

# Effects of raised water levels on wet grassland plant communities in southern England

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# Pevensey Levels: a farmed wet grassland landscape

- Salt marsh reclaimed from the sea for grazing about 1100AD
- 4300ha of freshwater marsh and wet grasslands: pastures (grazed) and meadows (cut for hay)
- Intersected by drainage channels
- History of flood events until pump drained in the 1960's
- One of the largest and least fragmented wet grassland systems in England



# Pevensey Levels: ecosystem services

- Productive agriculture (cattle, sheep, some crops)
- Flood storage
- Biodiversity
  - Protected for the diversity of aquatic plants and invertebrates in the drainage channels
  - Grassland flora and fauna (e.g. birds) is impoverished



# Pevensy Levels: recent history

- Agri-environment schemes to restore wet grasslands began in 1982
- Broad aims to encourage wetland vegetation and birds
- Raise water levels to achieve
  - Shallow winter flooding
  - Water levels within 30cm of field level Jan-Aug
- Staggered entry of sites into schemes



# Study aims

- To establish the effects of raised water levels on wet grassland plant communities
  - Time since raised water levels
  - Vegetation management
  - Water regime



# Pevensy Levels study sites

- chronosequence of 0-21yrs
- 13 pastures (P) & 10 meadows (M)
- hydrological sequence

Source: Toogood and Joyce, 2009

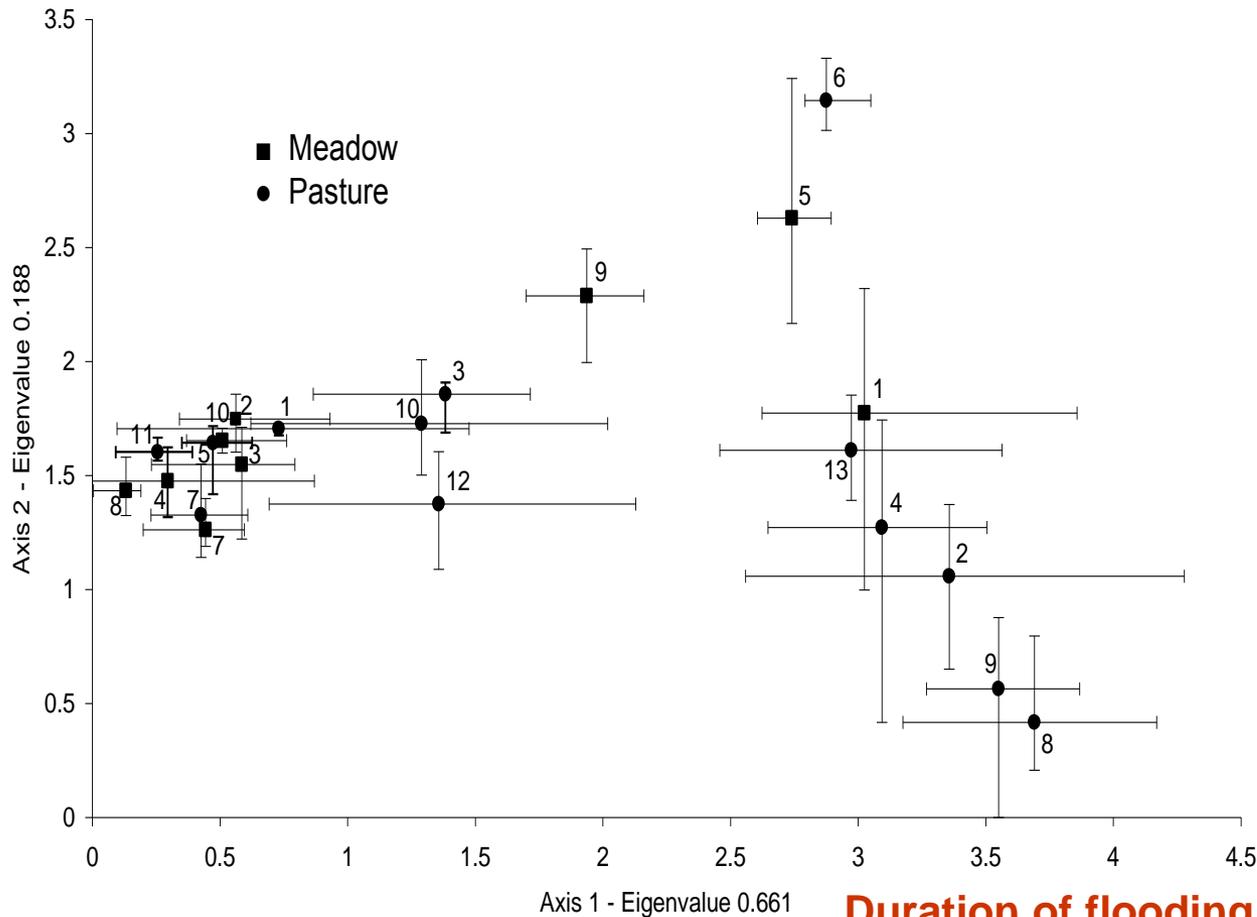


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# Methods

- Plant species abundance (cover and biomass) recorded in June 2001-3
- Plant functional traits and indicator values
- Water level and soil moisture monitoring 2001-3
- Soil nutrients in 2002
  
- See Toogood and Joyce (2009) *Applied Vegetation Science*, **12**, 283-294 for further details





Grasses  
Perennials



- Wetness +

Duration of flooding  
Mean water table  
Mean soil moisture  
Bare ground  
SC strategists  
Sedges  
Helophytes  
Hydrophytes

## Results

Detrended  
Correspondence  
Analysis of plant  
community cover.  
Mean site values  
with sample score  
ranges ( $n=5$ ) are  
shown.

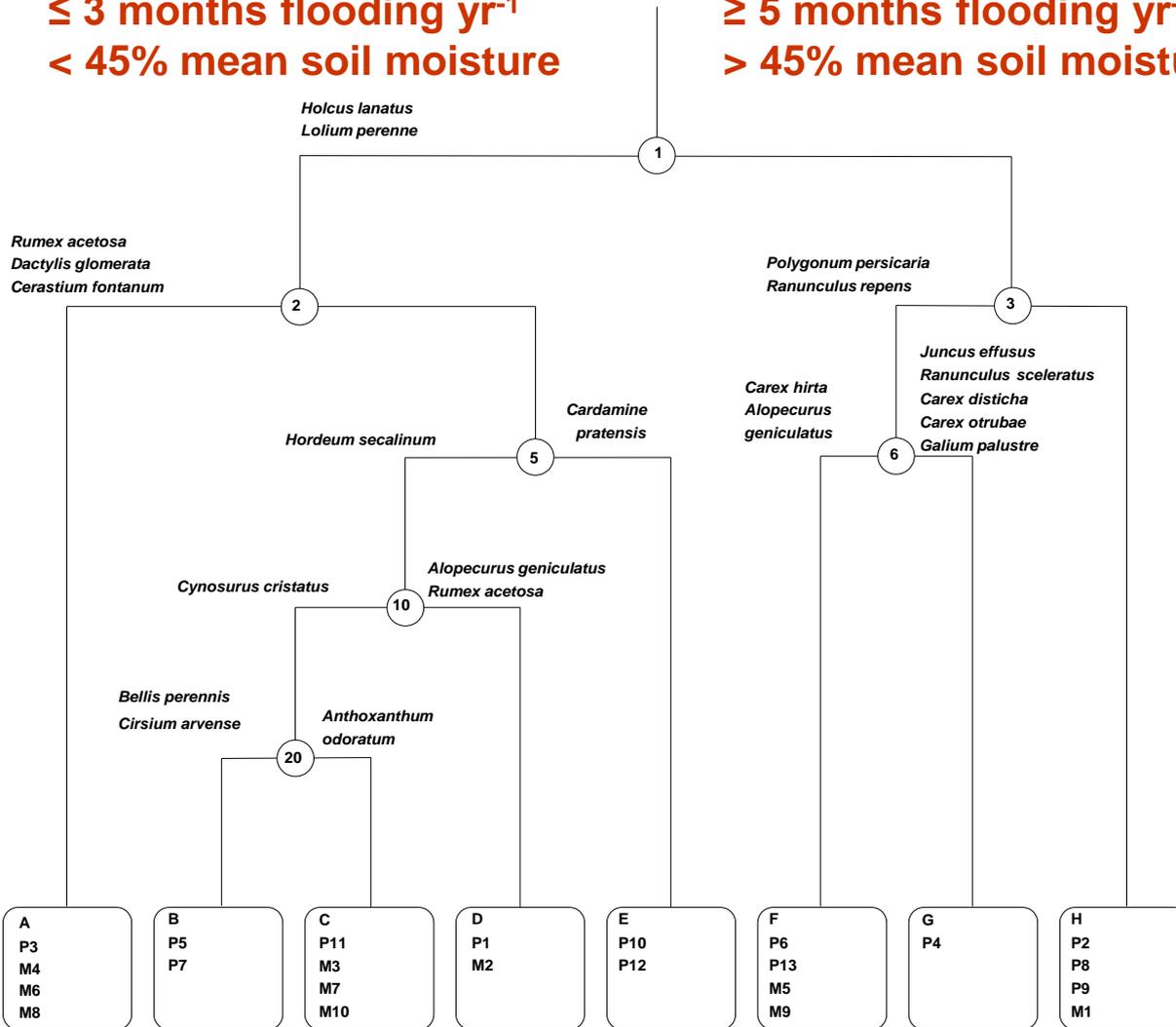
Source: Toogood and  
Joyce, 2009



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**Closed-sward grasslands**  
 $\leq 3$  months flooding yr<sup>-1</sup>  
 $< 45\%$  mean soil moisture

**Open wetlands**  
 $\geq 5$  months flooding yr<sup>-1</sup>  
 $> 45\%$  mean soil moisture



## Results

Classification of sites using plant community cover.

Source: Toogood and Joyce, 2009



# Conclusions

- Grasslands responded rapidly to substantially raised water levels
- Management was a small influence compared to hydrology
- Threshold? 3-5 months of winter flooding (into the growing season)
- All grasslands were dynamic annually, especially those with substantially raised water levels



# Implications of raised water levels

- Creation or rehabilitation of wet grasslands by (re)wetting is possible = generally good for ecosystem services
- More bare ground (max. 28% cover), water (11%) and wetland plants (e.g. sedges) = good for biodiversity (e.g. birds)
- Less plant biomass, delayed grazing or cutting = bad for agriculture
- Farmers require financial support (incentives, compensation or alternative income)





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