Bundesministerium für Verkehr, Bau und Stadtentwicklung

KLIWAS
Climate · Water · Navigation

KLIWAS

Impacts of climate change on waterways and navigation:
searching for options of adaptation

Changes of plant diversity in riverine grassland after extreme hydrologic events on the Elbe floodplain

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KLIWAS Project 5.06

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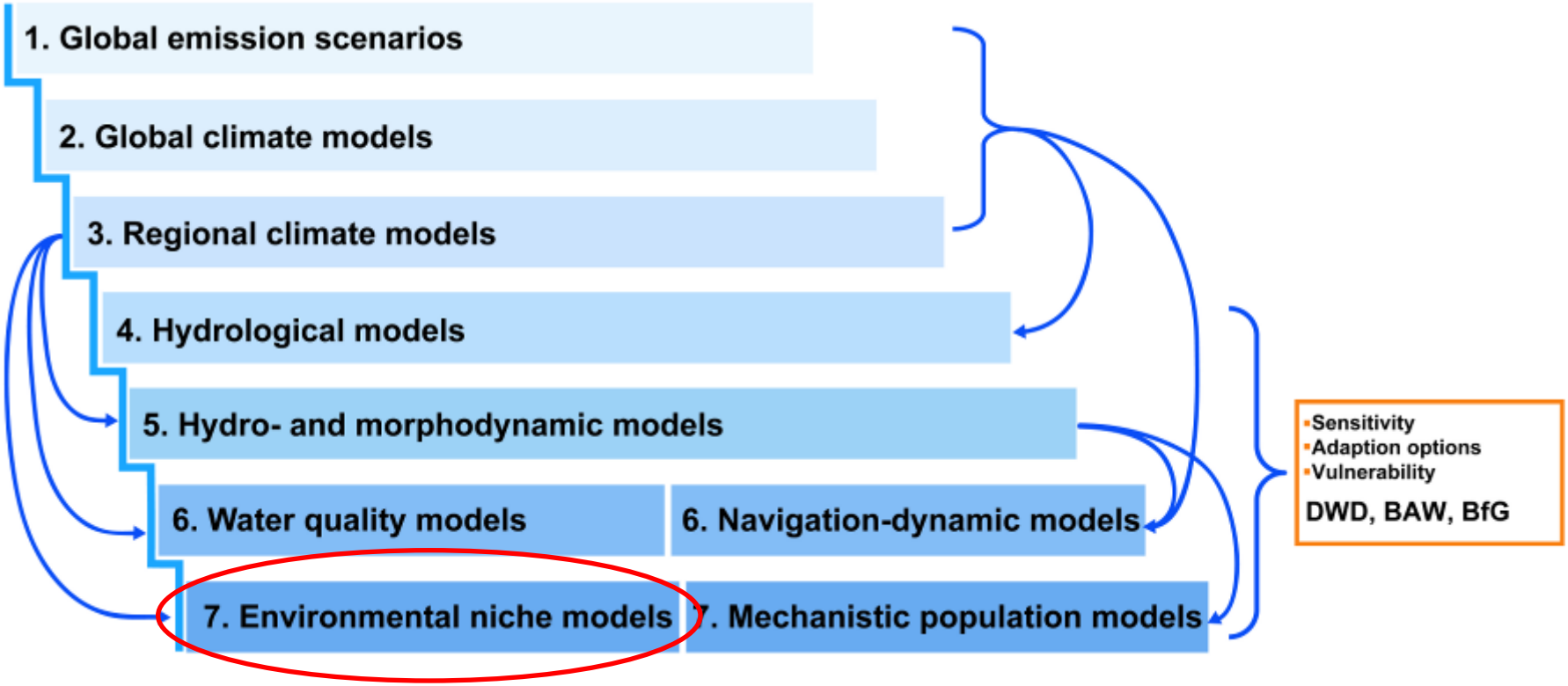
KLIWAS

Impacts of climate change on waterways and navigation: searching for options of adaptation



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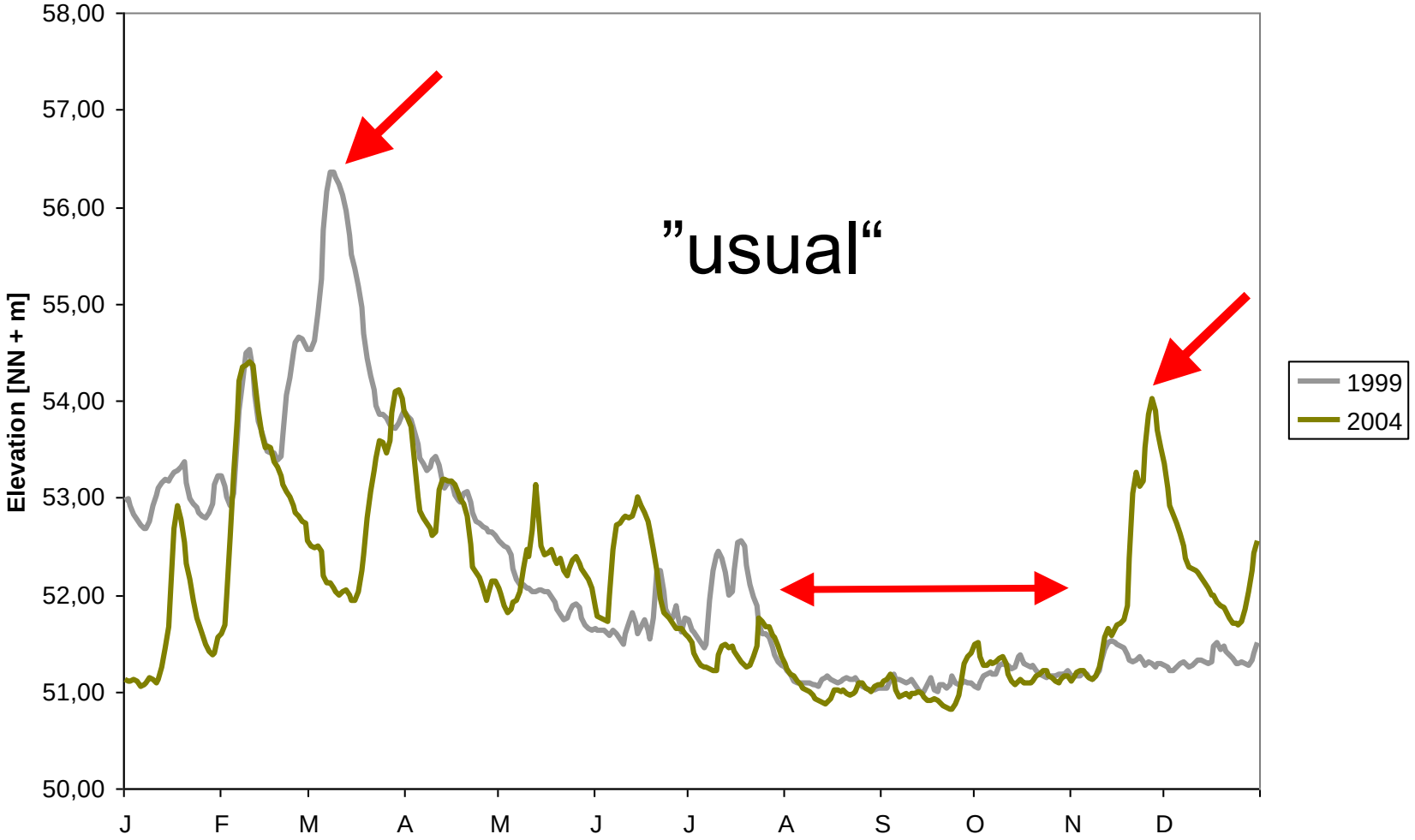
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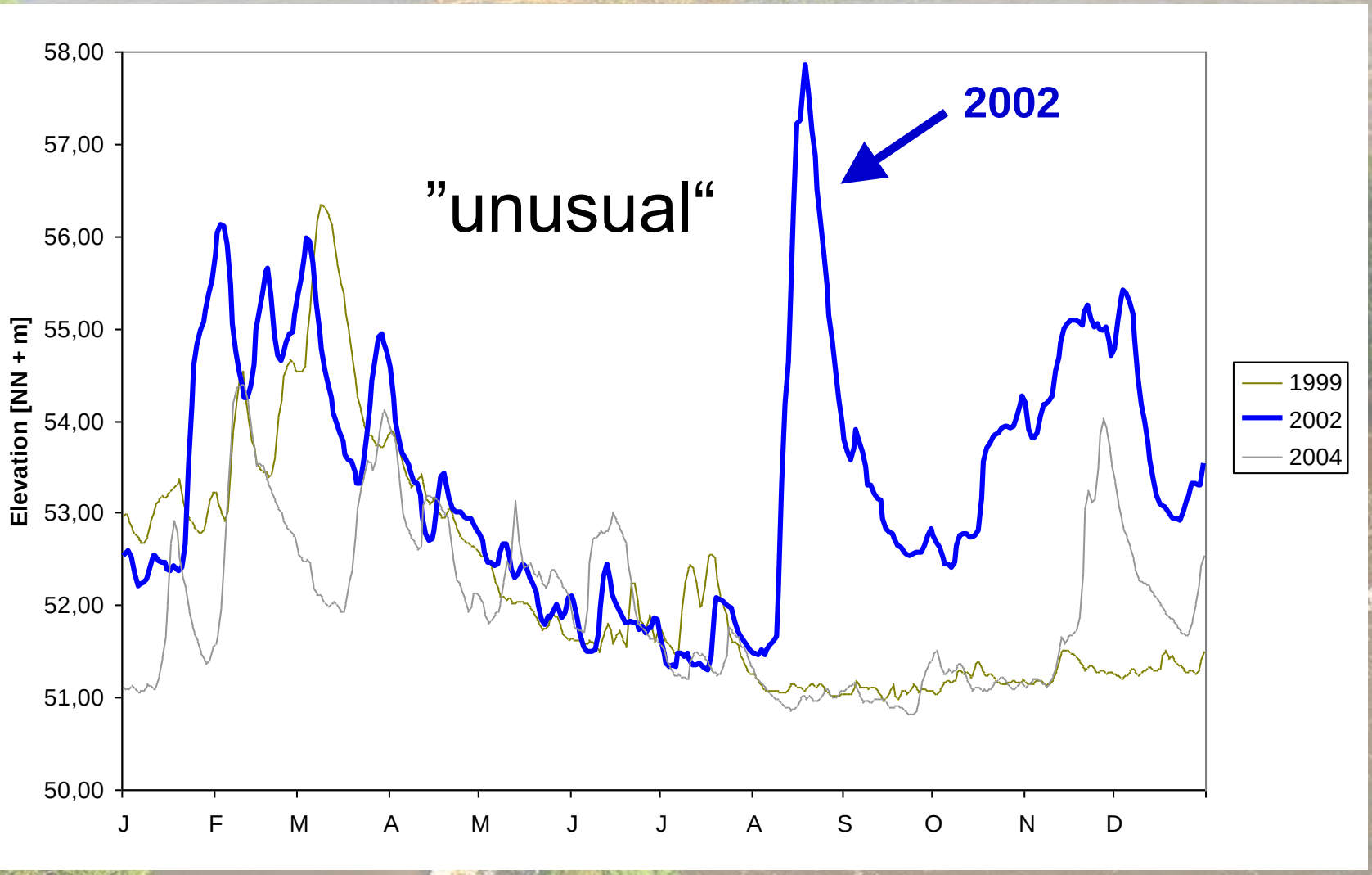
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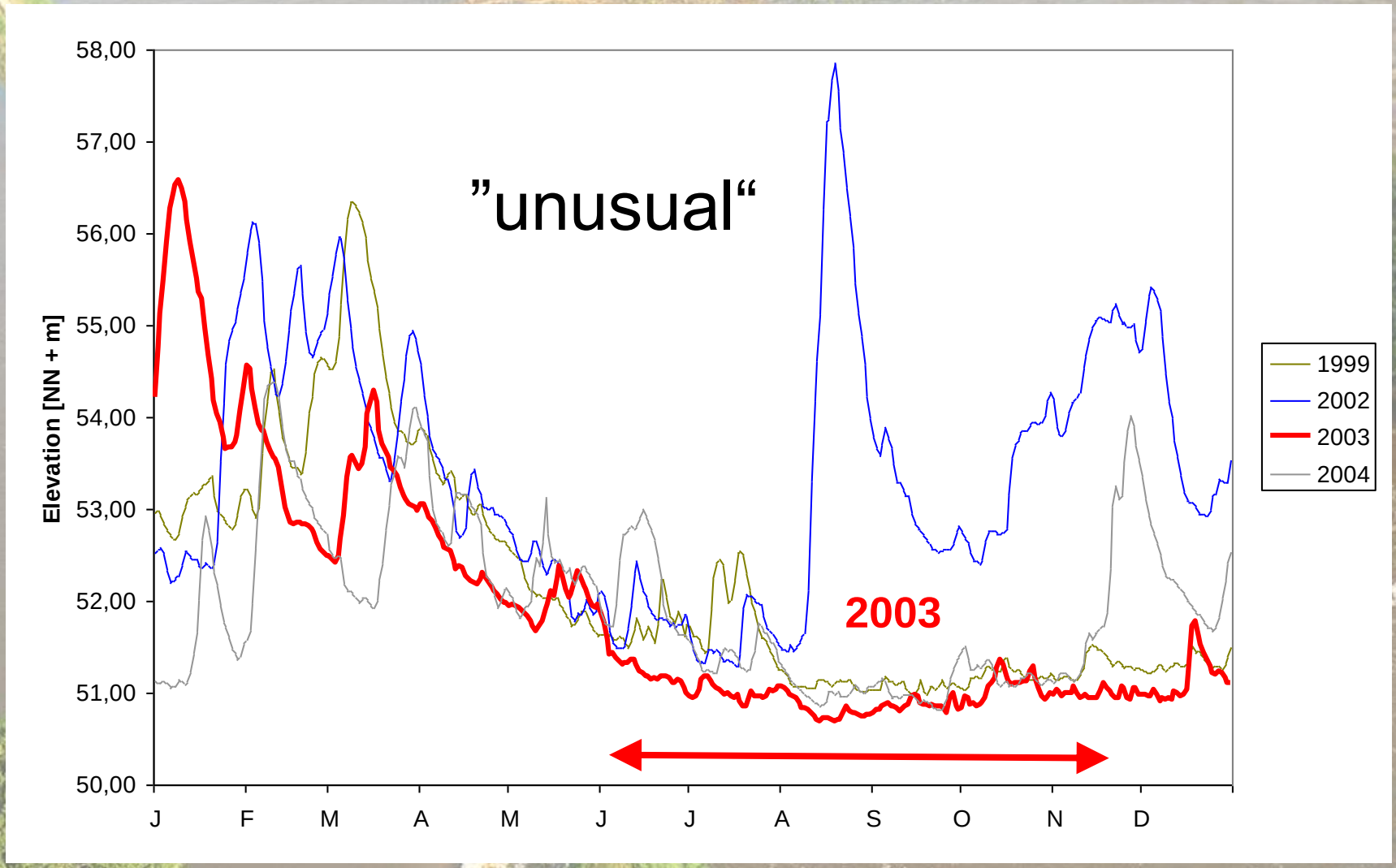
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The floodplain habitat and its organisms

KLIWAS

- Floods and droughts are essential components of active floodplain ecosystems
- Floodplain organisms are well adapted to the alternating wet-dry cycle
- Most adaptations aim to survive „usual“ winter and spring floods
- Effects of “unusual” extreme hydrologic events on floodplain organisms are little known

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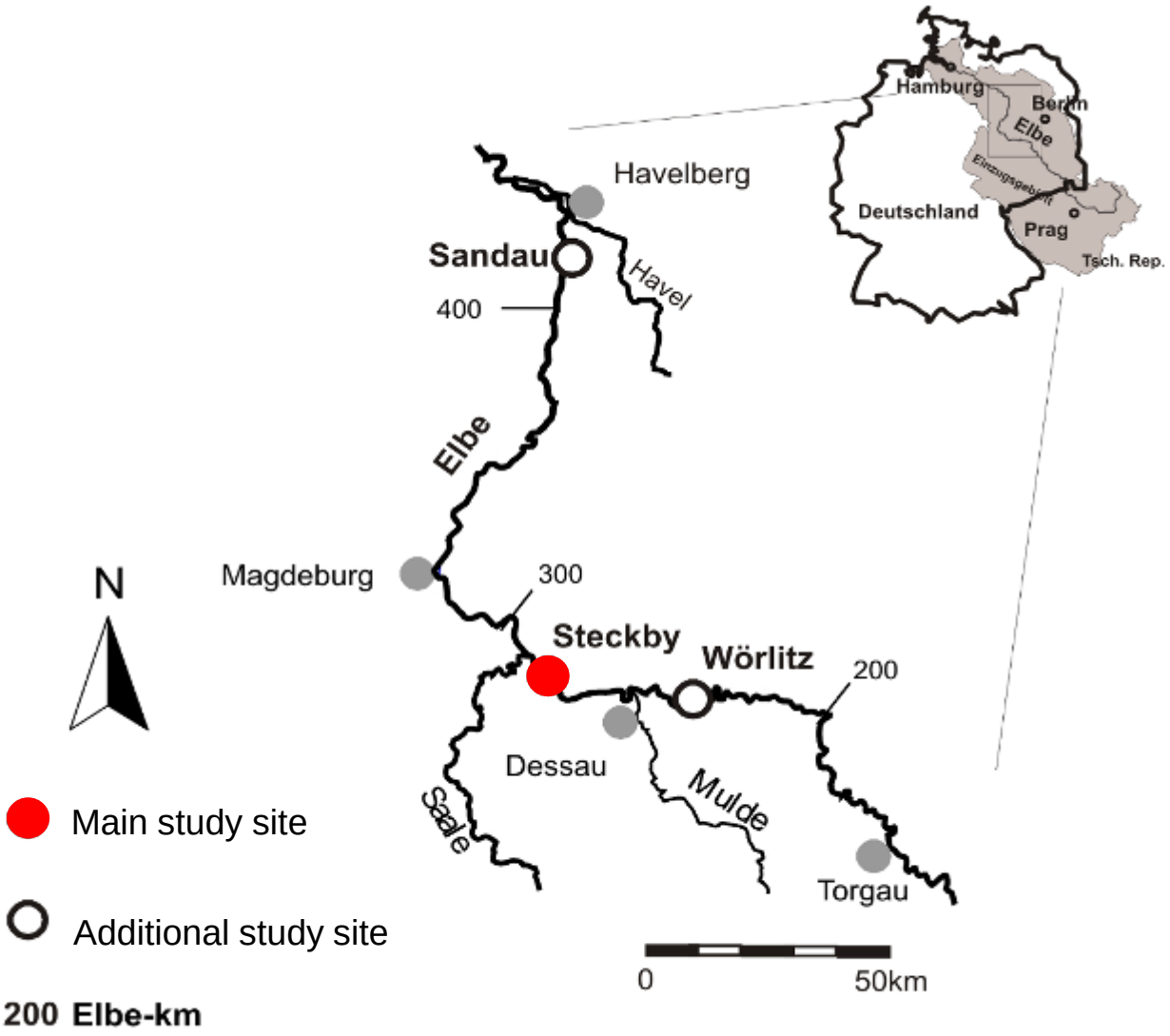
Research question

Do extreme hydrologic events such as summer floods and droughts affect plant diversity in floodplain vegetation ?

→ what may happen in future

Study Area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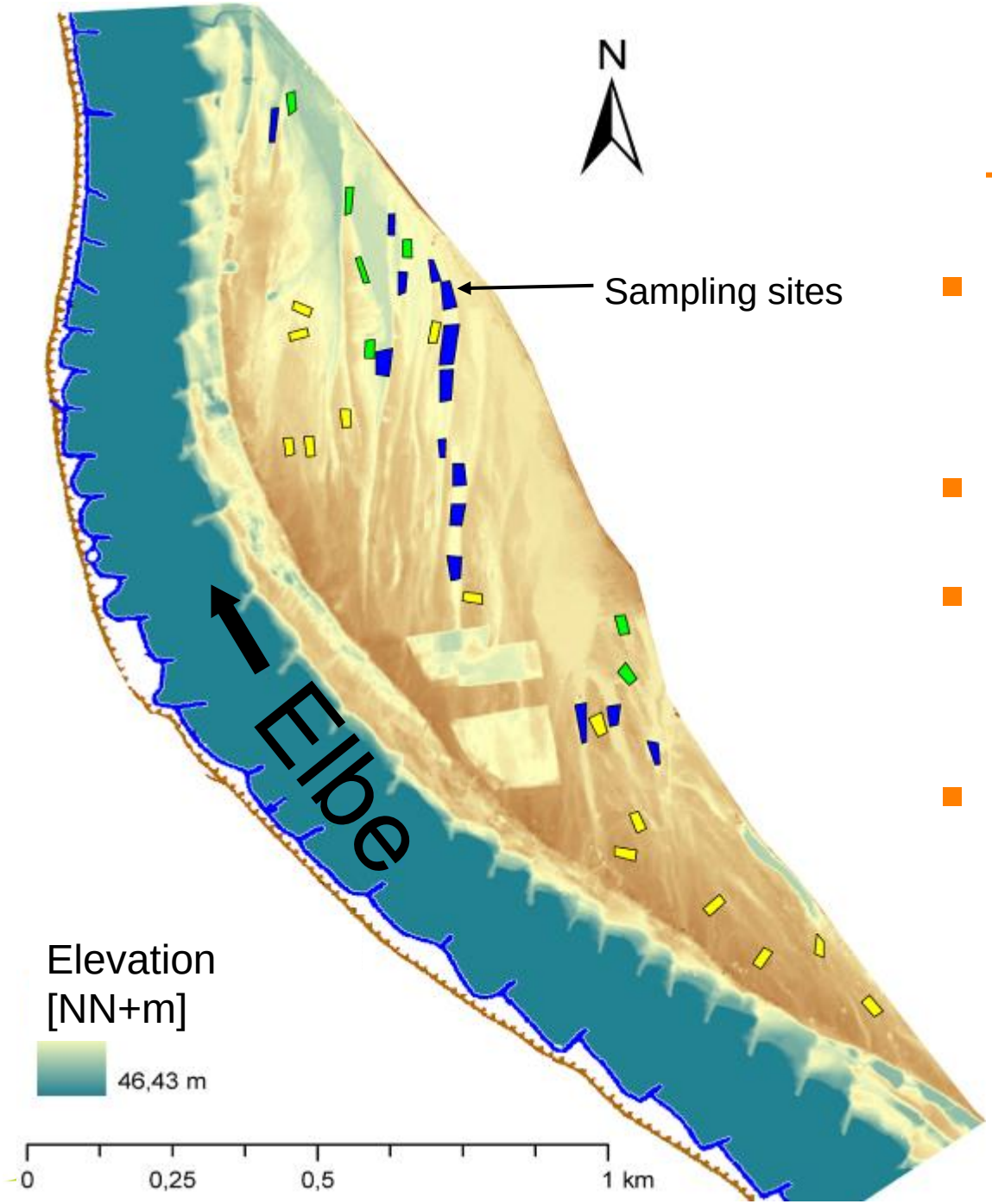
Berlin
Elbe
Einzugsgebiet
Deutschland
Prag
Tsch. Rep.
Havelberg
Sandau
Havel
400
Elbe
N
Magdeburg
300
Steckby
Wörlitz
200
Dessau
Mulde
Saale
Torgau
0
50km
Main study site
Additional study site
200 Elbe-km



KLIWAS

- Stratified random sampling design
- **36** sampling plots
- Each with a size of **100 m²**
- Sampling years: 1998/99, 2003-2006, 2009-2010

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Methods

Classification:

- Data set of 1999
- Based on dissimilarity of species composition (Bray-Curtis)

→ Schmidtlein, S., Tichý, L., Feilhauer, H., Faude, U. (2010): A brute force approach to vegetation classification. Journal of Vegetation Science 21: 1162–1171, 2010.

R Development Core Team (2010). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL http://www.R-project.org/.

Methods

Measures of plant alpha diversity:

- Species' richness

Number of species
in the 100 m² samples

- Simpson's dominance index

$$D = \sum \left(\frac{n_i \left[n_i - 1 \right]}{N \left[N - 1 \right]} \right)$$

n_i = Cover of species i
N = Total cover

→ Simpson, E.H. (1949) Measurement of diversity. Nature 163: 688.

Magurran, A.E. (2004) Measuring biological diversity. Oxford, UK, Blackwell Publishing.

Jari Oksanen, et al. (2011). vegan: Community Ecology Package. R package version 1.17-6.
http://CRAN.R-project.org/package=vegan

Methods

Measures of plant species turn-over:

- Ordination (NMDS) with years fitted onto it

→ T. F. Cox and M. A. A. Cox (1994, 2001) *Multidimensional Scaling*. Chapman & Hall.

Venables, W. N. and Ripley, B. D. (2002) *Modern Applied Statistics with S.* Fourth edition. Springer.

Results: classification

	Flooded Depressions	Wet Grassland	Dry Grassland
number of plots	12	13	11

Results: classification

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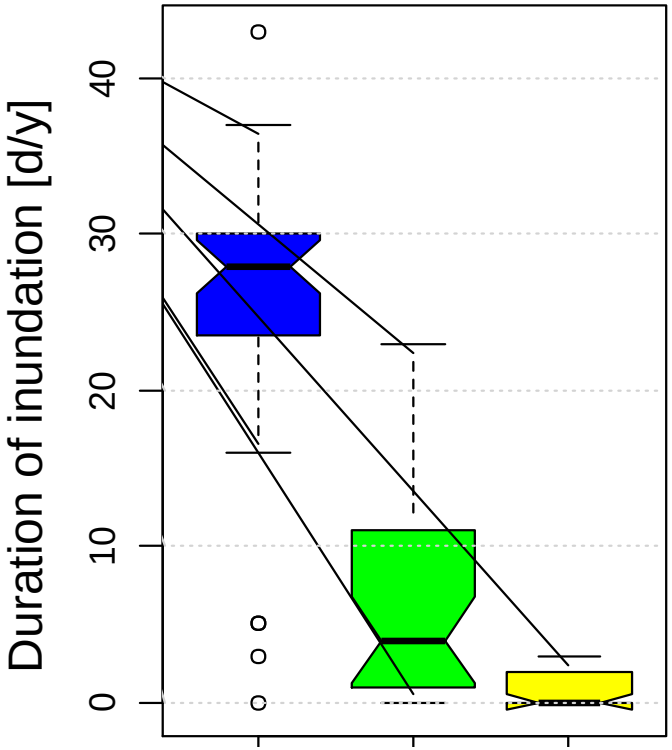
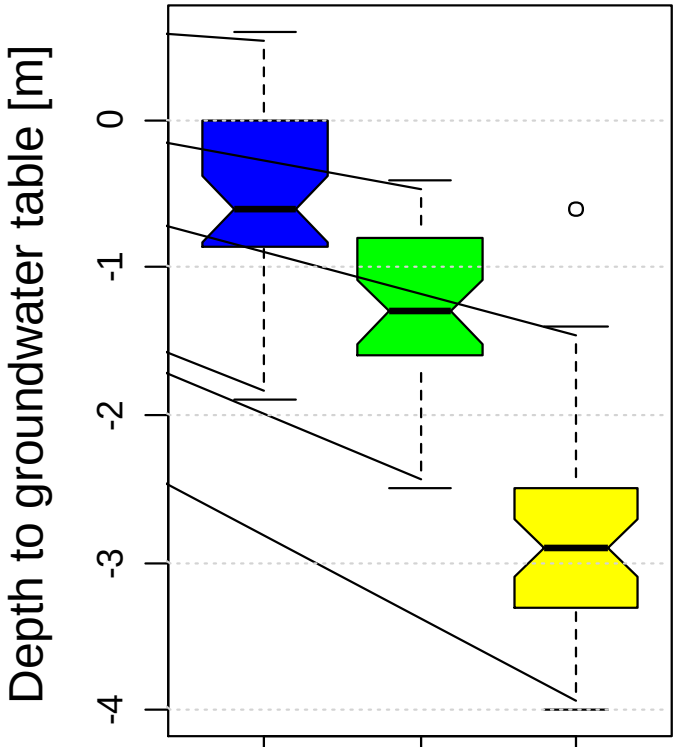
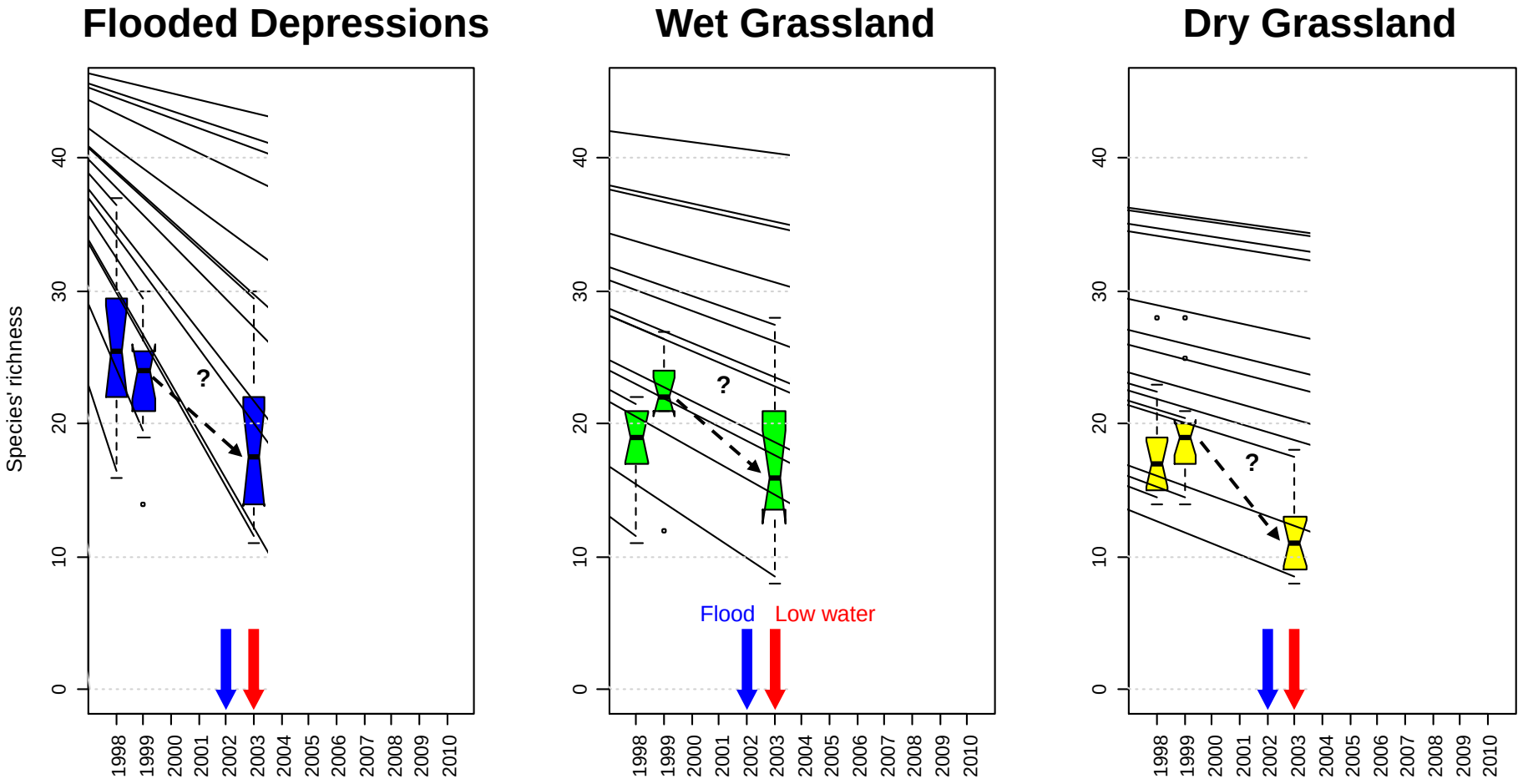




Averages of 1997 to 1999

Results: species‘ richness



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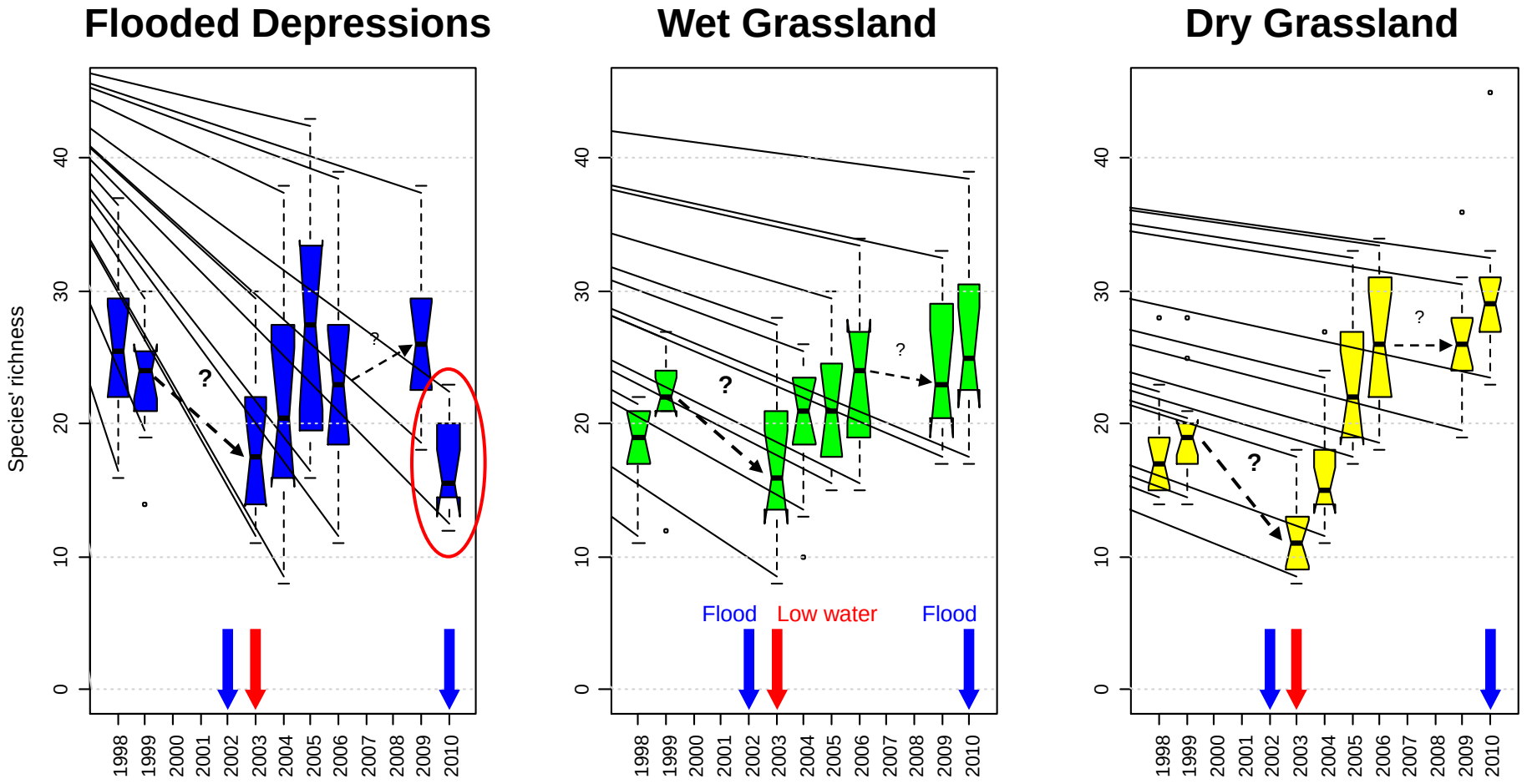
Results: species‘ richness



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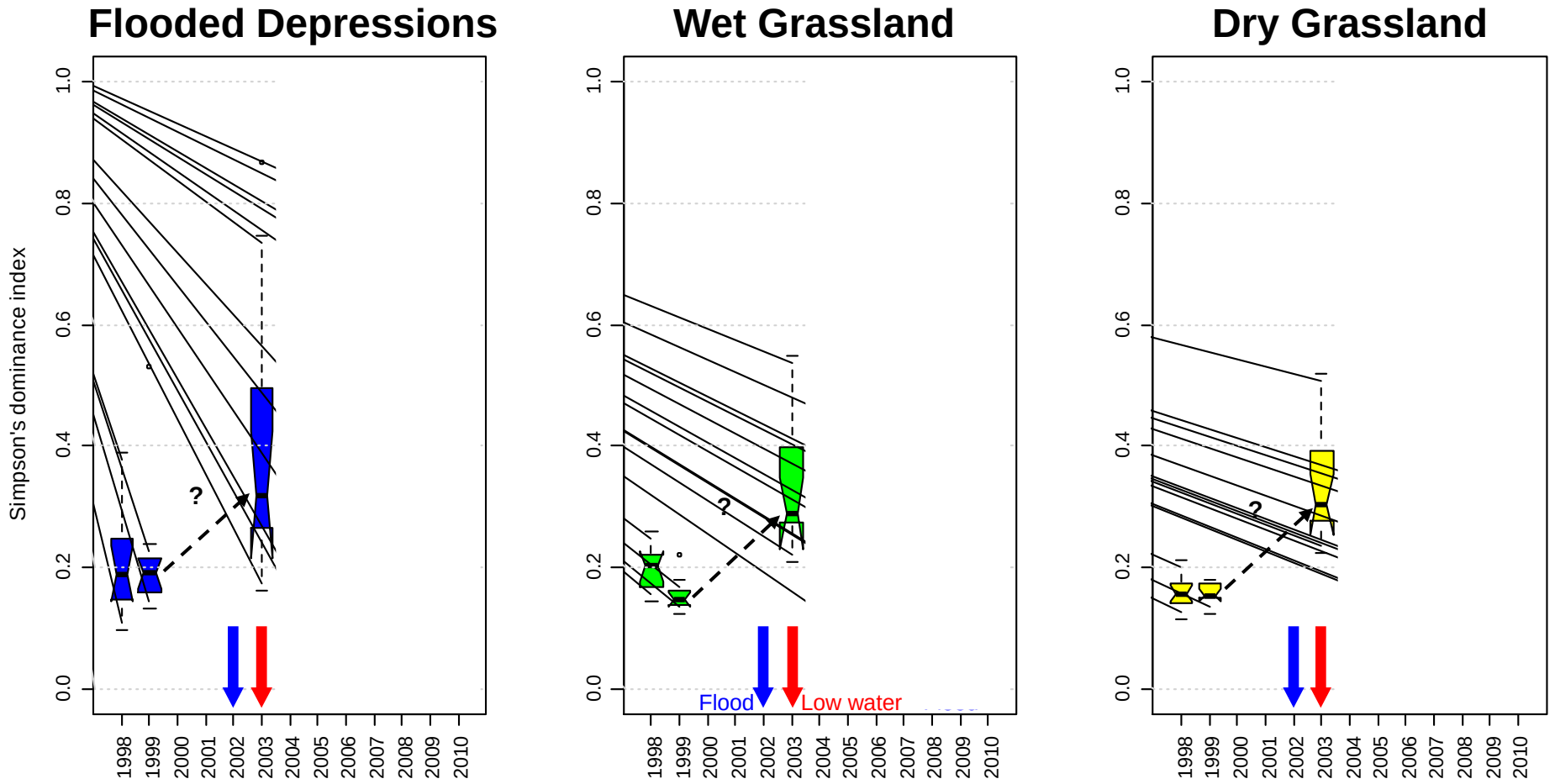
Results: Simpson‘s dominance



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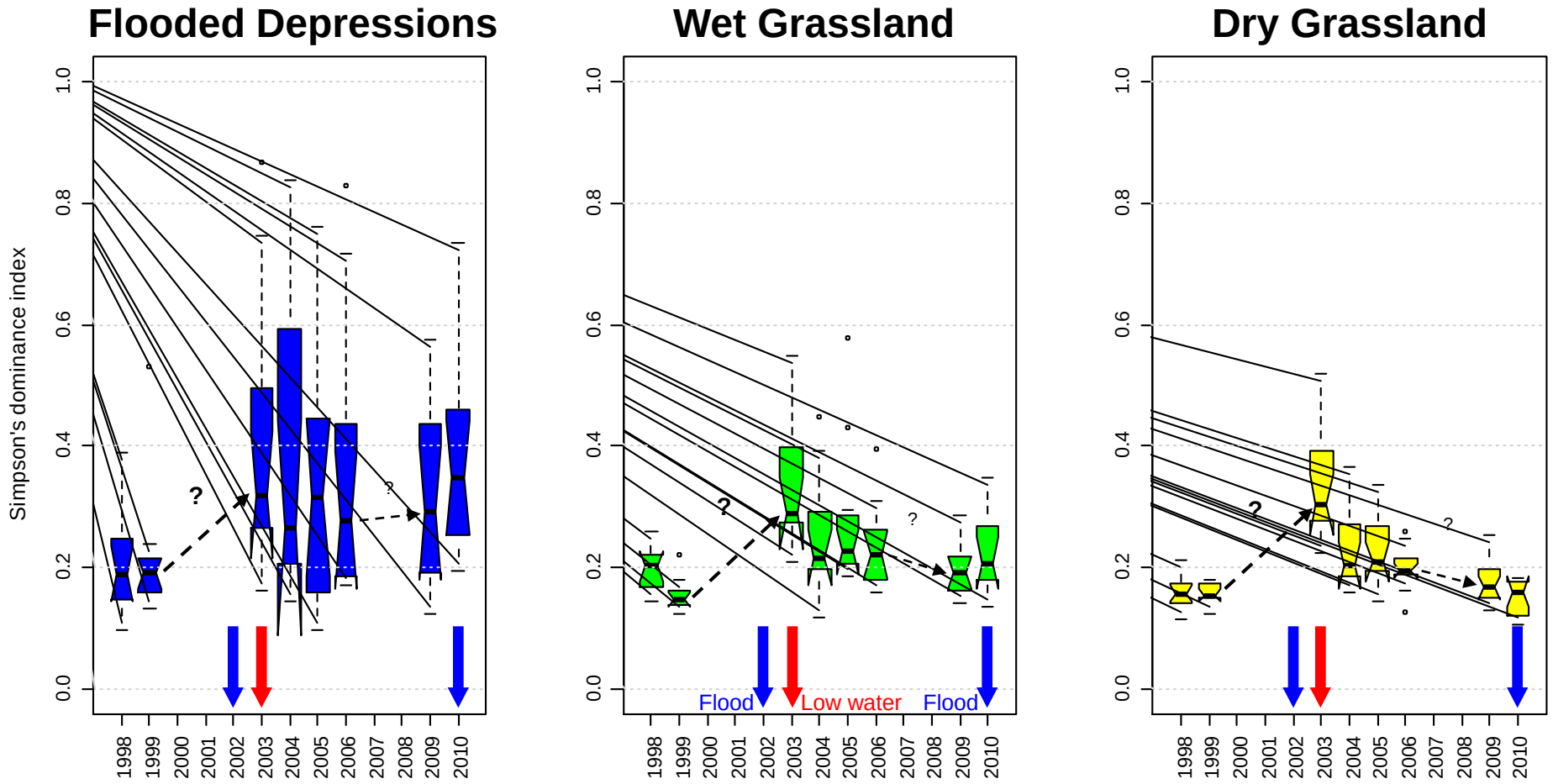
Results: Simpson‘s dominance



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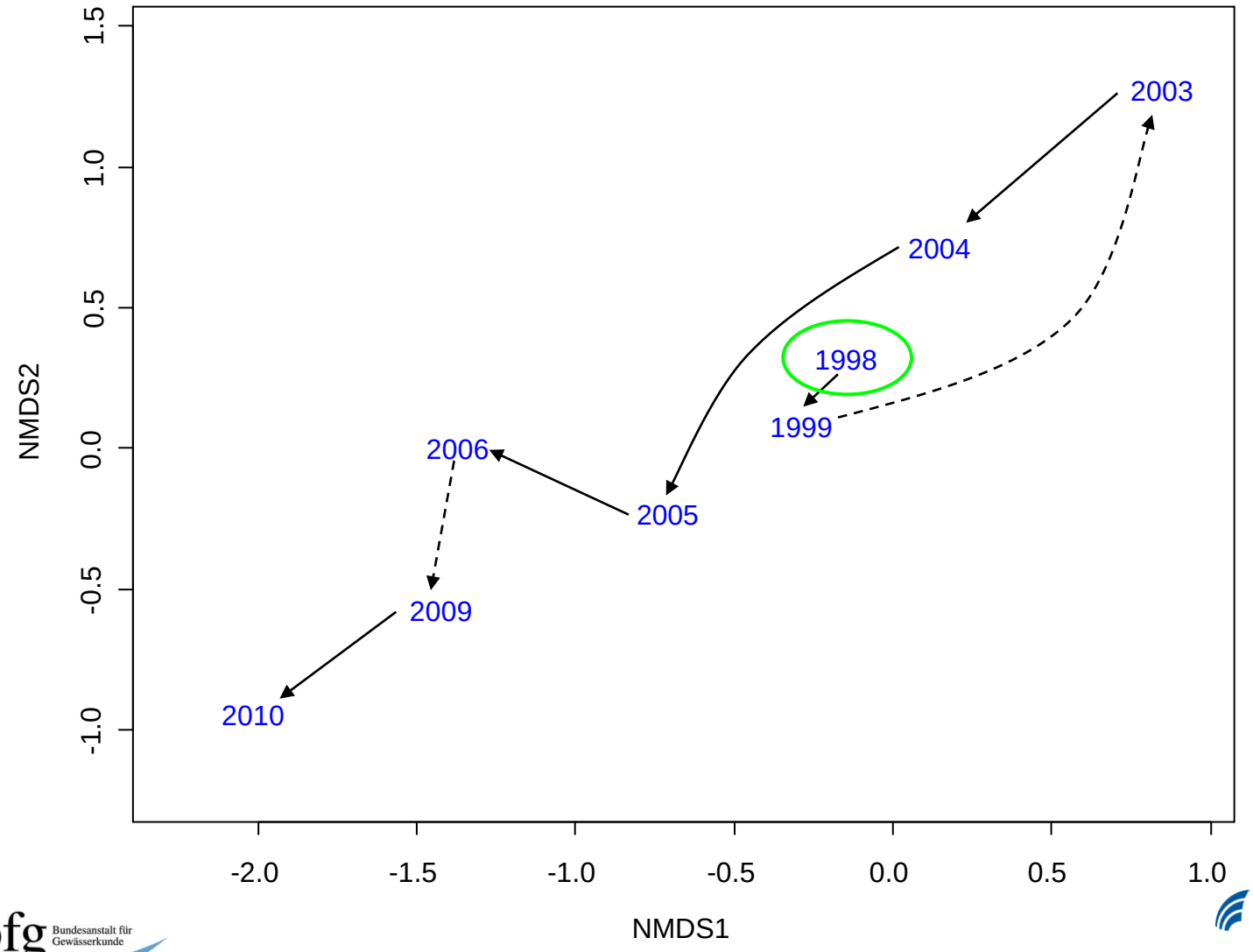
Results: Species turn-over



Dry Grassland

Results: Species turn-over

Increase in average cover value after summer flood 2002

Flooded Depressions

Xanthium albinum

Lythrum salicaria

Dry Grassland

Ranunculus ficaria

Alopecurus pratensis

Photo sources: www.floraweb.de
www.schule-bw.de/unterricht/faecher/biologie

Conclusions

- Observed extreme hydrologic events seem to affect floodplain vegetation at our study site in a way that diversity declines and needs some years to recover
- Species composition can be different after extreme hydrologic events for many years (how many…?)
- It remains uncertain if the flood event of 2002 or the drought of 2003 or the combination of both led to the observed changes in vegetation.

Outlook

- What are the effects of long-term change of hydrologic regime on the plant community…?

- A yearly monitoring of floodplain sites at least until 2013 may provide further understanding of the effects of changes in hydrologic regime.


Questions…?
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