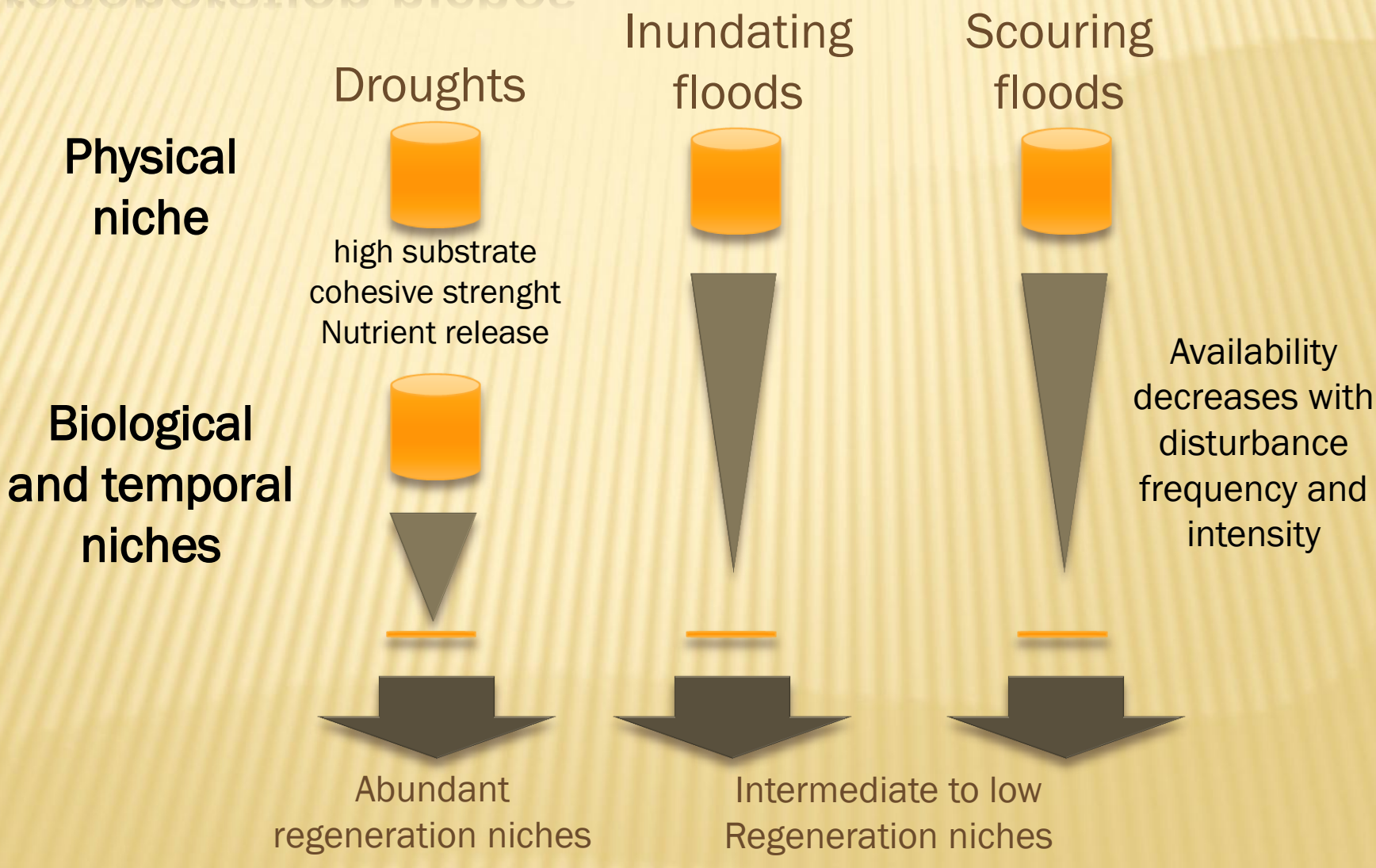


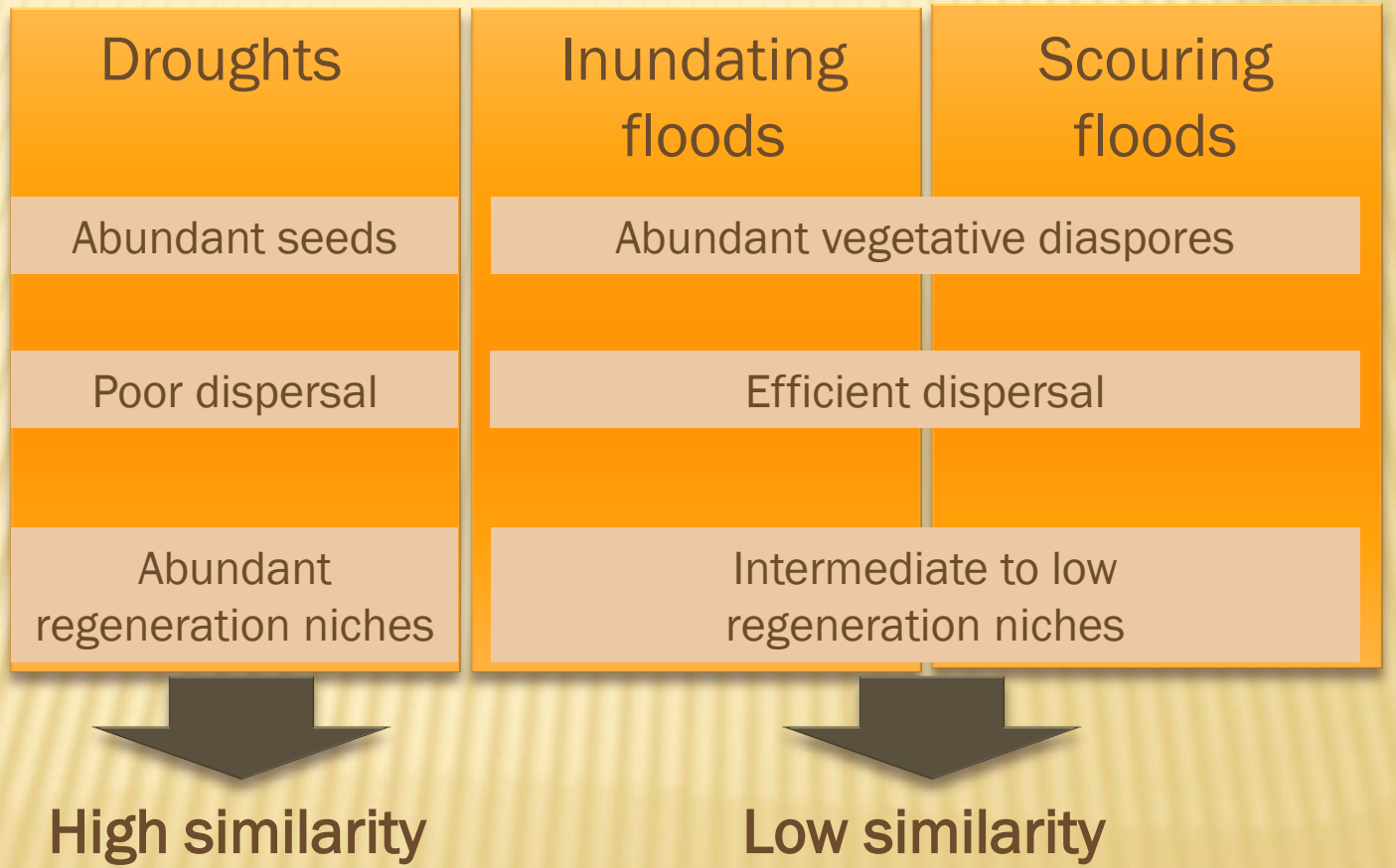
Figure 4. Number of *P. nigra* and *S. alba* sexual and asexual recruits encountered along 1996 transect from different years of establishment (1993–1996).

Barsoum 2002

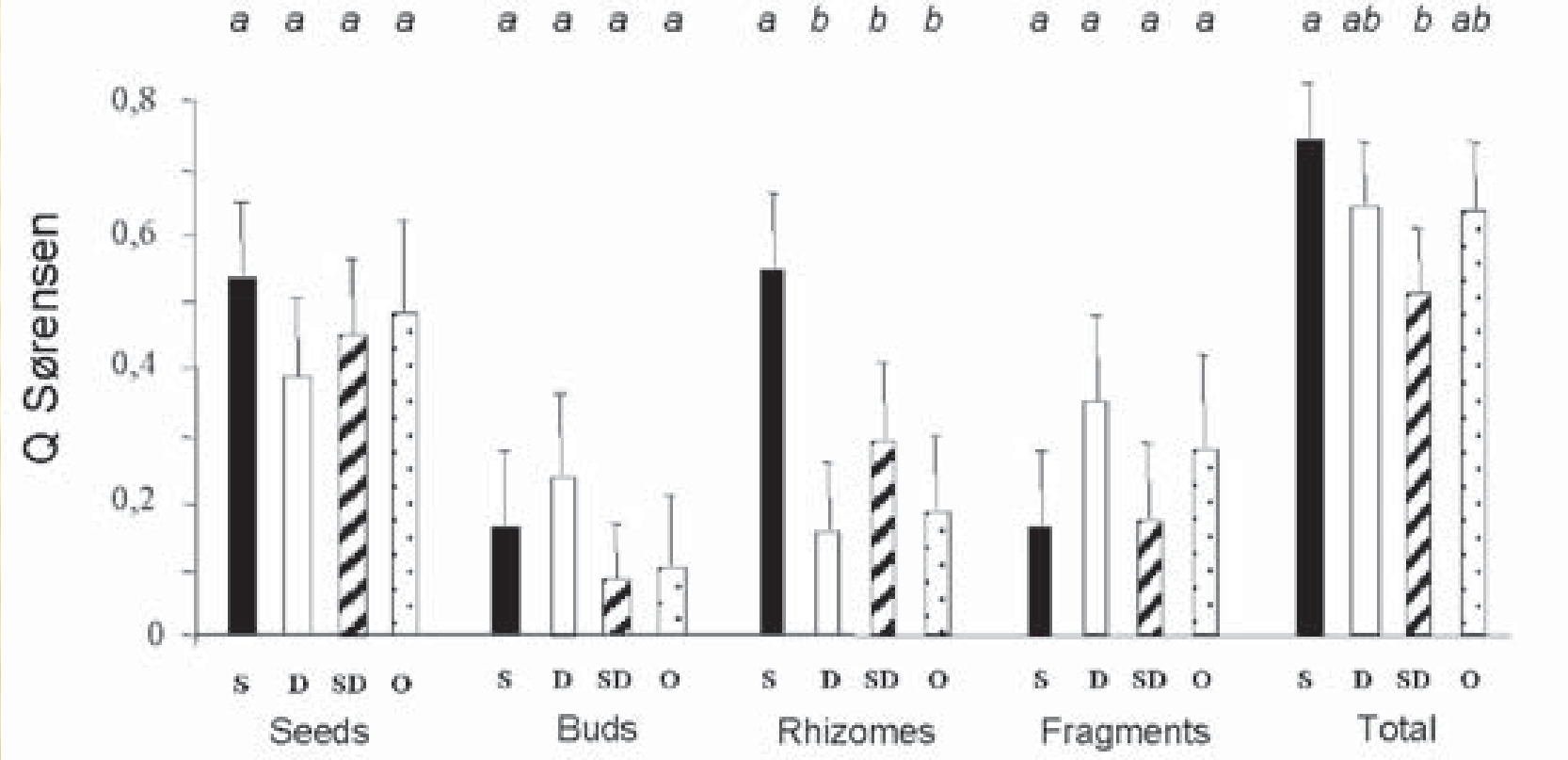
Only droughts increase the availability of regeneration niches



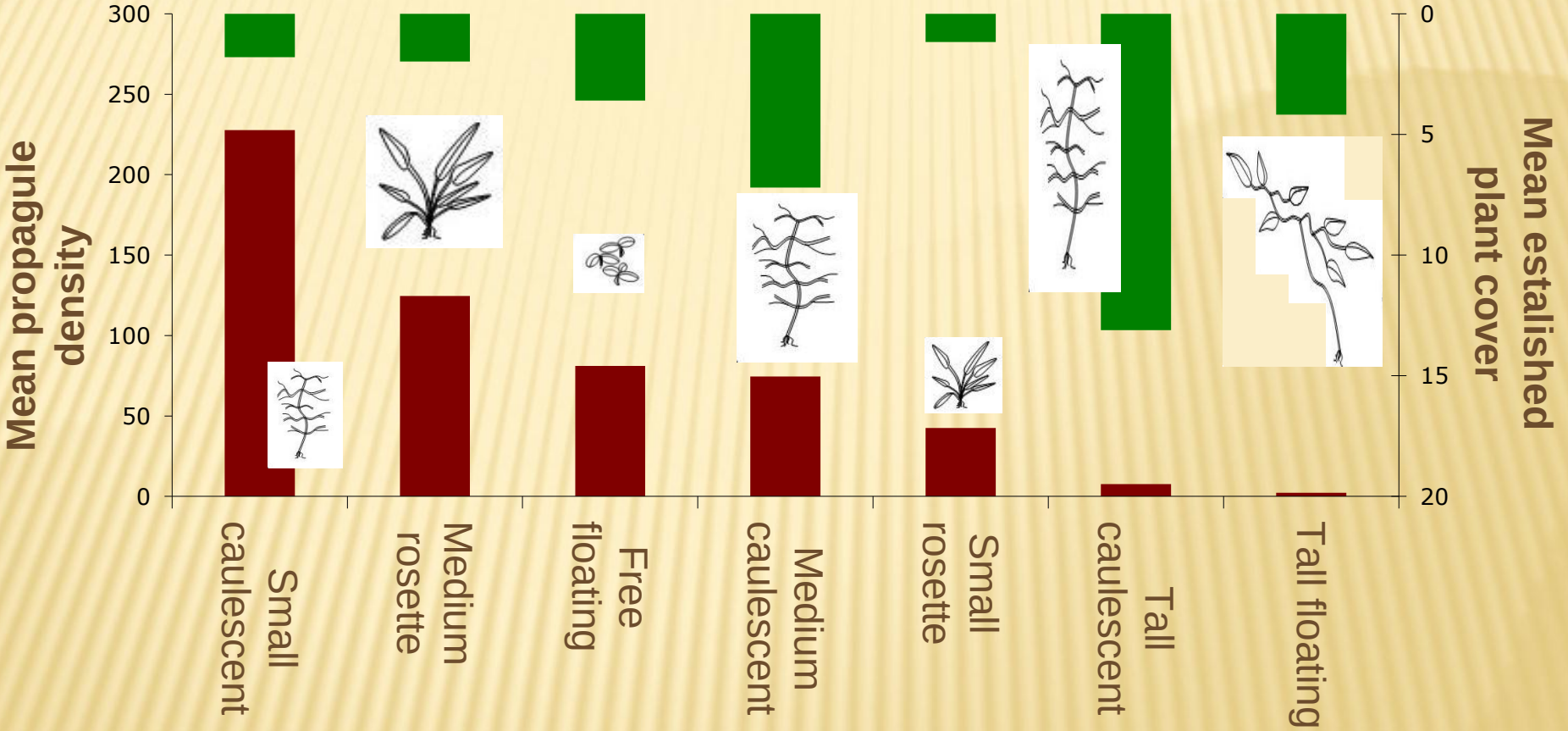
EXPECTED CONSEQUENCES FOR SIMILARITY ?



HAS STILL TO BEE TESTED, BUT….



We must integrate plant strategies and abundance



Small poorly competitive species are over-represented in the propagule bank
Tall competitive species are over-represented in the established vegetation

Averaging effect ?


Thank you