# Assessing the Effect of Long-wall Mining Subsidence on Internationally Important Floodplain Grasslands in the Lower Derwent Valley, UK

# Still Relevant 20 Years-on

At the 15th Annual National ASMR Meeting in May 1998 we gave research papers on quantifying the ecological effects of long-wall mining subsidence on two internationally important wetland ecosystems.

Since then studies on the Lower Derwent continued for a further 14 years until 2012.

So why bother presenting an update with the cessation of under-ground coal mining in the UK?

Well, the studies are relevant to mining elsewhere, but also to the consequence of the effects of climate change through raising sea levels.

# Two back-to-Back Presentations

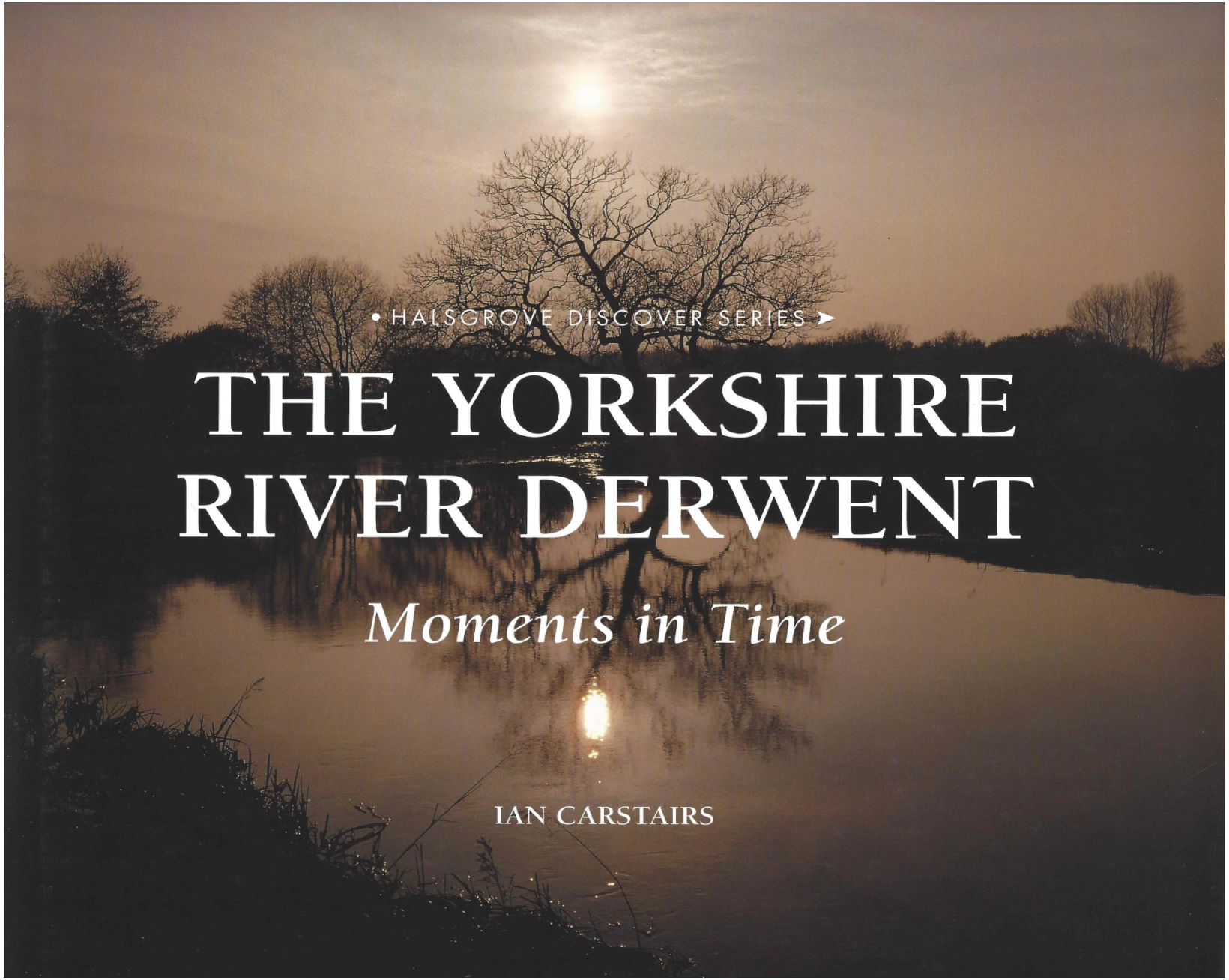
This first presentation is about the gathering of technical evidence needed by the mining company to argue its case

The second presentation is about the use of this to find a solution to one of several  legislative constraints – the MG4 type of grassland

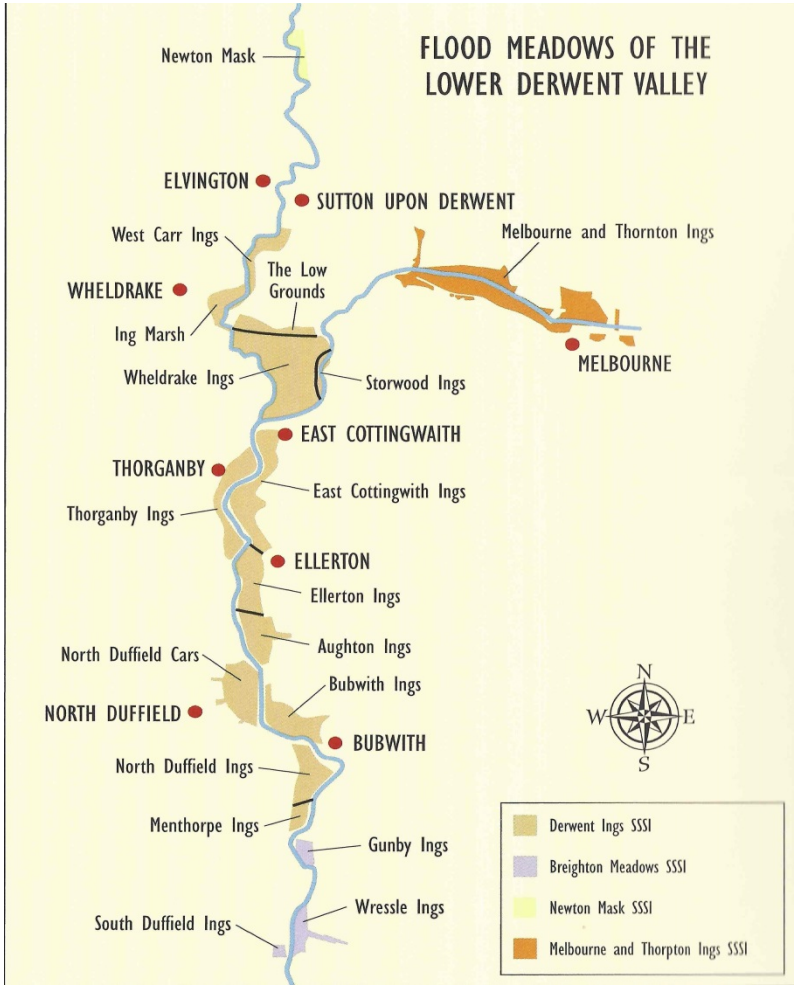
# Competing Interests and Legislation Creep

The context of these two presentation is very complex; comprising a history of competing uses of the river and its floodplain for water abstraction, navigation rights, agriculture and nature conservation all in a changing legislative landscape and public expectations.

Coal mining came late to the party but no less involved – ‘a must see’ Carstairs’ book

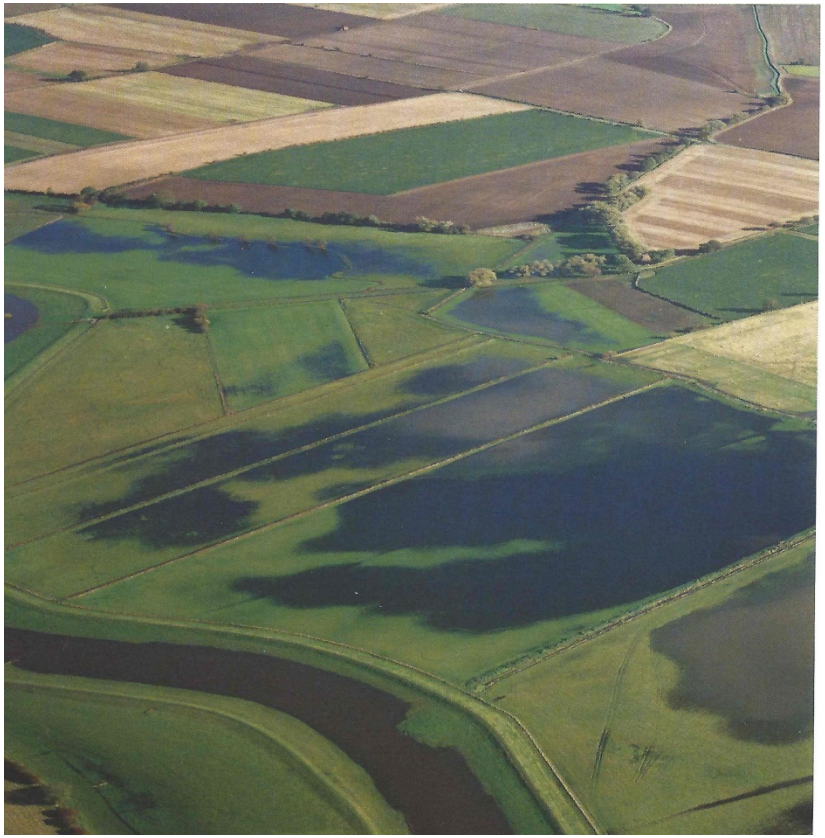

• HALSGROVE DISCOVER SERIES ➤
THE YORKSHIRE RIVER DERWENT
Moments in Time
IAN CARSTAIRS

# Location of Lower Derwent Valley

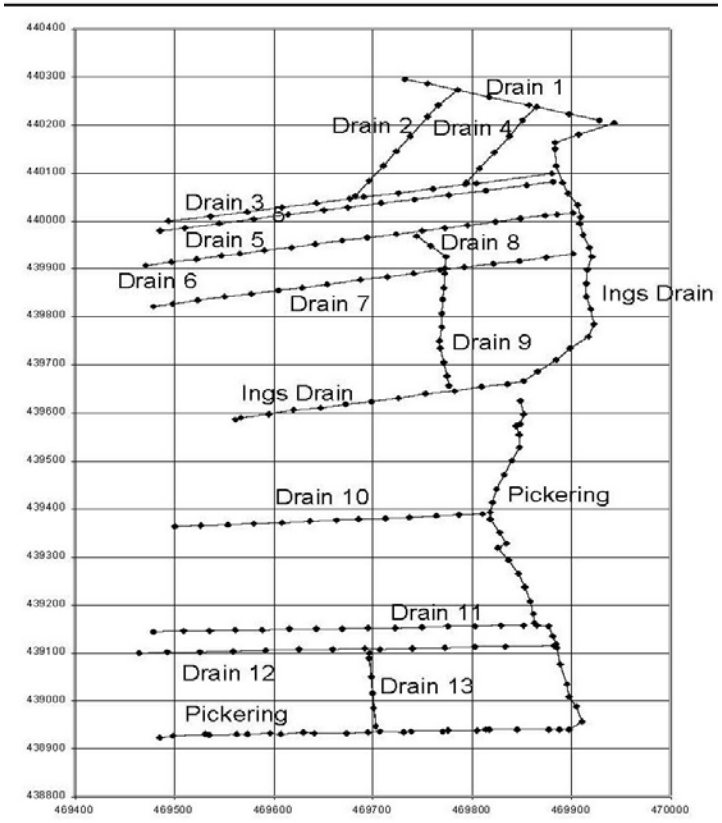


# Regulated River & Floodplain Drainage

**Part of floodplain catchment for Ing Drain, Ellerton**



**Drain network for Ing Drain and Pickering Drain**



# Range and mosaic of grassland plant communities and wetland habitats





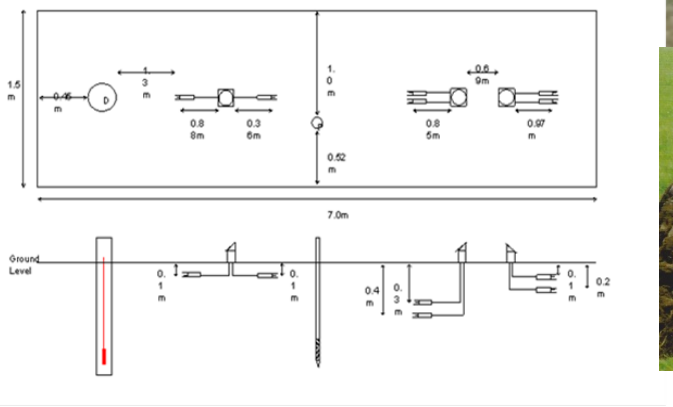

# Grassland  Community, Soil and Hydrological Studies

Botanical & soil & topographic surveys

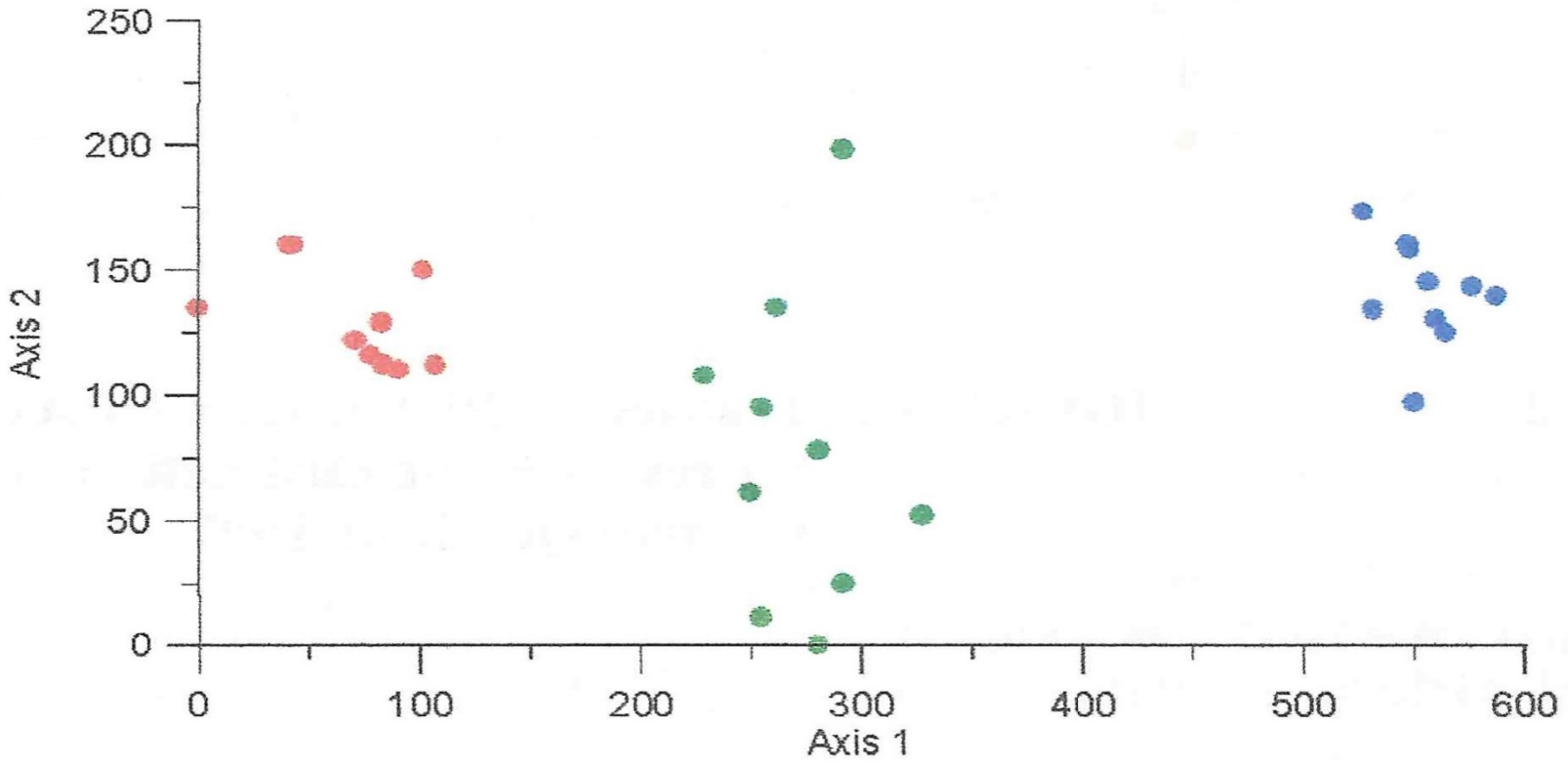
Instrumentation

Experimentation





# Grassland Communities - Ordination of quadrat floristic data



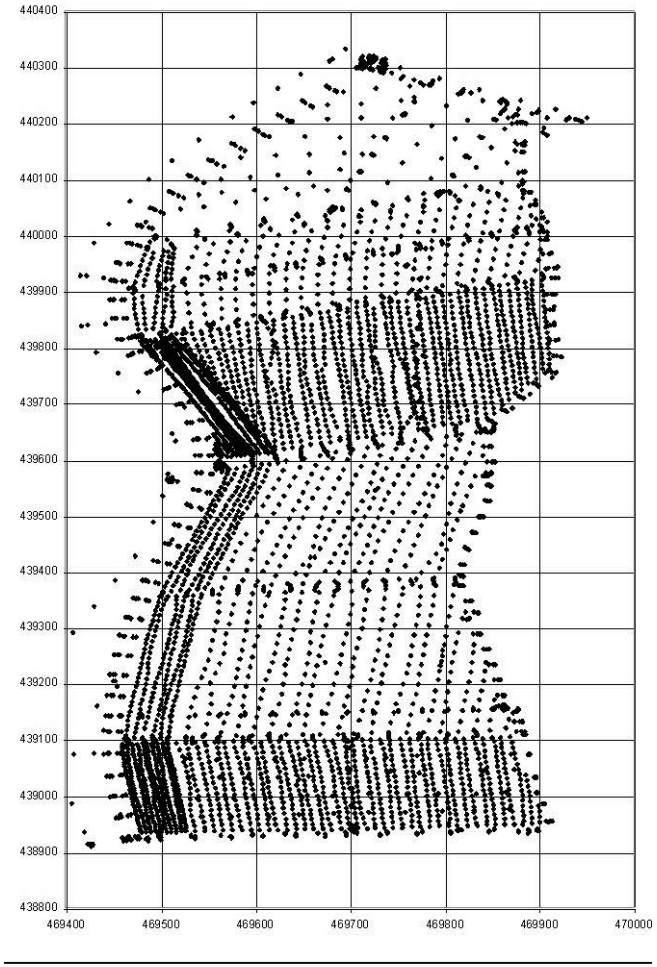
# Grassland Communities –

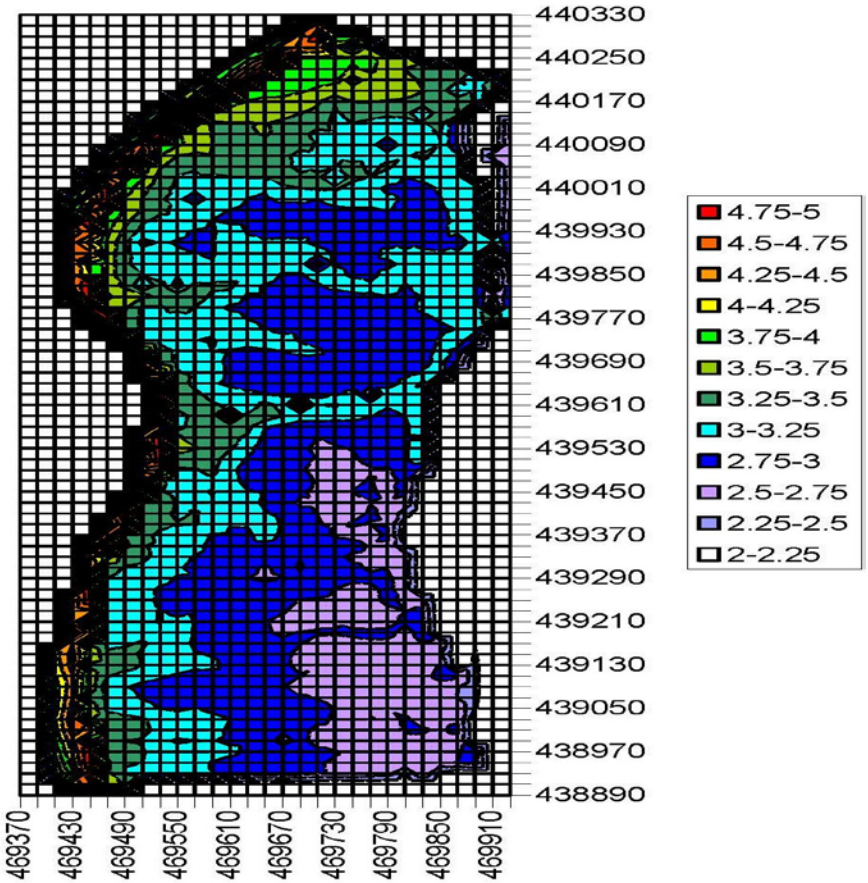
- Predominantly 3 distinct mesotrophic communities (MG4, MG7, MG13) with 2 swamp communities (S5 & S28)

- Composition faithful between years and between and within meadows

| |
|---|
| **MG4** *Alopercurus pratensis – Sanguisorba offinalis* - hay meadow<br>General high frequency & abundance of –<br><br>**Sanguisorba officinalis**, **Anthoxanthum odoratum**, Trifolium dubium, **Trifolium pratense**, **Cynosurus cristatus**, **Lathyrus pratensis**, **Cerastium fontanum**, **Plantago lanceolata**, **Holcus lanatus**, Festuca rubra, **Silaum silaus**, **Rhinanthus minor**, **Ranunculus acris** |
| |
| **MG7c** *Lolium perenne – Alopecurus pratensis* - flood pasture<br>General loss above dicotyledon species and cover, but increase in –<br><br>**Elymus repens**, **Cardamine pratensis**, **Ranunculus repens**, **Polygonum amphibium**, Lolium perenne, **Festuca pratensis** |
| |
| **MG13** *Agrostis stolonifera – Alopecurus geniculatus* – inundation garssland<br>Loss or reduction in frequency and cover of Rumex acetosa, Taraxacum sp, Filipendula ulmaria, Phleum pratense but also an increase in frequency and cover of –<br>Myosotis laxa, Galium palustre, Oenanthe fistulosa, Caltha palustris, **Agrostis stolonifera**, **Alopecurus geniculatus,** Phalaris arundinacea, with **Carex acuta** and **Agrostis canina** on some Ings |
| Source Benyon & Humphries (1998) |
| Major indicator species in **bold** |

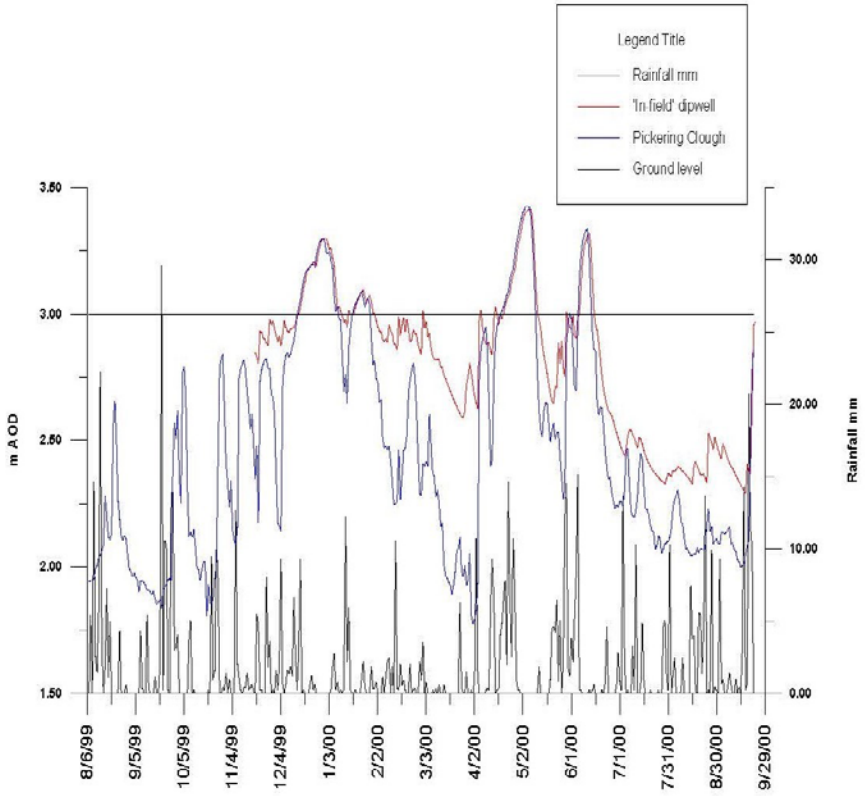
# Topographic gradient



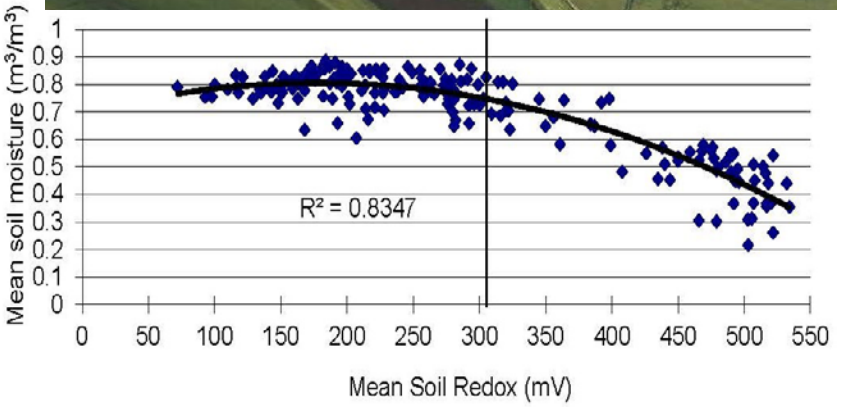



# Topographical & Wetness Gradient

## Inundation & soil saturation




## Soils anaerobic when saturated



# Wetness Gradient - Reciprocal turf transfer

**MG4 community indicator species**

| MG4 | Remained | | | | Gained | | | | Lost | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Plot MG4 Turf Assigned | C | 4 | 7 | 13 | C | 4 | 7 | 13 | C | 4 | 7 | 13 |
| Sang off | x | x | x | x | | | | | | | | |
| Anth odor | x | x | x | | | | | | | | | x |
| Ranu acris | x | x | x | | | | | | | | | x |
| Cyno crist | x | x | | | | | | | | | x | x |
| Trif prate | x | x | | | | | | | | | x | x |
| Holc lanat | x | x | | | | | | | | | x | x |

# Distinct community boundaries

Figure 10a Anthoxanthum odoratum


Figure 10b Cerastium fontanum

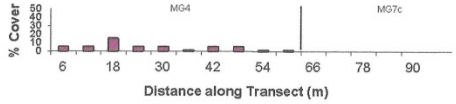



Figure 10c Cynosurus cristatus

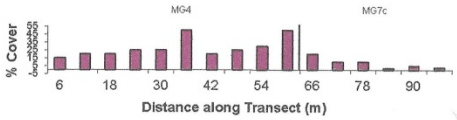



Figure 10d Holcus lanatus

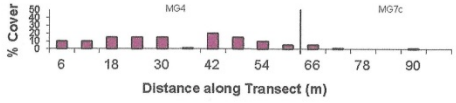



Figure 10e Lathyrus pratensis

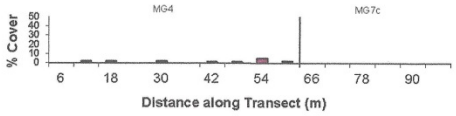



Figure 10f Plantago lanceolata

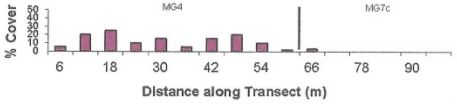



Figure 10g Sanguisorba officinalis

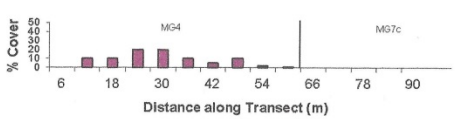



Figure 10h Silaum silaus

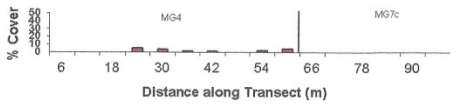



Figure 10i Trifolium pratense

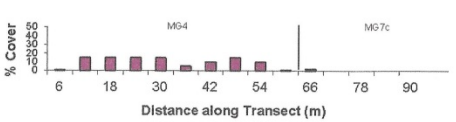



Figure 10j Ranunculus acris

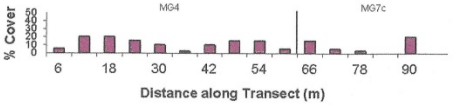



Figure 10k Rhinanthus minor

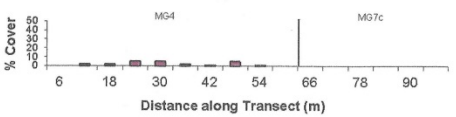
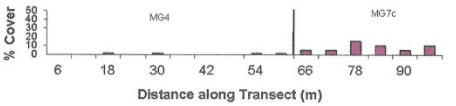
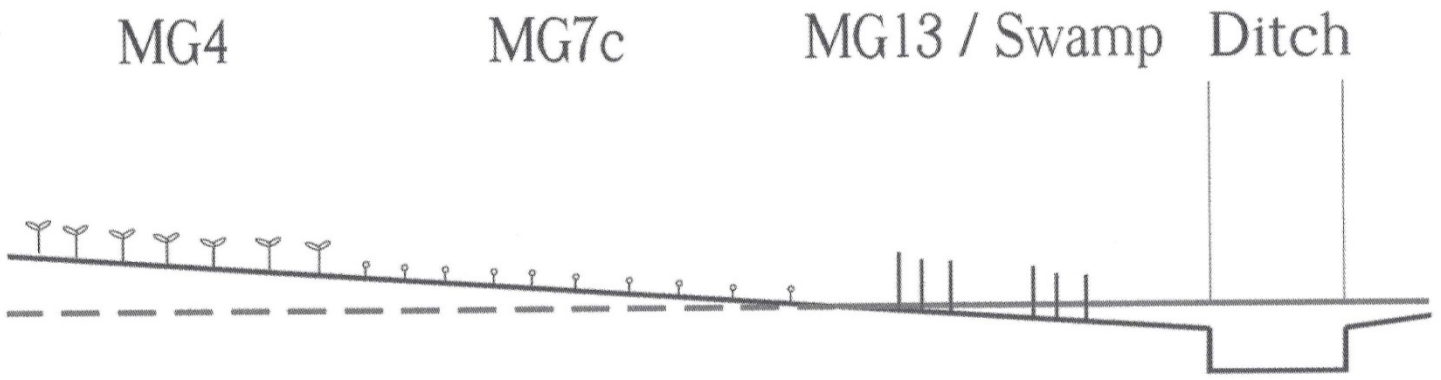



Figure 10l Cardamine pratensis




# Key Findings

- Topographic gradient from river to edge of floodplain
- Grassland community type and distribution according to wetness gradient
- Zones of wetness manifest as distinct community boundaries due to change in species composition and dominance




| | MG4 | MG7c | MG13 | Swamp |
|---|---|---|---|---|
| Saturated topsoil<br>Standing water | November–March | November–April<br>December–March | October–May<br>October–April | All year<br>September–June |

# Some References


- Humphries R N et al, 1998. Assessing the effects of mine subsidence on an internationally important wetland site, p 446. in Throgmorton et al (eds), Proceedings of 15th Annual National Meeting of the American Society for Surface Mining & Reclamation, St Louis, USA.
- Benyon P R, 2003. Soil Wetness as a Determining Factor in the Distribution of MG4 (*Alopercurus pratensis – Sanguisorba officinalis* L.) Grassland. MPhil Thesis, University of Nottingham.
- Parkin G et al, 2004. Project BD1316 - Water Availability and Budgets for Wetland Restoration and Re-creation Sites. Defra, London.
- Milsom T (ed), 2006. Land Use, Ecology and Conservation in the Lower Derwent Valley. PLACE, York, UK.
- Carstairs I, 2007. The Yorkshire River Derwent: moments in time. Halsgrove, Wellington, UK.

# Main Cast

**Humphries Rowell Associates** (researchers) –
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**RJB** (coal mining company) – Chris Bennett, Steve Peace

**English Nature** (statutory government agency) – Jeff Lunn, Tim Dixon

**Light Owlers Trust** (ngo & land owner) – Ian Carstairs