Effects of climate change on European riparian plant communities

Preliminary results REFRESH WP4 2011

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SEVENTH FRAMEWORK PROGRAMME

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Climate change

- Millennium Ecosystem Assessment (2005):

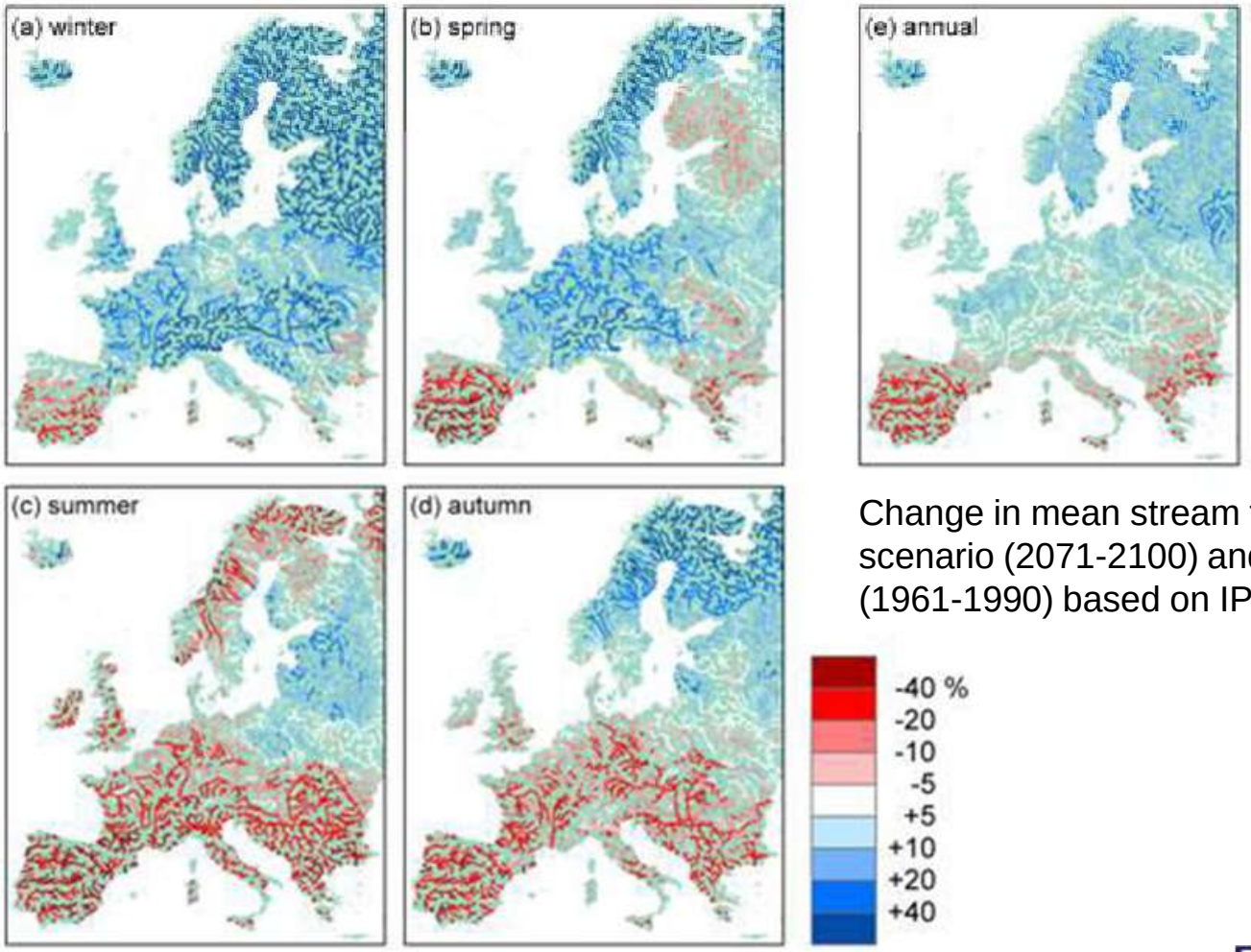
  "Freshwater ecosystem biodiversity most threatened by climate change impacts"

- IPCC (2007): Increasing temperature and changing precipitation intensity

- Europe: wetter winters, drier summers

- Precipitation changes will affect stream ecosystems, riparian plant communities

Climate effects on water resources



Change in mean stream flow between scenario (2071-2100) and control period (1961-1990) based on IPCC scenario A2

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Source: Joint Research Centre, European Commission, Dankers and Feyen (2009)

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Challenges

- Riparian plant communities are structured by hydrological regime
- Growing need to identify thresholds and indicator species to predict future vegetation responses

- Colonization processes, especially dispersal, codetermine biodiversity riparian plant communities

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Adaptive strategies to mitigate the impacts of climate change on European freshwater ecosystems

7th Framework Programme European Commission

- Impacts of climate change on European freshwater ecosystems
- Practical relevance for EU Water Framework and Habitats Directive, Ramsar Convention, Convention on Biological Diversity.
- Generating scientific understanding to implement measures successfully

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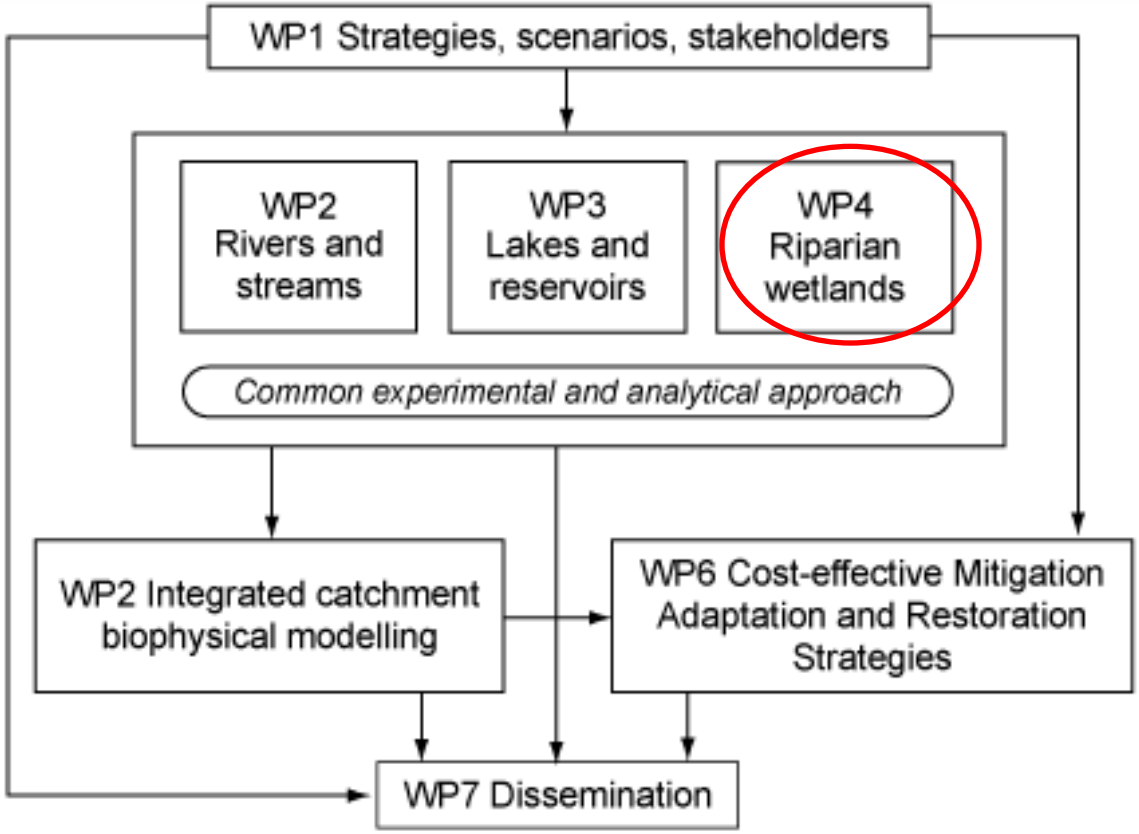
REFRESH structure



Partners involved in Riparian Wetland Research:
Sweden (SLU), Denmark (AU), Germany (UDE, FVB), Netherlands (Alterra, Utrecht University), Spain (UV, CSIC & UB)

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Main study aims PhD study

1. Effects of a simulated increased drought and flooding on the **colonization process and biodiversity** of riparian plant communities

2. Define **thresholds and riparian indicator species** for climate change

3. Suitable **adaptation and restoration measures** for natural resources management

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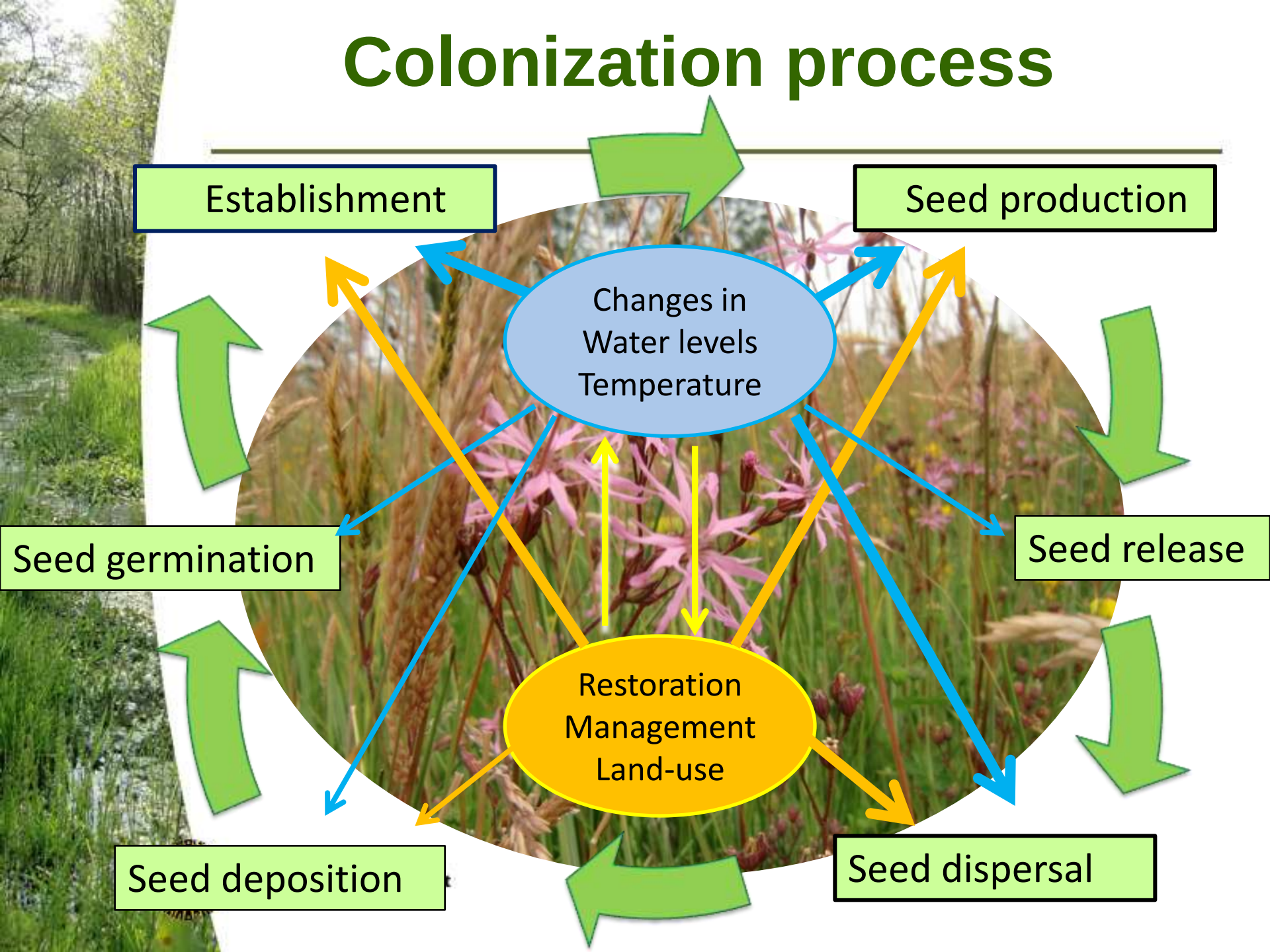
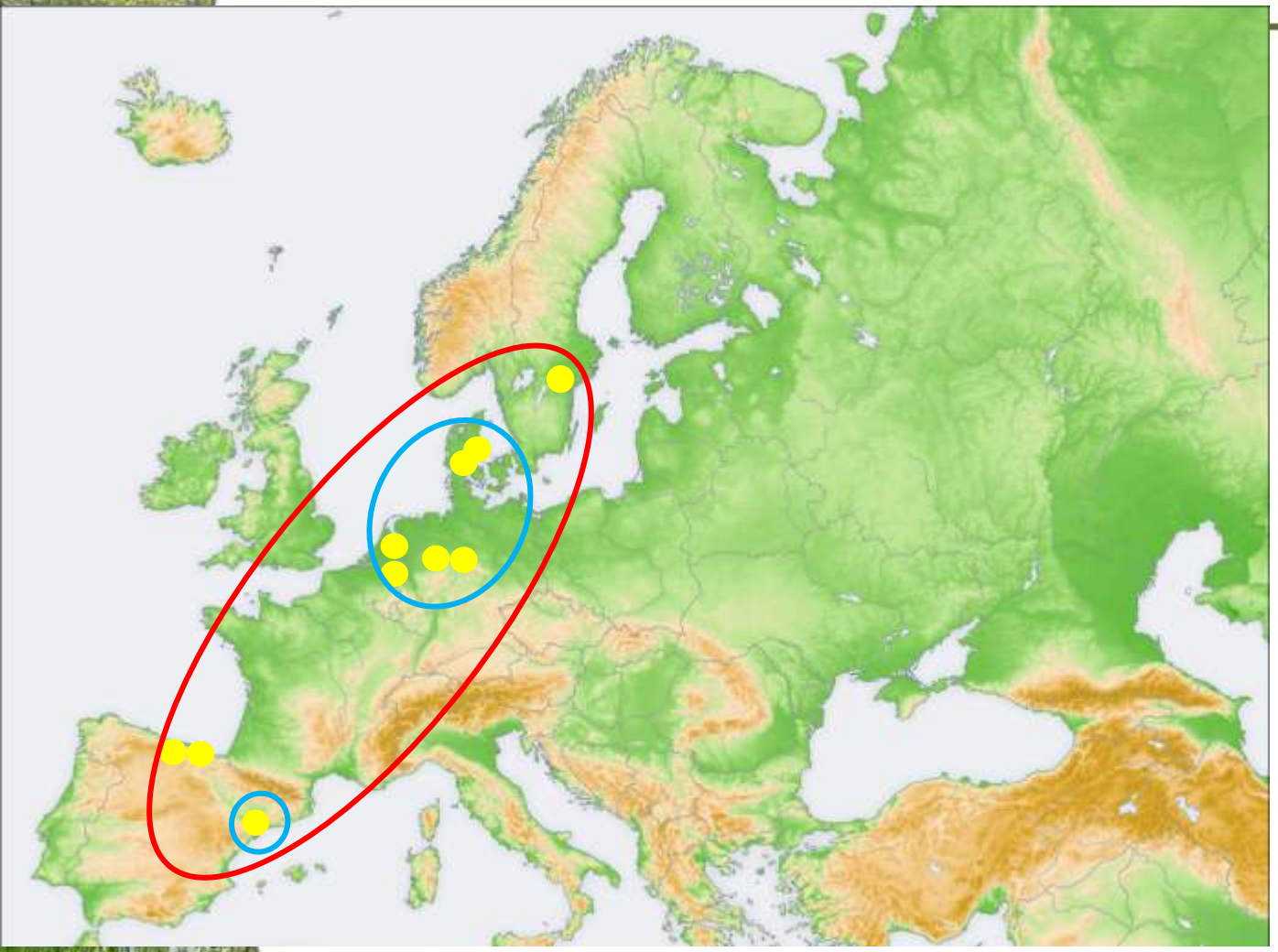
Colonization process



Experimental study outline REFRESH



10 lowland streams selected within Europe

Drought experiment:
↓
along climatic gradient

Flooding experiment: NW Europe & Spain

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Experimental outline

- Summer drought simulated (Jun - Sep 2011-2013)

- Water from main channel diverted by bypass

- Late winter flooding simulated (Mar - Apr 2011-2013)

- Water level experimentally raised by dam construction

- Each stream: an experimental and control section
- Three transects at each section
- Measurements ranging from environmental conditions and functioning to biodiversity

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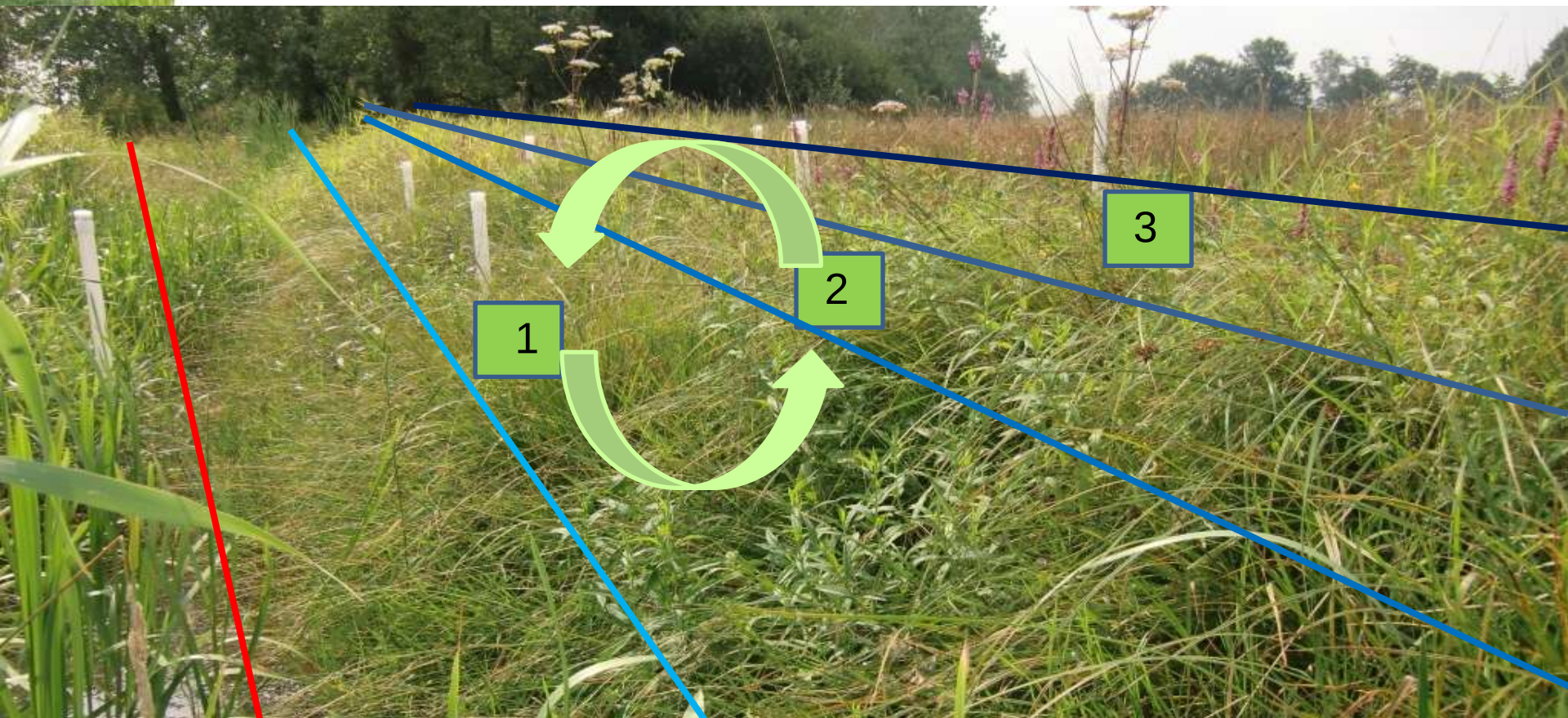
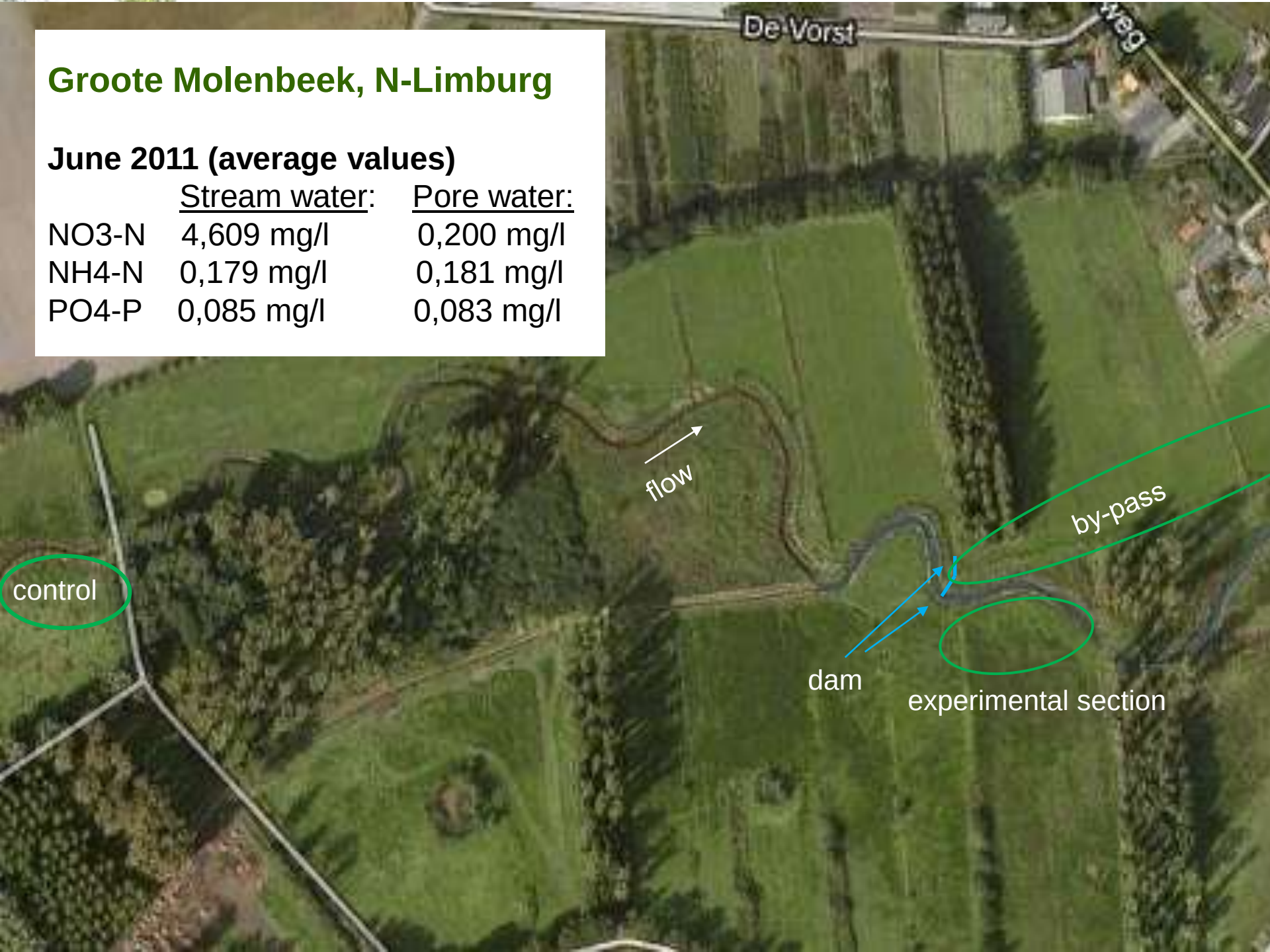
Species composition

Changes expected in species composition and richness along elevational gradient

- mortality or growth, indirectly competition





Groote Molenbeek, N-Limburg

June 2011 (average values)

	Stream water:	Pore water:
NO3-N	4,609 mg/l	0,200 mg/l
NH4-N	0,179 mg/l	0,181 mg/l
PO4-P	0,085 mg/l	0,083 mg/l

Drought experiment 2011

Groote Molenbeek, Noord Limburg

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Drought section Groote Molenbeek

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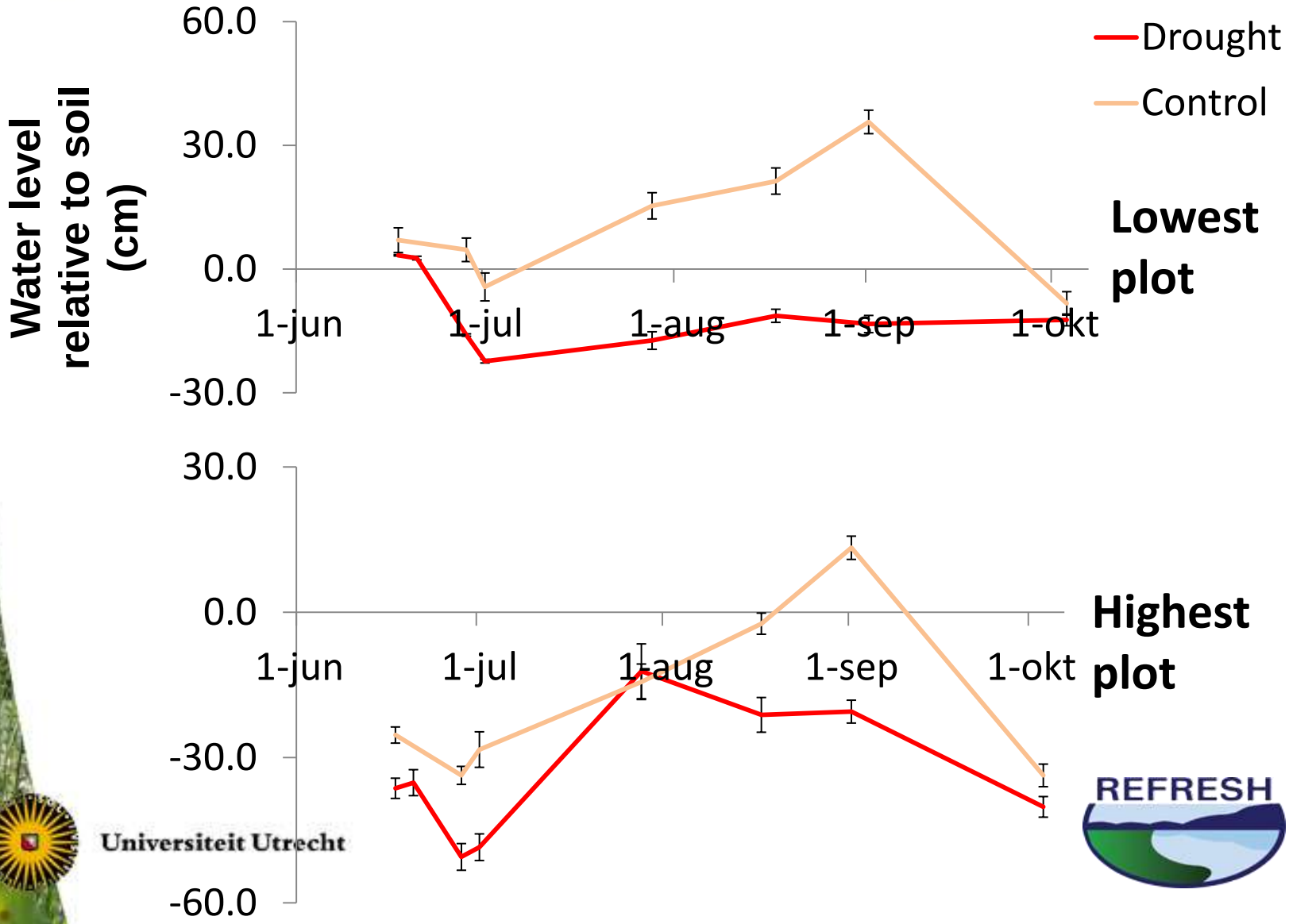
Groundwater levels



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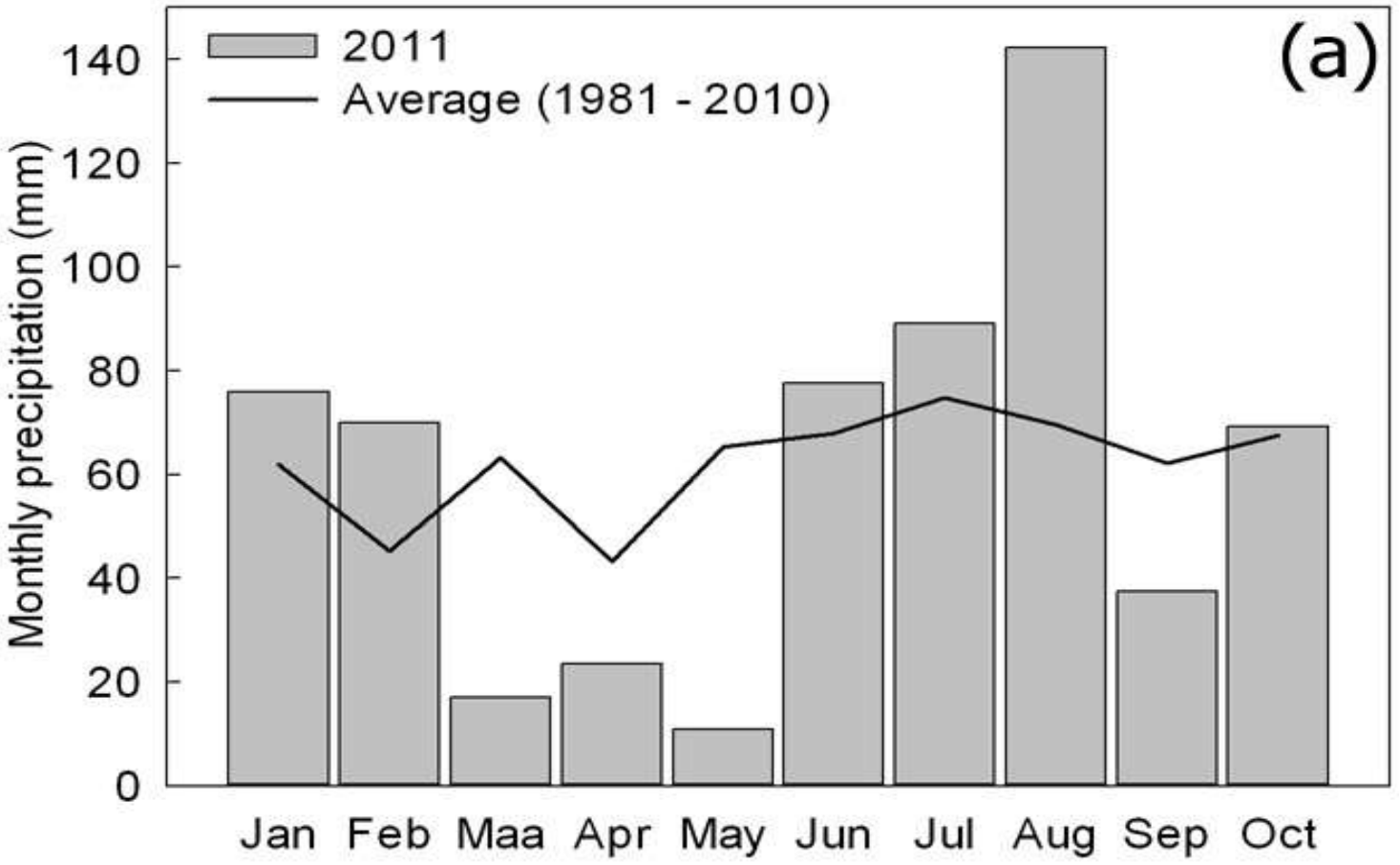
Precipitation 2011



Source: KNMI, data from weather station Sevenum

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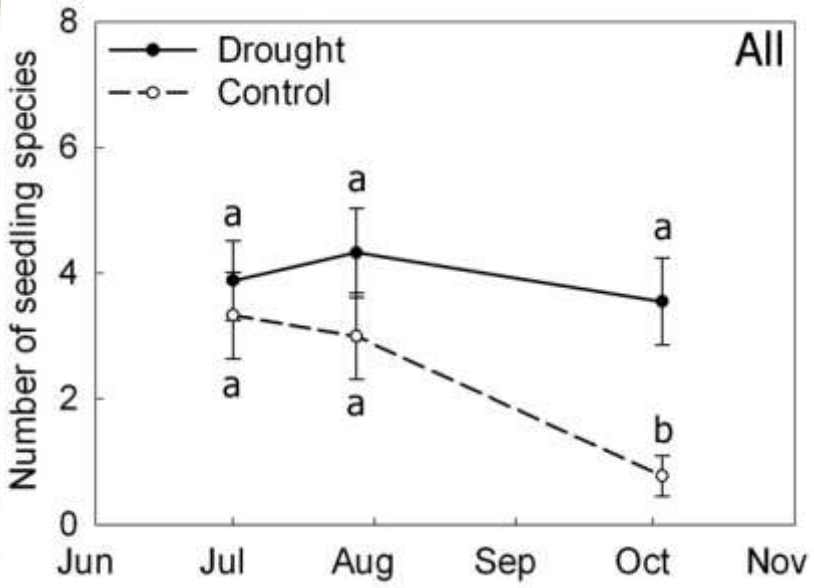
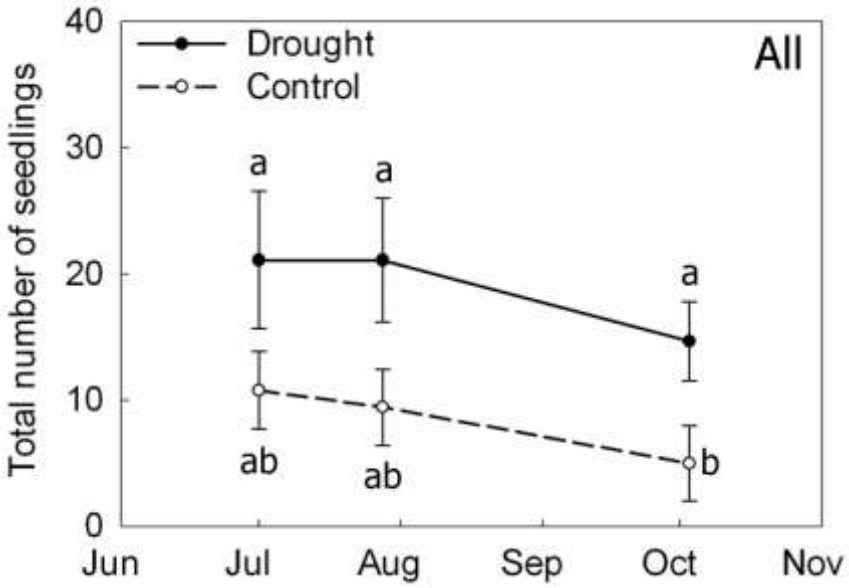
Seedling survival





Seedling mortality due to flooding of control section

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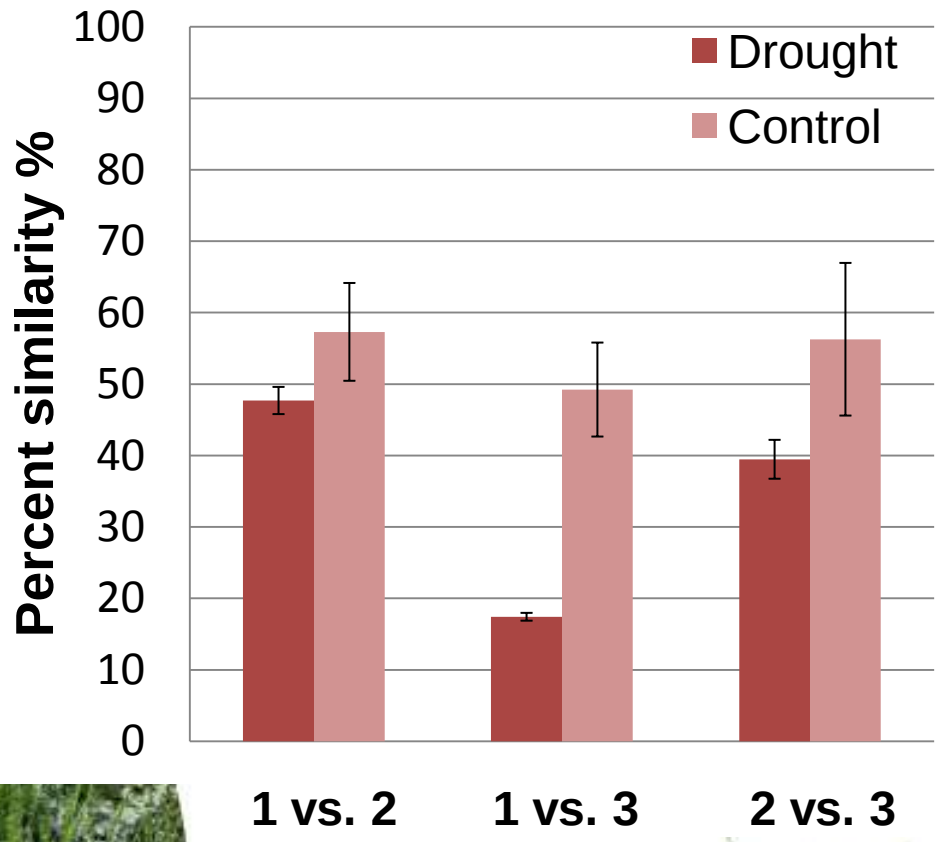
Similarities vegetation

Before



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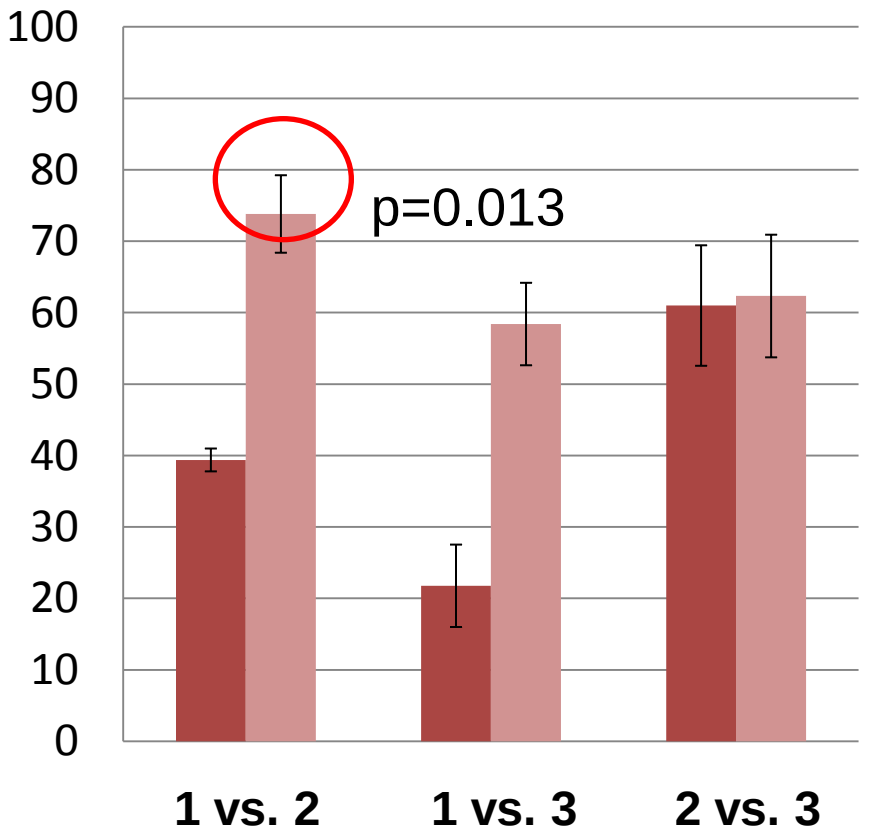

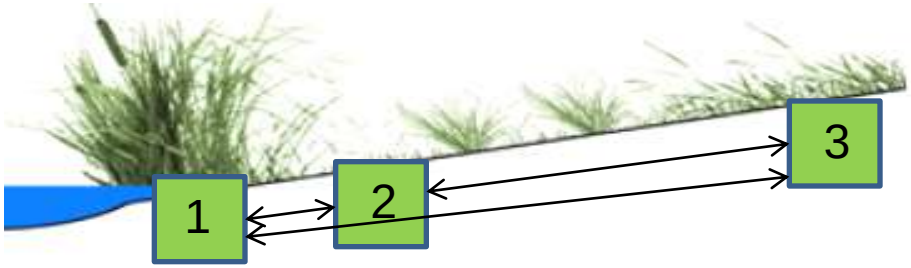

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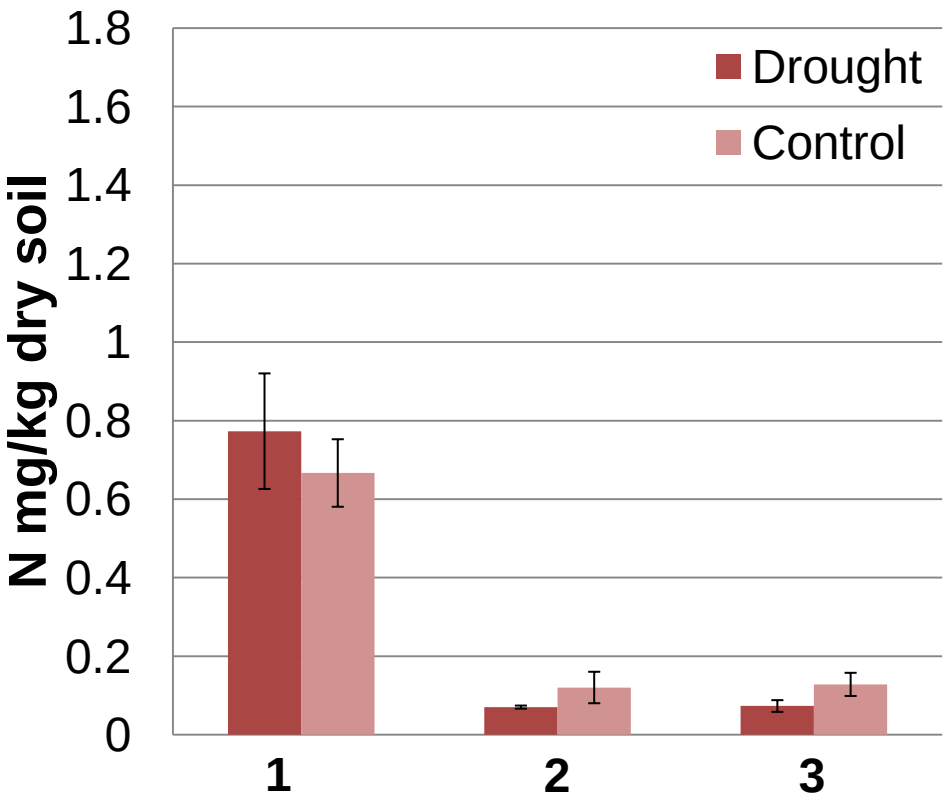
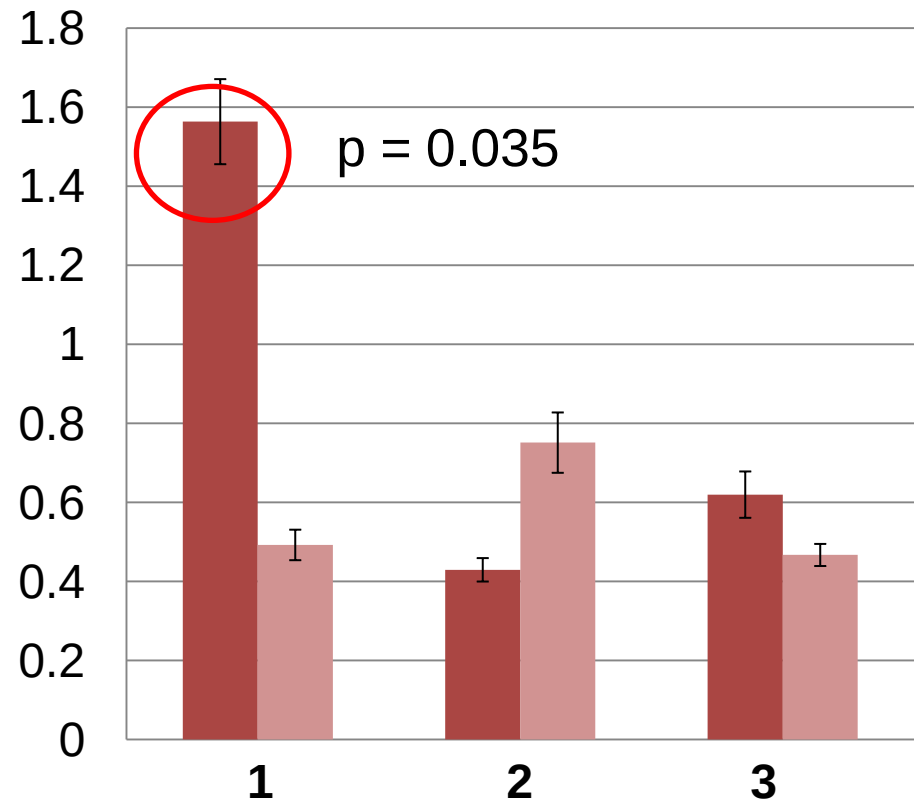
Available nitrogen in soil

Before

End





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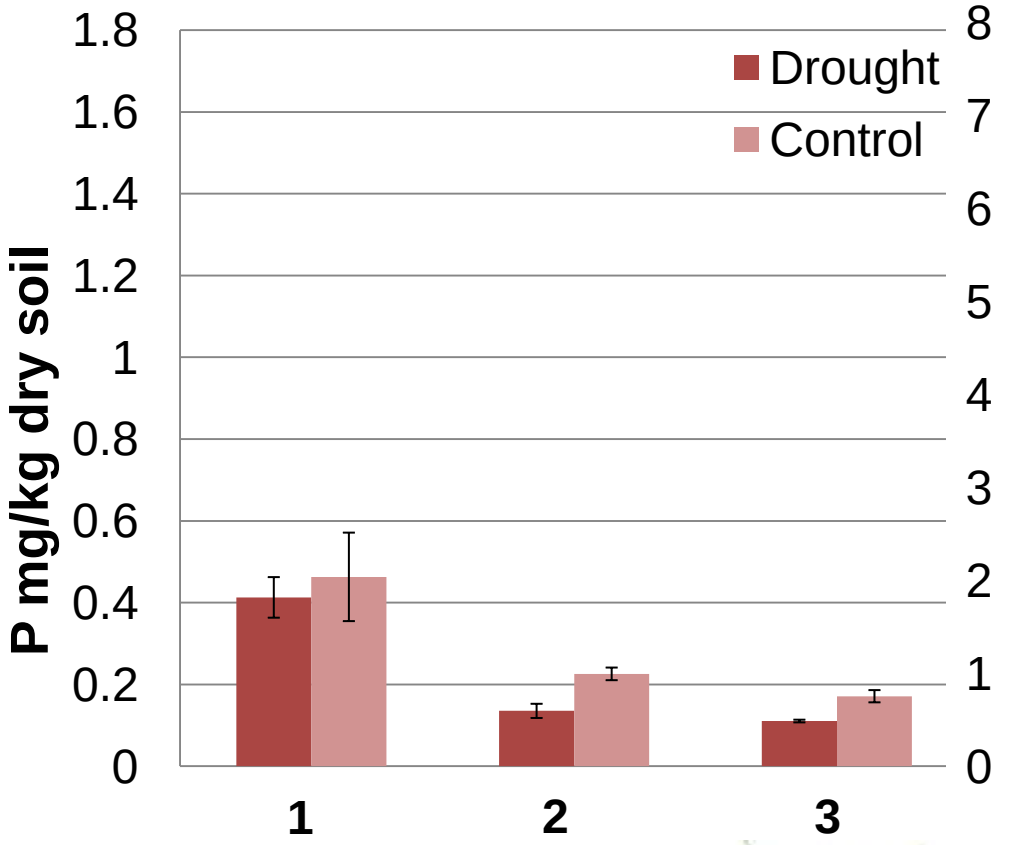
Available phosphorus in soil

Before



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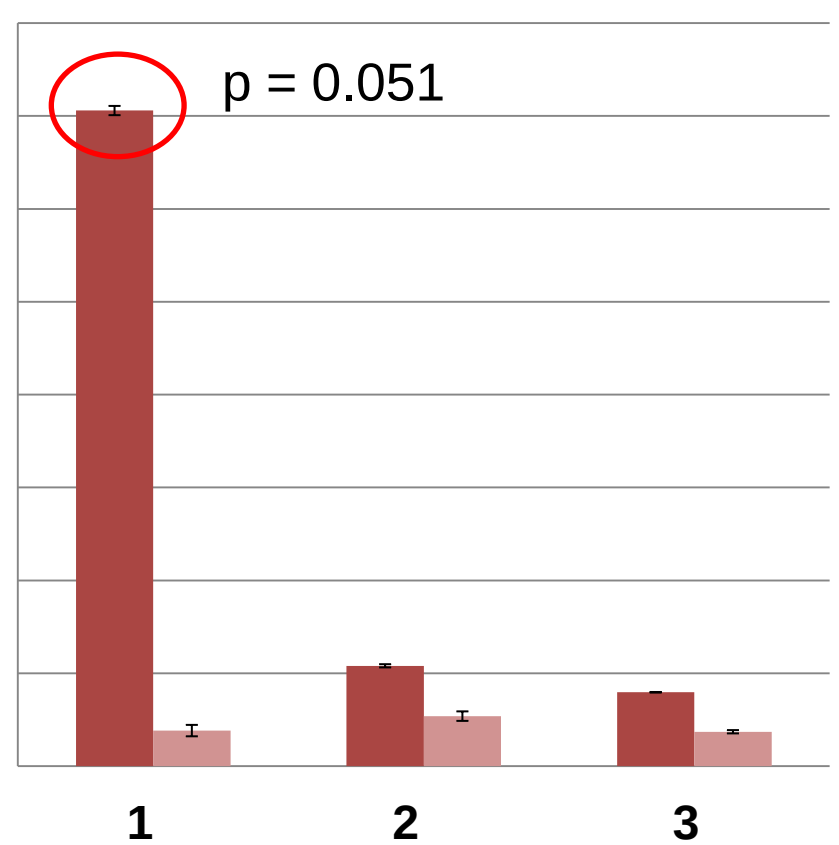

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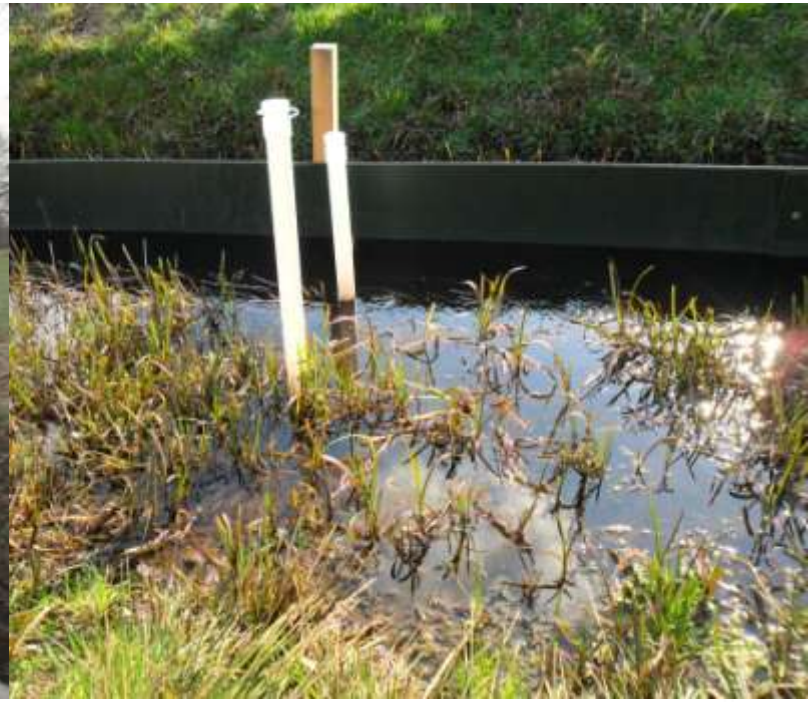
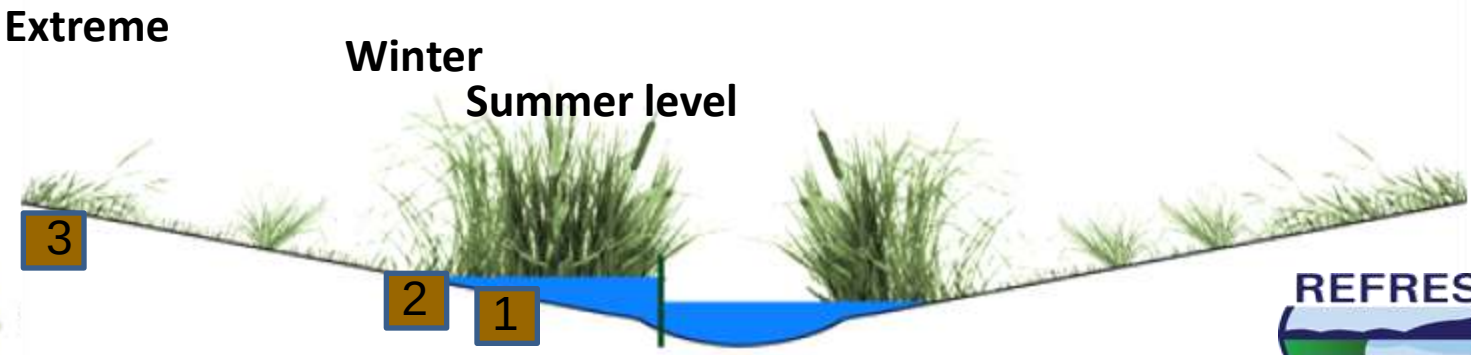
Flooding experiment 2011

Verloren Beek Oosterhuizen, Veluwe





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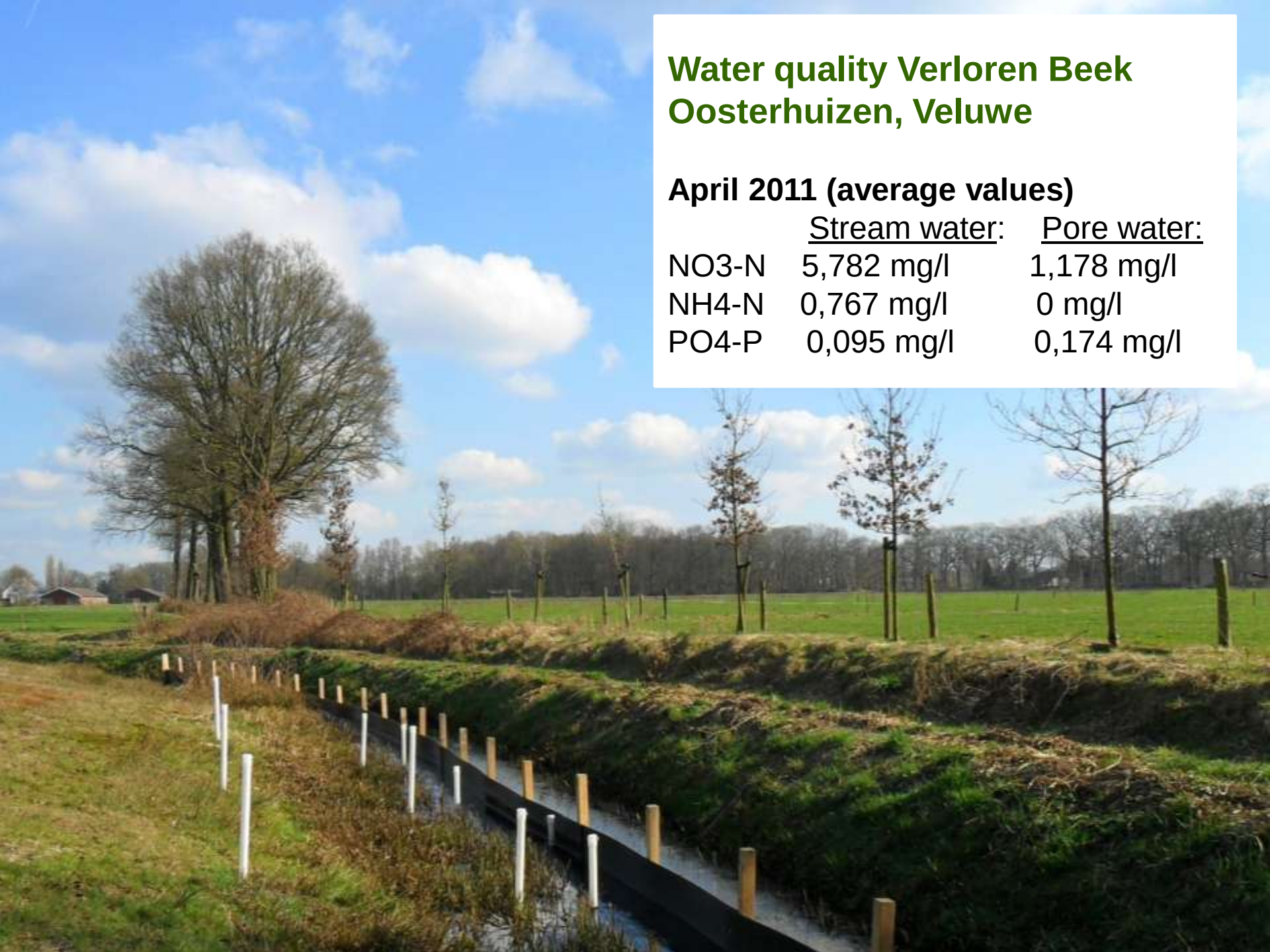


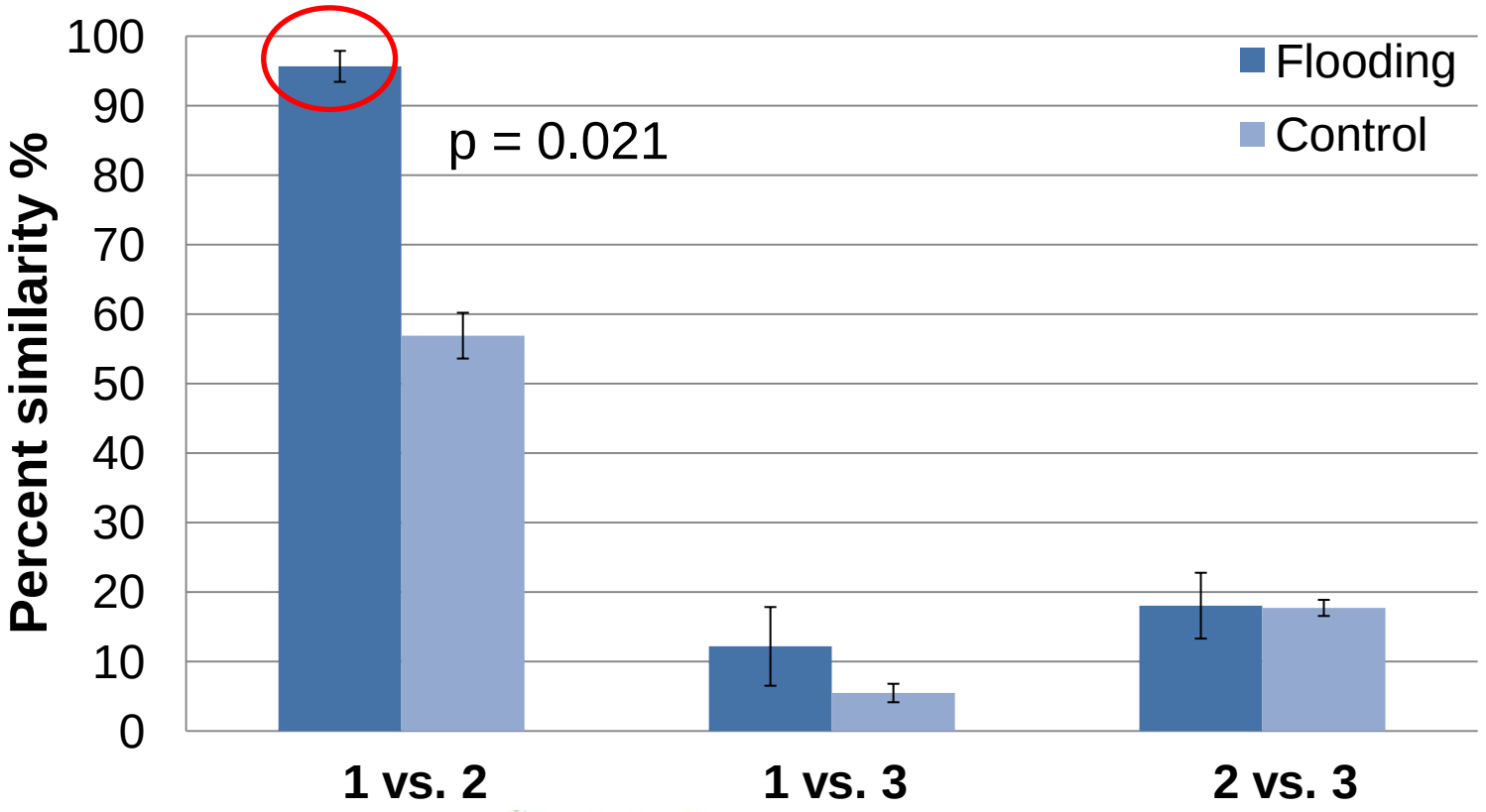
Water quality Verloren Beek Oosterhuizen, Veluwe

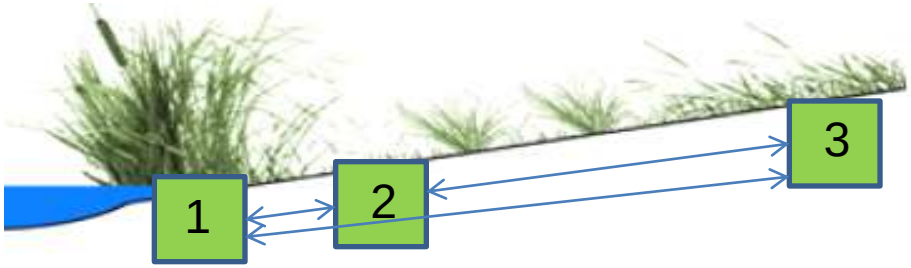
April 2011 (average values)

	Stream water:	Pore water:
NO3-N	5,782 mg/l	1,178 mg/l
NH4-N	0,767 mg/l	0 mg/l
PO4-P	0,095 mg/l	0,174 mg/l

Similarities vegetation

after flooding





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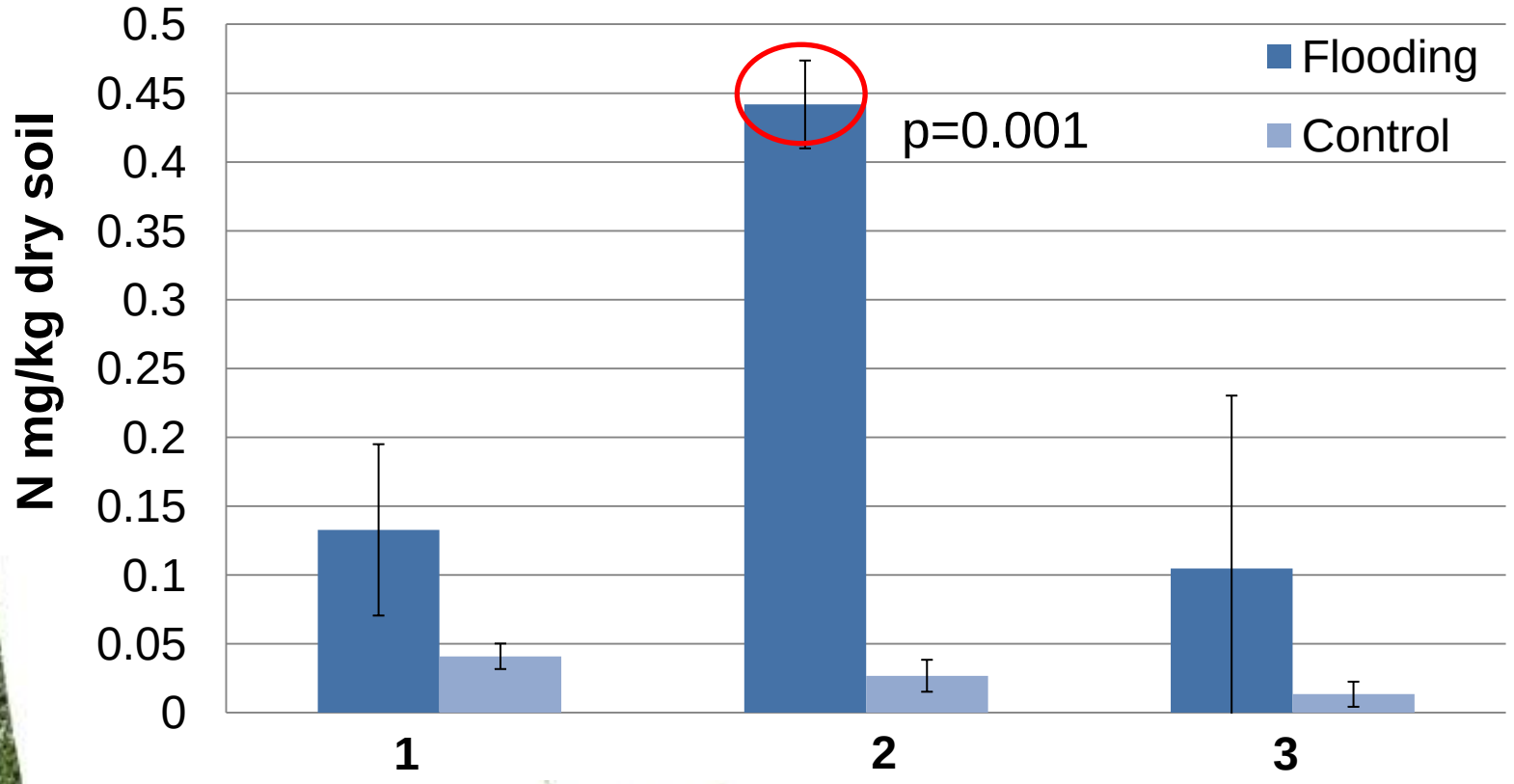
Available nitrogen in soil



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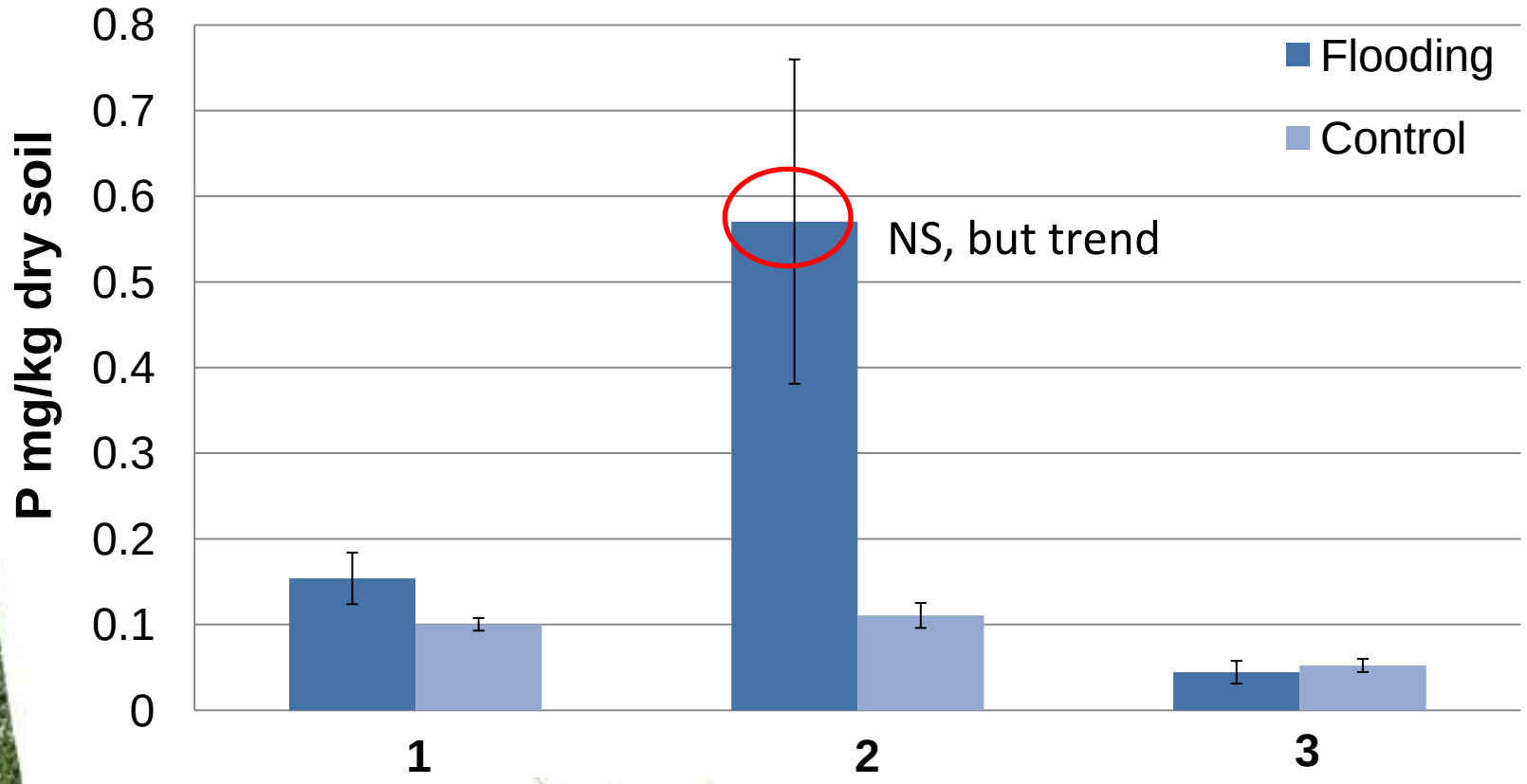
Available phosphorus in soil



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Preliminary results

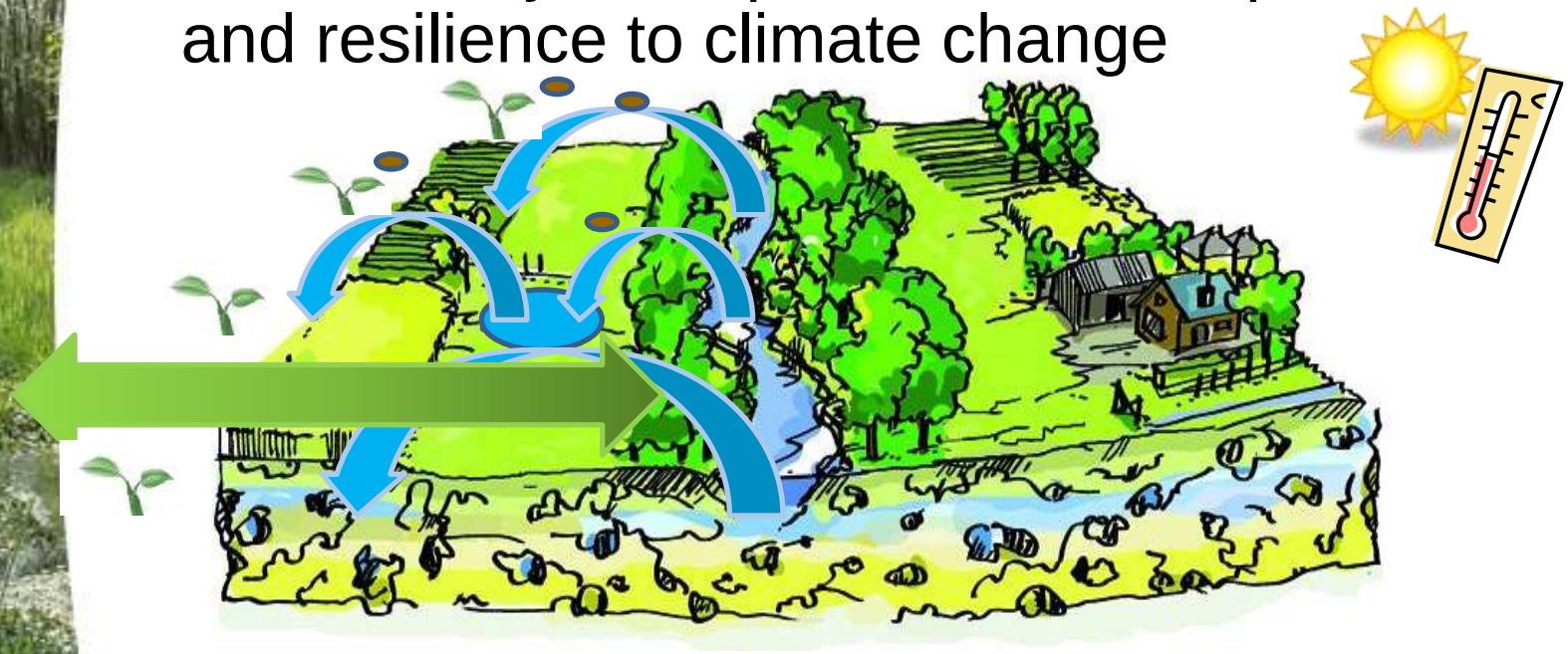
- Surprisingly, already indications for changes in species composition. Similarity of lowest plots increased due to high water levels.

- Increased mortality of seedlings: seedling survival depends strongly on stream water tables.

- More nitrogen and phosphorus availability in lower plots due to mineralisation.

Recommendations

- Connectivity and space for natural processes and resilience to climate change



- Connect riparian zones
- Create a broader riparian gradient
  - ➢ Increase migration and ecosystem resilience

} biodiversity increase

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Acknowledgments

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Peel en Maasvallei

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