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Hydrology and vegetation of floodplain meadows in UK

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Floodplain Meadows Partnership

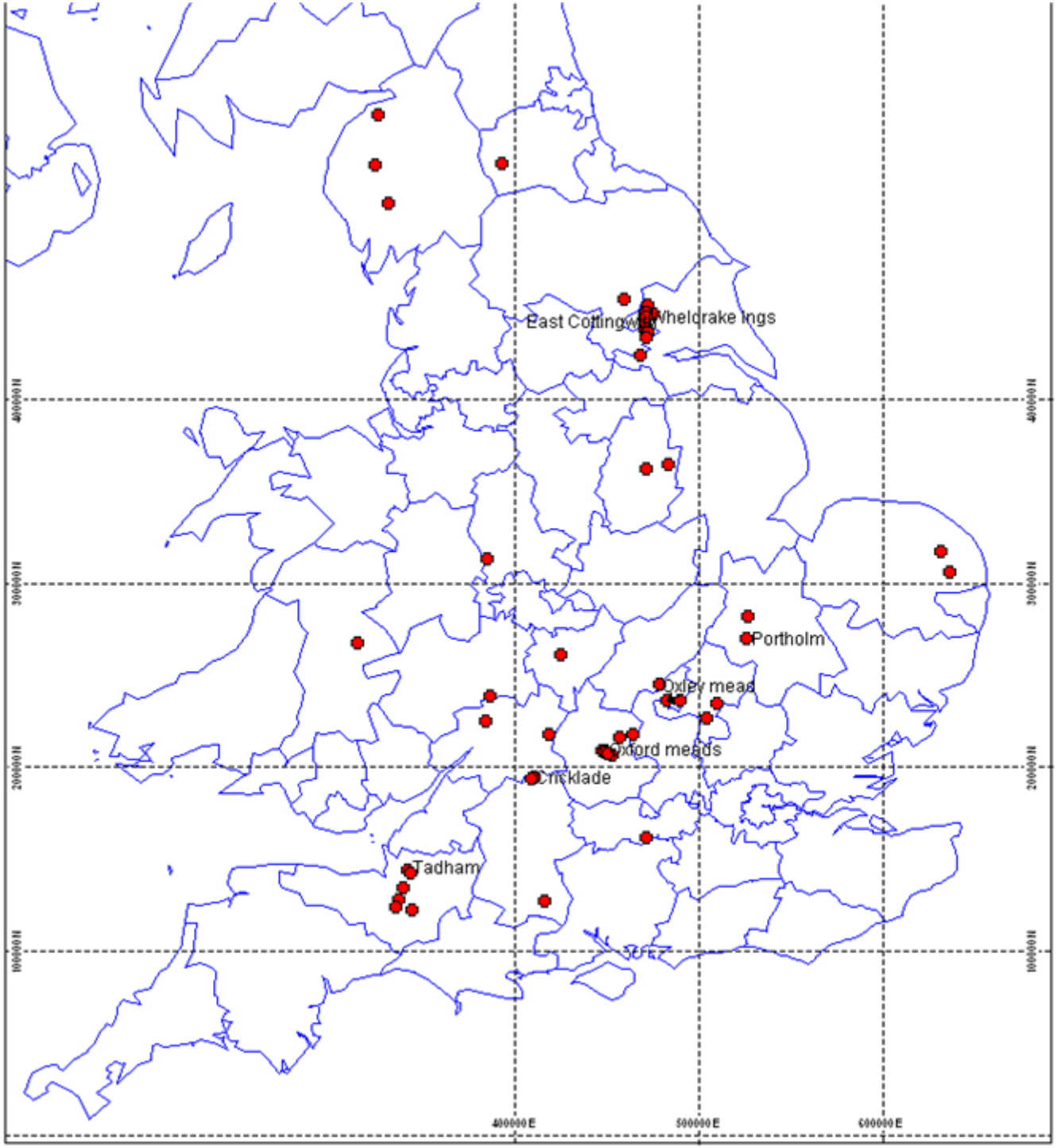
April 2010

Structure

- Research on UK floodplain meadows
- Database of results
- Quantifying the water regime
- Sub-communities within MG4
- Community response to water regime and soil fertility

The UK Floodplain Meadows database

- 58 sites across England and Wales
- >17,000 quadrats
- 2 million modelled weekly water-table depths
- >400 analyses of soil and plant-tissue nutrient status
- Botanical data spans 1986 to 2009



Data collection sites

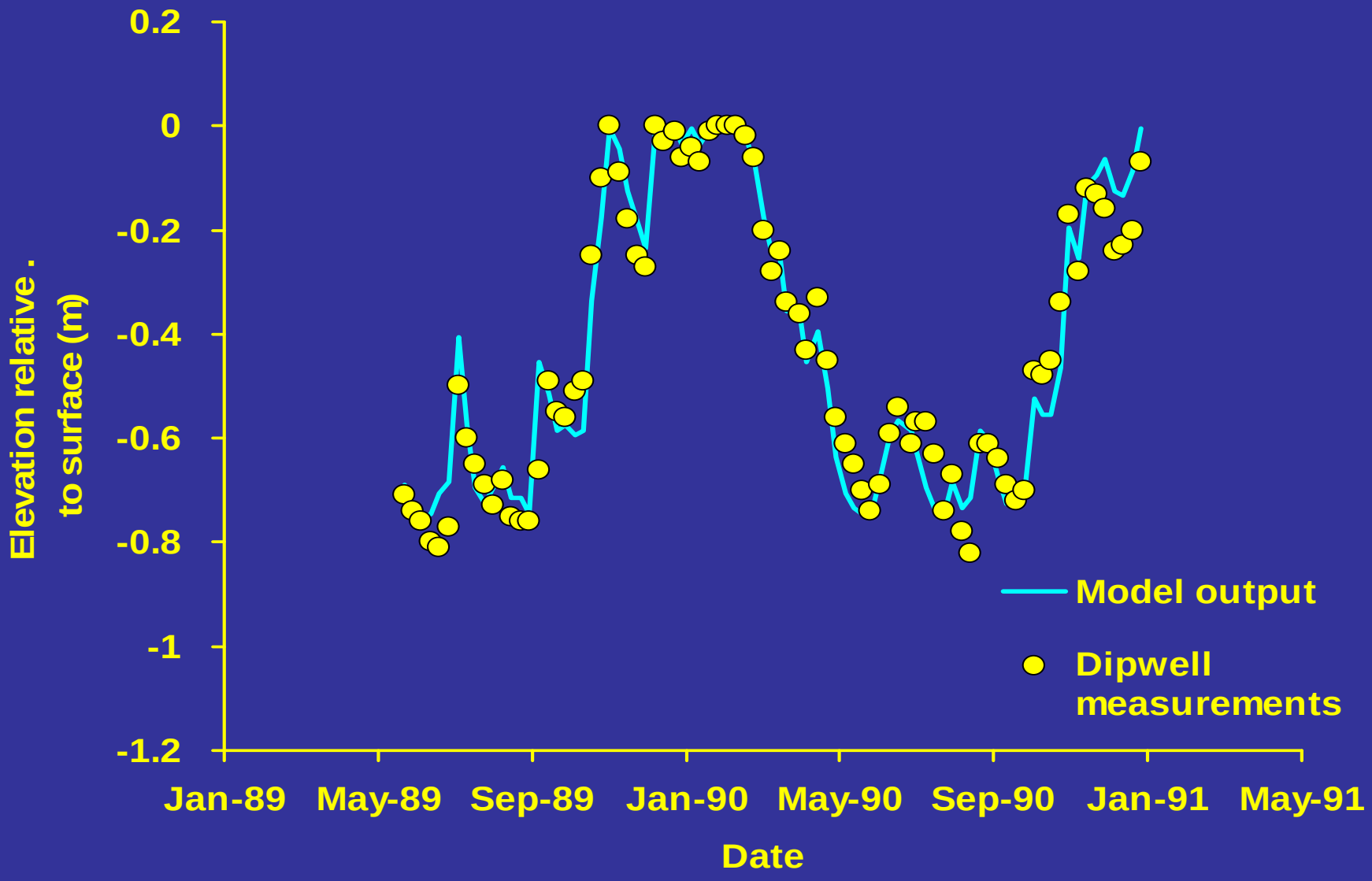
Those with long-term data sets are named

Quantitative hydrology

- Water-table depth is easiest variable to measure
- It can reflect soil-water status throughout profile
- It controls water availability to plant
- It controls oxygen status of soil
- It controls nitrogen mineralisation rate
- Influences soil temperature
- Influences intensity of grazing/management

Hydrological fieldwork

Validation of hydrological model



Parameters of water-table depth

- as previously used in the literature

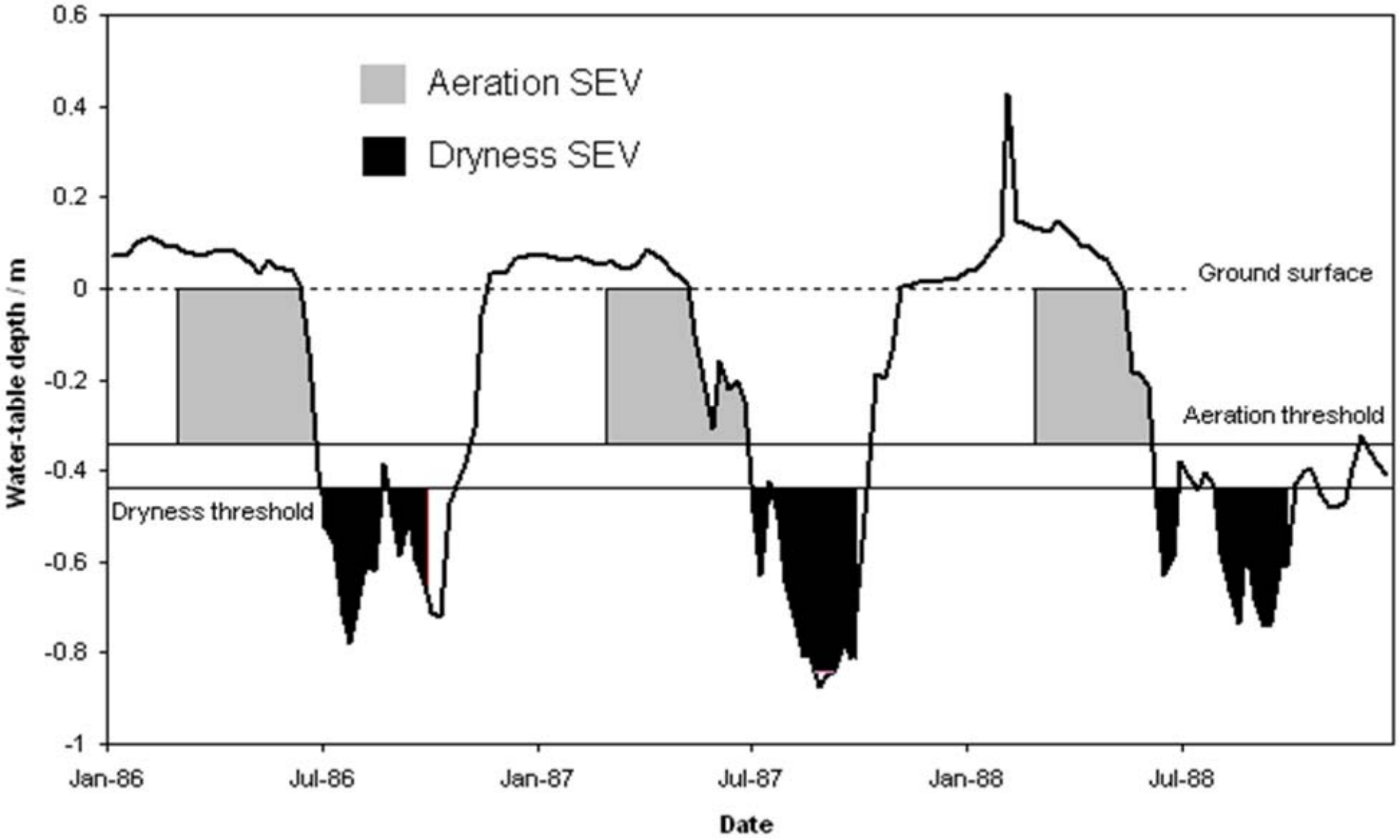
- Mean depth
- Median depth
- Duration above or below critical thresholds*
- Exceedence above or below critical thresholds

- Any of the above at specific seasons

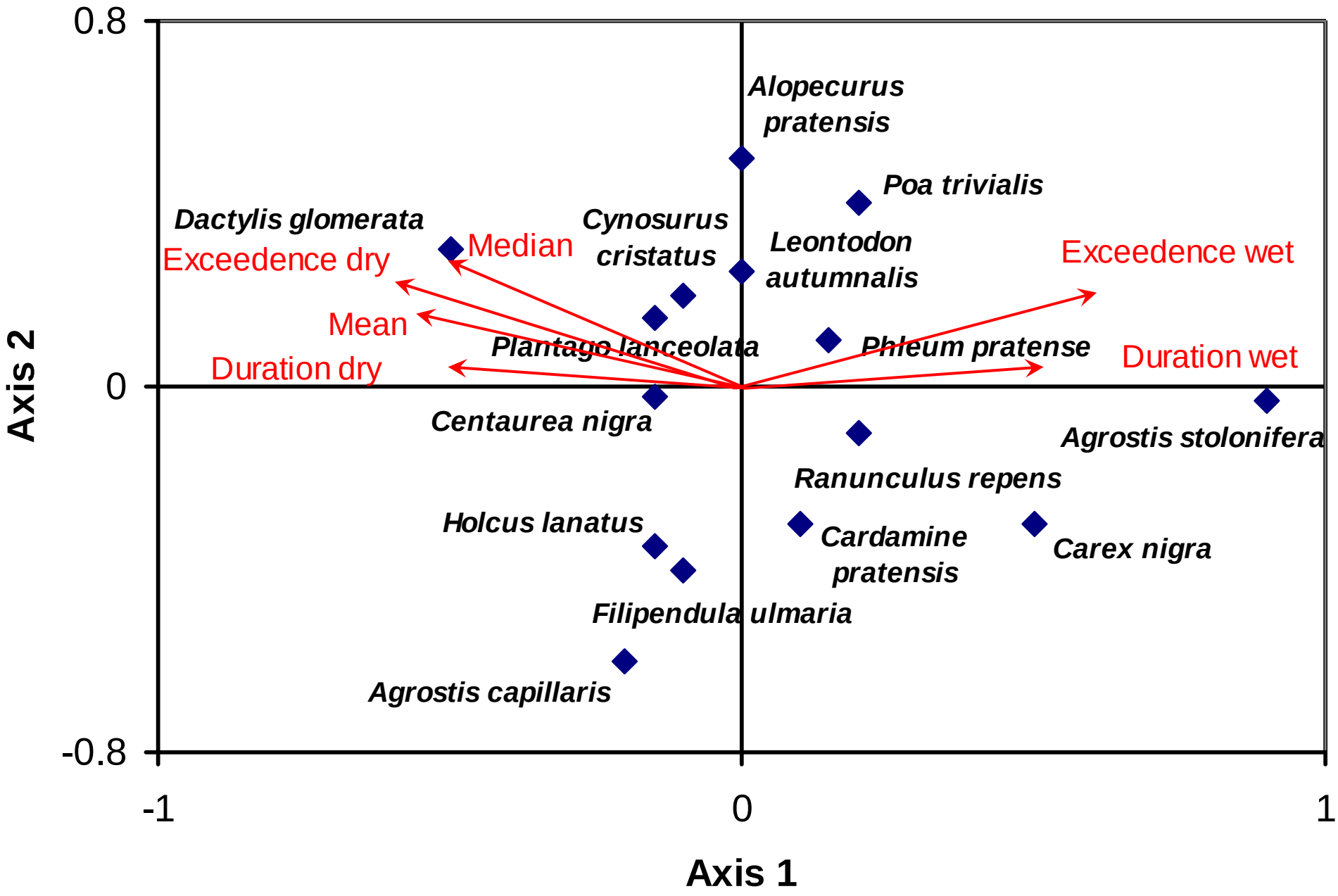
*Threshold for wetness is when oxygen can no longer freely diffuse

Threshold for dryness is when capillary rise no longer matches evaporative demand

Quantifying episodes of potential stress

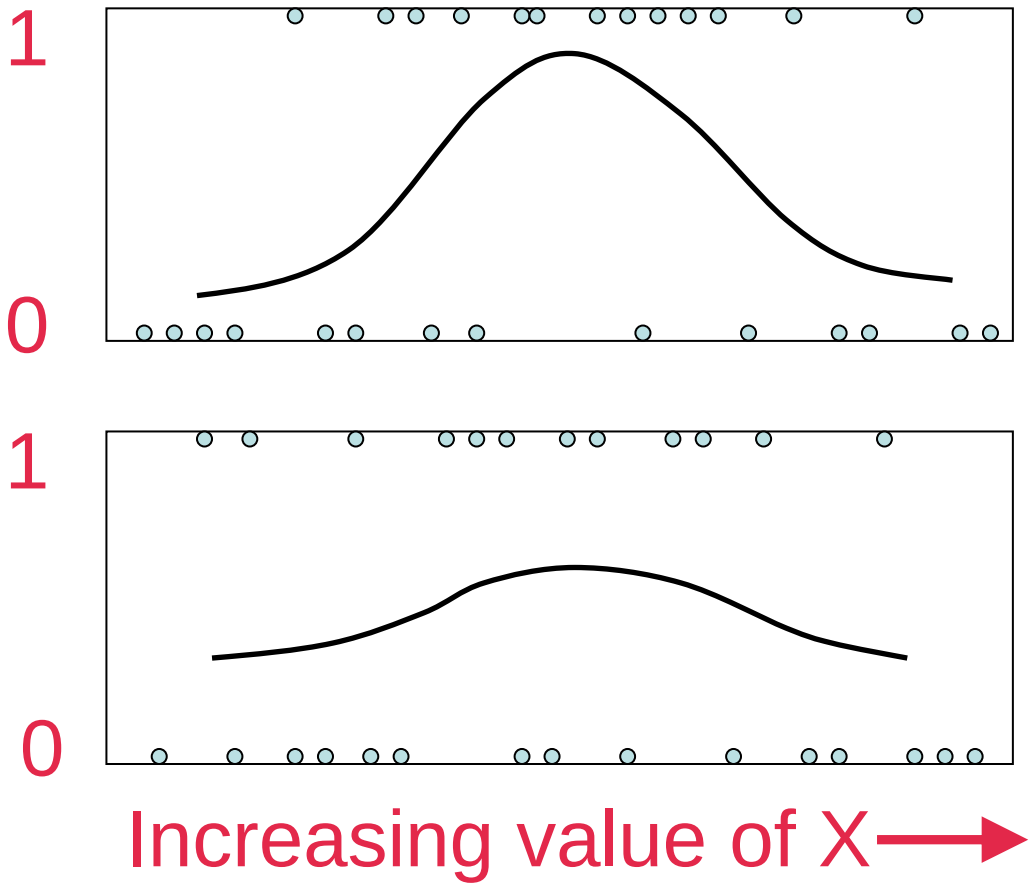


Ordination plot (CANOCO)



Data analysis

- Logistic regression using presence/absence data ranked according to parameter X



Wald statistic = 70

Wald statistic = 7

Which variable has most explanatory power?

Parameter	No of species
SEV waterlogging	6
Median depth	2
Mean depth	1
SEV soil drying	1
Duration soil drying	0
Duration waterlogging	0

The floodplain-meadow community

- UK National Vegetation Classification
  - *Alopecurus pratensis- Sanguisorba officinalis* grassland
  - MG4 (Mesotrophic Grassland number 4)
- Continental phytosociology
  - Fritillario-Alopecuretum (Westhoff & den Held)
- European Habitats Directive
  - Habitat 6510 Lowland Hay Meadow (*Alopecurus pratensis, Sanguisorba officinalis*)

… but is it a single entity?

Data analysis

- 4746 quadrats from across 58 sites
- Pre-selected to conform to MG4 or MG8 categories
- Subjected to TWINSPAN analysis
- 511 end groups recombined to give 4 putative sub-communities for MG4 (plus a possible 6 for MG8)

MG4 Typical

- **Species occurring at their highest frequency within this community:**
  - ***Ranunculus acris***
  - ***Rumex acetosa***
  - ***Leontodon autumnalis***
  - ***Lychnis flos-cuculi***

MG4 Dactylis

- **Species occurring at their highest frequency within this community:**
  - ***Dactylis glomerata***
  - ***Trisetum flavescens***
  - ***Cynosurus cristatus***
  - ***Plantago lanceolata***
  - ***Leucanthemum vulgare***
  - ***Arrhenatherum elatius***
  - ***Ranunculus bulbosus***
  - ***Leontodon hispidus***

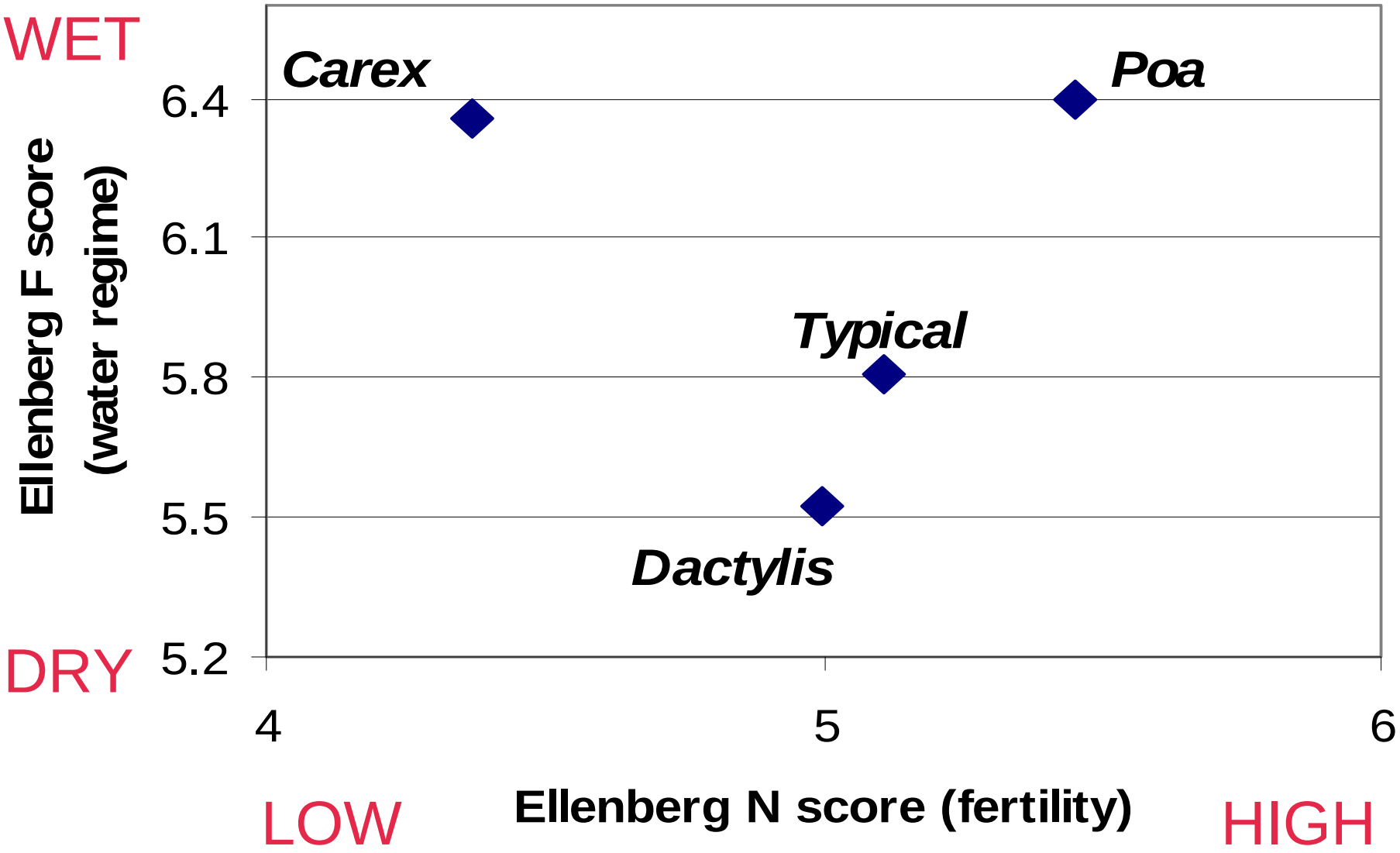
MG4 Carex

- **Species occurring at their highest frequency within this community:**
  - ***Carex panicea***
  - ***Juncus acutiflorus***
  - ***Succisa pratensis***
  - ***Carex nigra***
  - ***Carex flacca***
  - ***Equisetum palustre***

MG4 Poa

- **Species occurring at their highest frequency within this community:**
  - ***Poa trivialis***
  - ***Cardamine pratensis***
  - ***Agrostis stolonifera***
  - ***Carex acuta***
  - ***Phleum pratense***
  - ***Ranunculus repens***

MG4 mean Ellenberg scores by sub-community



Dynamism driven by water regime

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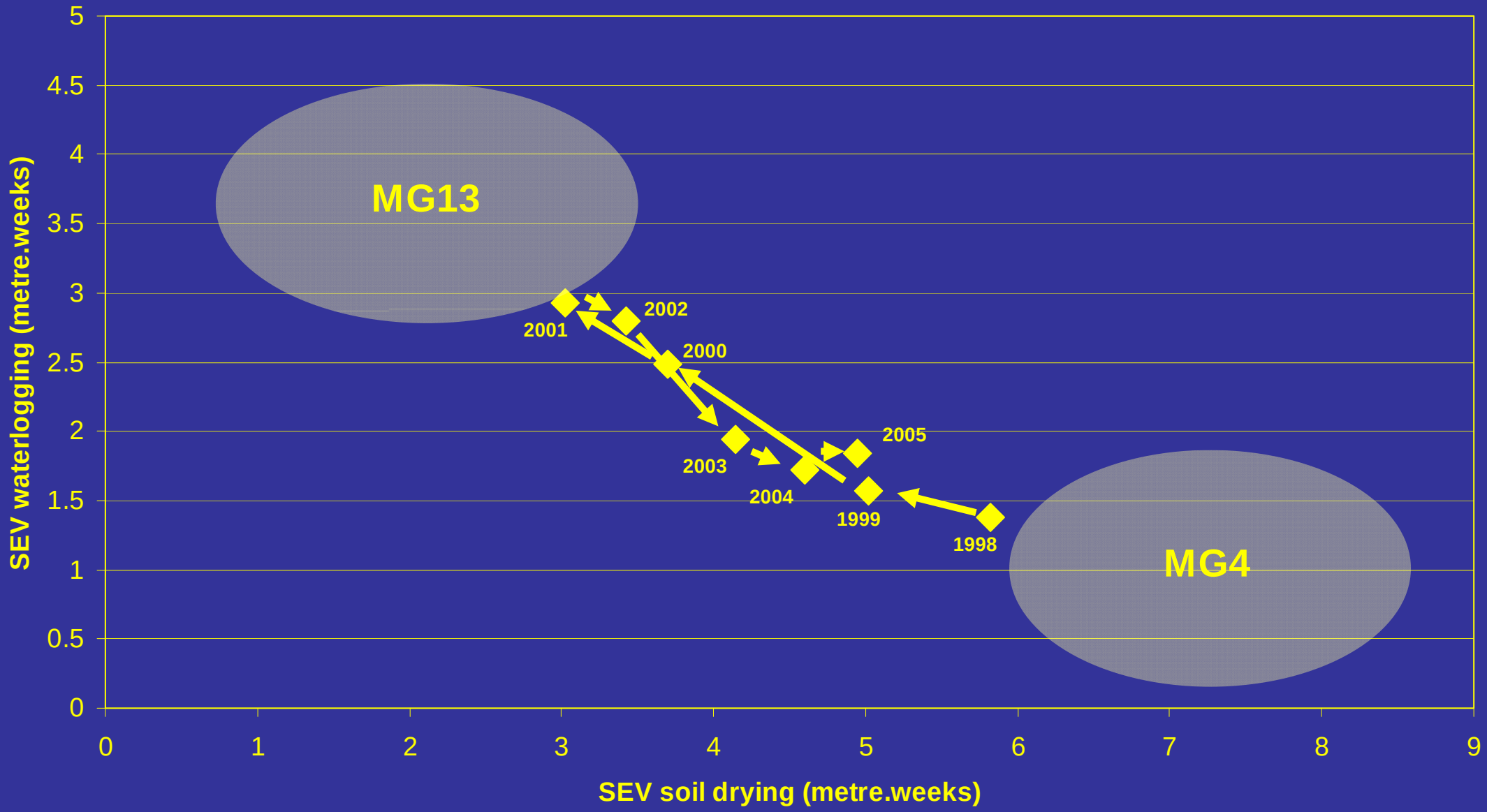
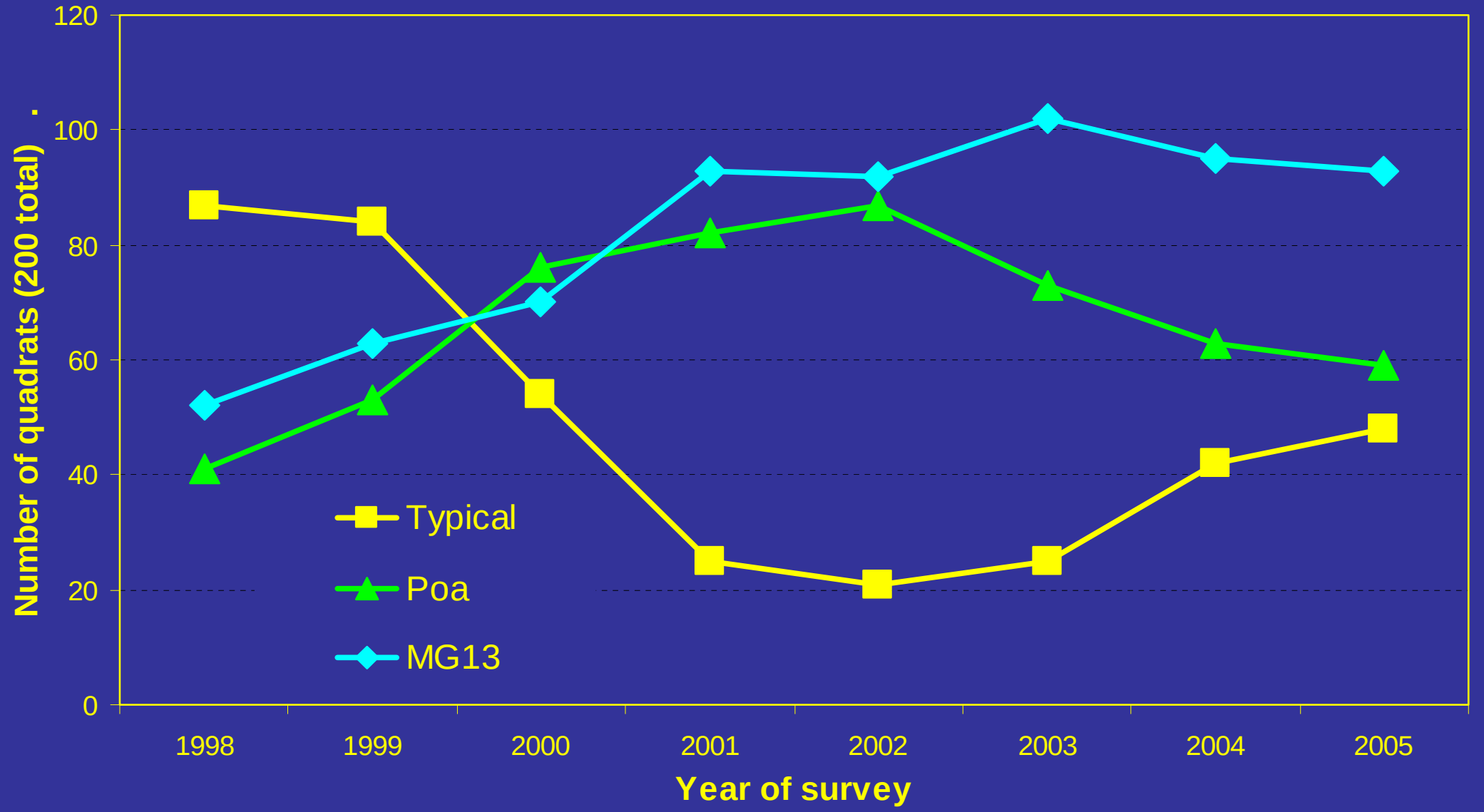
Community response to changing rainfall patterns



Response of communities to soil-water regime



Summary

- Datasets from across UK floodplains now in single format
- Species are highly sensitive to water regime
- Sum Exceedence Values (SEV) offer a useful approach to quantifying requirements
- There are recognisable variants within the UK's MG4 community
- These show clear differences in terms of environmental requirements
- The community is very dynamic and not necessarily in equilibrium with the prevailing water regime

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