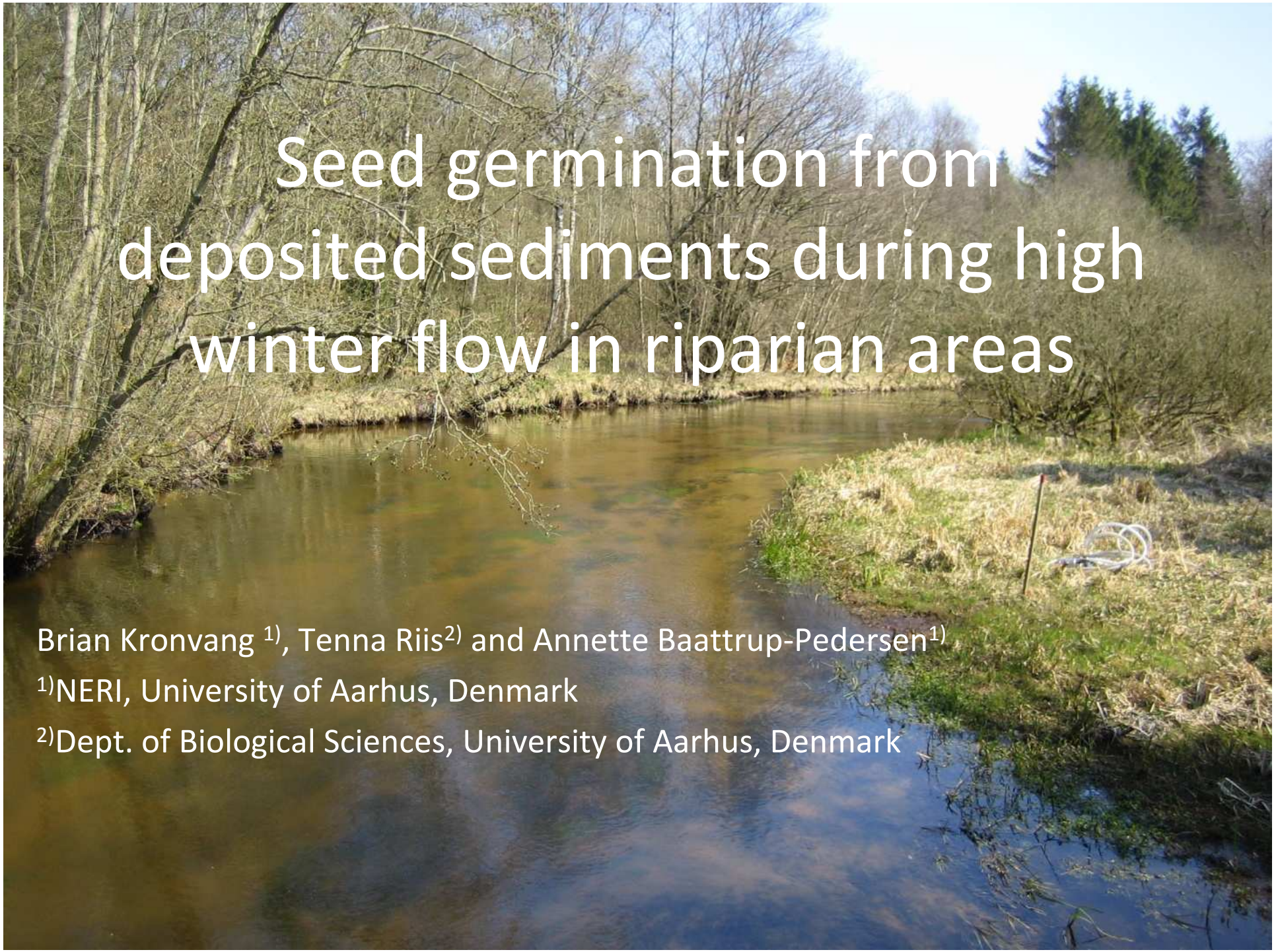

Seed germination from deposited sediments during high winter flow in riparian areas

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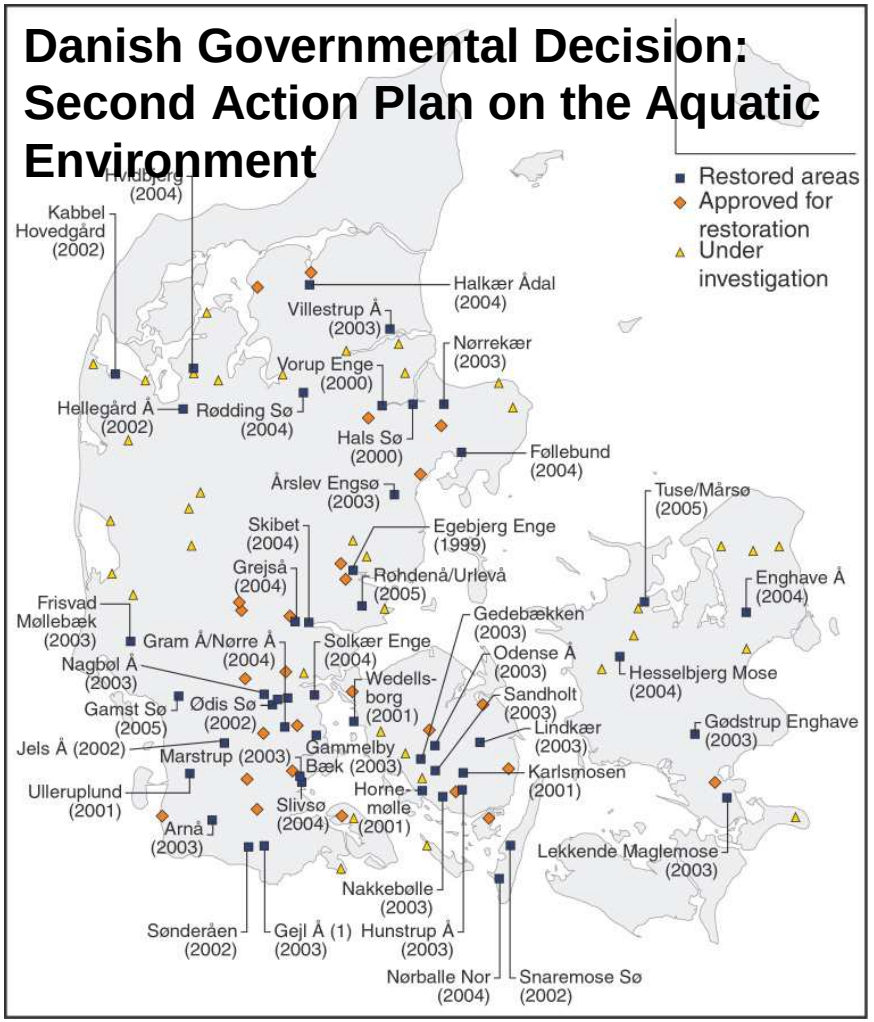
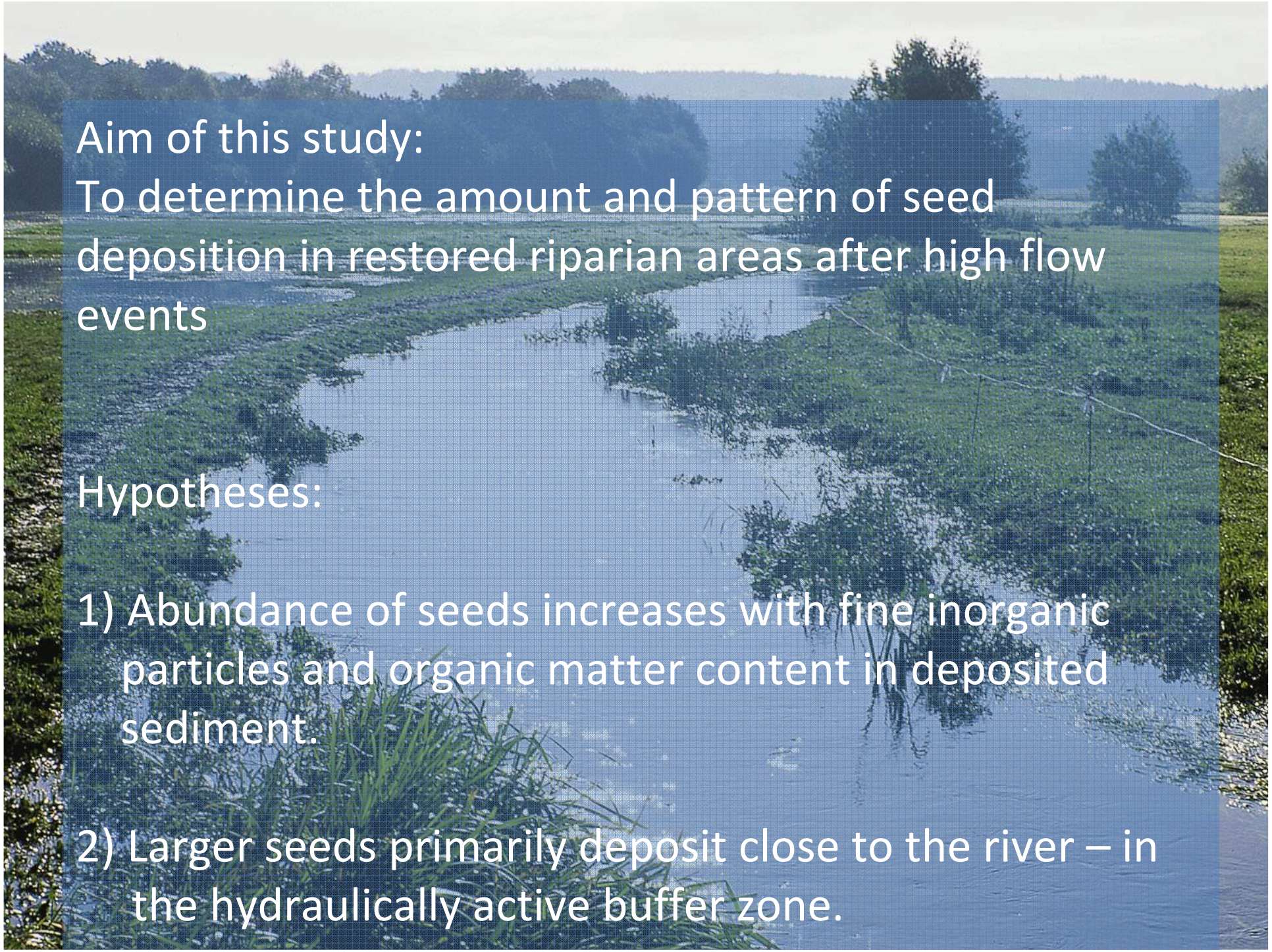
River re-meandering and wetland restoration – DK in the forefront – but for nitrogen retention purposes – what about P-retention and biodiversity of restored wetlands ?



3000 ha lakes and 4000 ha wetlands restored from 1998-2006



Aim of this study:
To determine the amount and pattern of seed deposition in restored riparian areas after high flow events

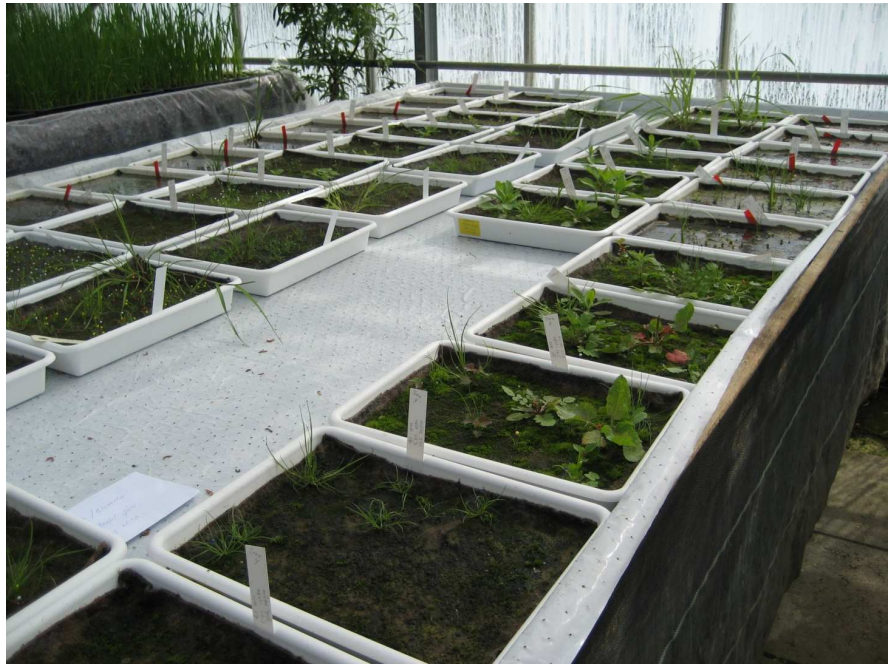
Hypotheses:

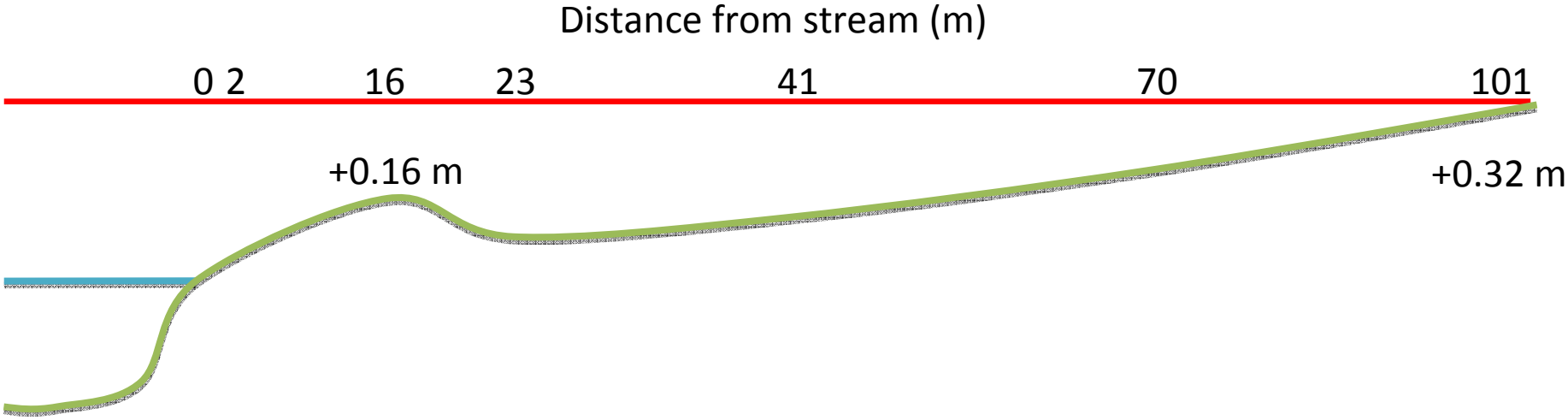
1) Abundance of seeds increases with fine inorganic particles and organic matter content in deposited sediment.

2) Larger seeds primarily deposit close to the river – in the hydraulically active buffer zone.

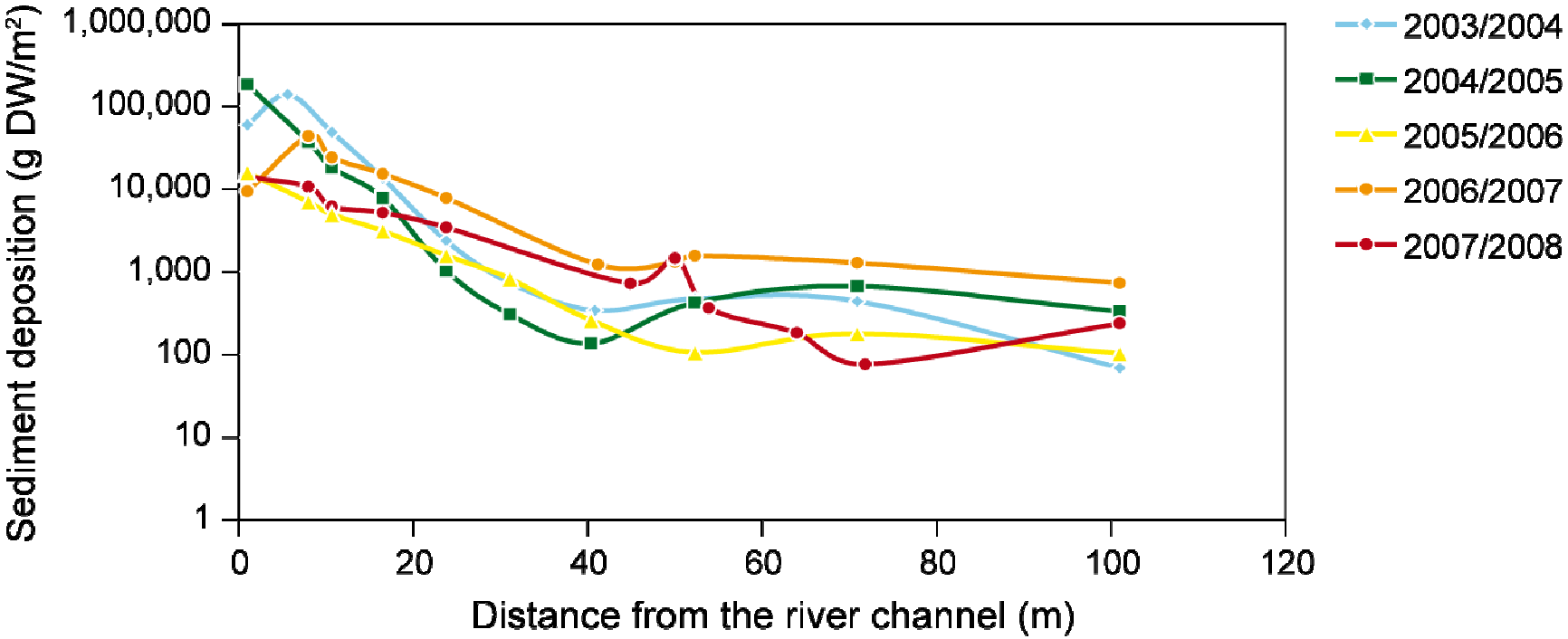
Collection of sediment after winter high flow – triplicates of 50x50 cm grass mats (astroturf)

Spread sediment in trays in greenhouse





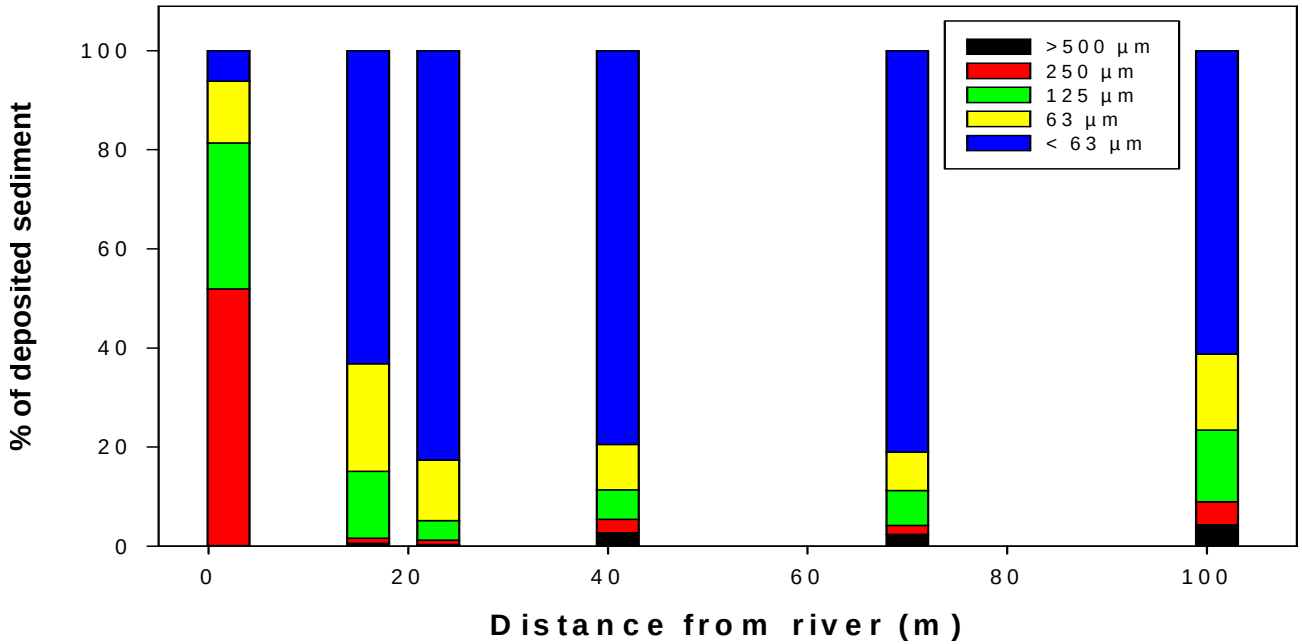
Sediment deposition on an inundated floodplain transect during five winter periods



Fine sediment deposited on the floodplain during winter 2006/2007 – being the wettest winter ever recorded in Denmark (possibly a 200 years return flood).

Deposited sediment characteristics

	Distance from stream (m)					
	2	16	23	41	70	101
Sediment (kg DW m^{-2})	9.36	15.25	7.80	1.22	1.28	0.73
Organic matter content (%)	1.8	21.9	27.3	35.4	43.4	52.8
Total P (mg P g^{-1} DW^{-1})	0.30	2.15	2.60	3.29	4.95	2.91
Total C (mg C g^{-1} DW^{-1})	8.47	96.1	109.9	135.5	142.7	176.2
Total N (mg N g^{-1} DW^{-1})	0.57	8.38	10.7	14.6	16.8	23.1
C/N ratio	17.2	13.4	12.0	10.8	9.9	8.9
Clay + silt content (%)	19	85	95	89	89	77



Seedling emergence

Identify new seedlings every week from 1-6 weeks

- In total 897 seedlings emerged
- Distributed over 31 species
- Most frequent:

Juncus bufonius (n=468): common name: Toad Rush
Juncus effusus (n=262): common name: Common Rush.
Urtica dioica (n= 41): common name: Stingling Nettle
Poa annua (n= 36): common name: Annual Blue Grass

The four most frequent species

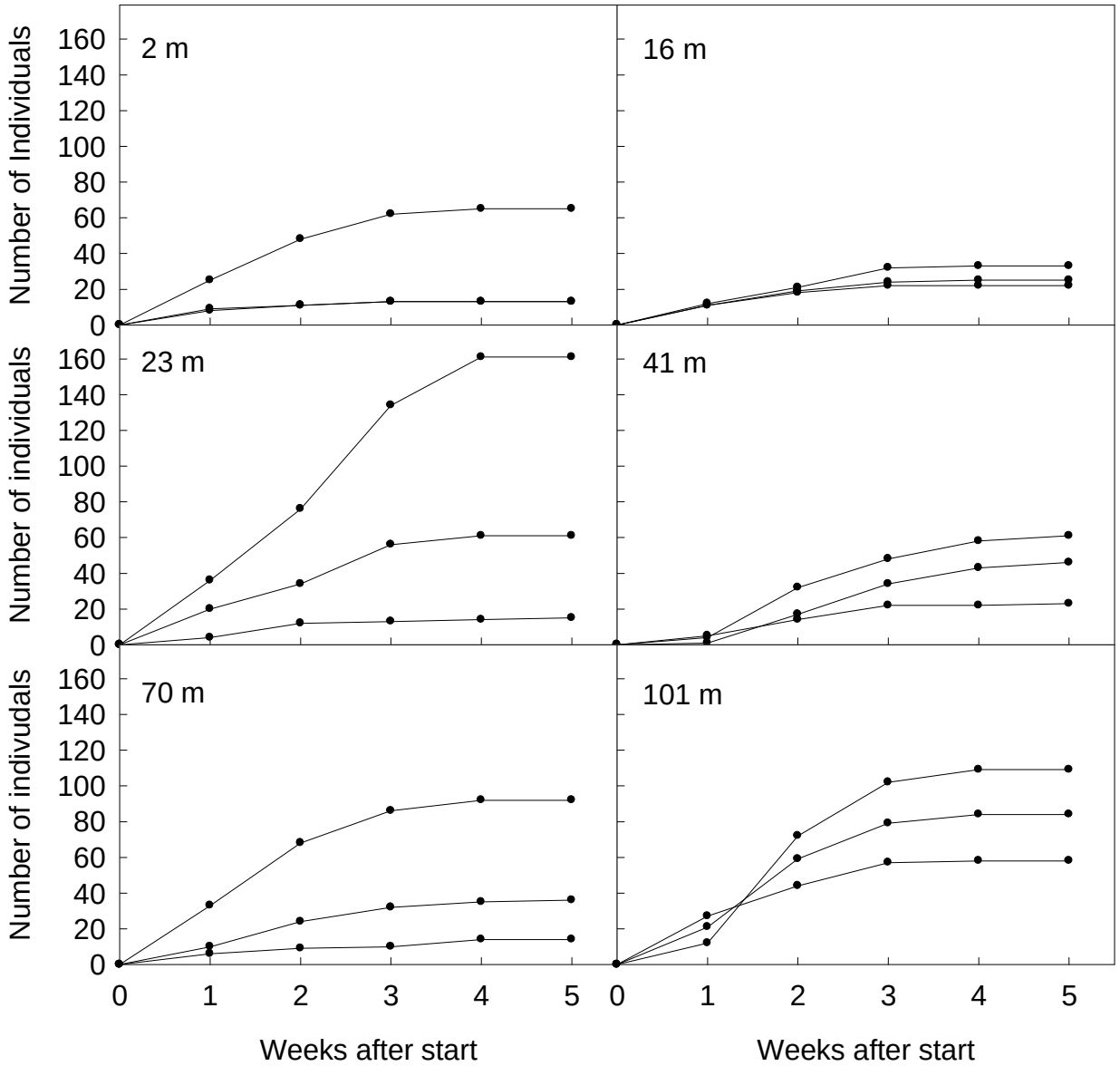
Juncus bufonius

Juncus effusus

Urtica dioica

Poa annua

Temporal dynamics of seedling emergence



Seedling characteristics with distance from river channel

	Distance from stream (m)					
	2	16	23	41	70	101
Number of seedlings (m^{-2})	1367 ±1198[a]	1183 ±176[a]	3817 ±3595[a]	1050 ±467[a]	1175 ±992[a]	2067 ±651[a]
Species richness	6.7 ±3.1[b]	10.7 ±1.5[c]	4.0 ±2.0[ab]	3.0 ±1.0[a]	4.7 ±1.5[ab]	4.7 ±1.2[ab]
Mean seed weight (mg)	0.064 ±0.023[a]	0.041 ±0.010[a]	0.018 ±0.002[a]	0.031 ±0.013[a]	0.058 ±0.035[a]	0.043 ±0.013[a]

No significant difference in seed weight or number of seedlings with distance !

Correlation between sediment characteristics, position in the riparian area and seedling characteristics

	Org. matter (fine particles and distance from stream)	Tot-P	Topography
Number of seedlings	0.512*		
Species richness		-0.497*	
NMS scores, axis 1	-0.699**	-0.530*	
NMS scores, axis 2	0.806***	0.693**	0.624**

Conclusions of this study:

1) Winter flooding of riparian wetlands causes deposition of viable diaspores
2) High variability on a small spatial scale
3) Abundance of seeds increases with fine inorganic particles and organic matter content in deposited sediment – strong linkages to micro topograpy of bufferzone and floodplain
4) No correlation between seed size and deposition distance
5) Only common eutrophied species dispersed – no rare species
6) Most seedlings emerge after 3 weeks

Management implications

Rehabilitating natural dynamic hydrological conditions between streams and wetlands assists in seed dispersal from upstream

However, natural non-eutrophied communities most often not established due to missing colonization areas upstream ?

May add seeds to rehabilitate wetland biodiversity