Flow accretion profiling as a method of hydrological characterisation of wetlands in permeable catchments

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Aim

- **To develop or improve methods of wetland characterisation, in order to ensure that hydrological processes and functions in wetlands are correctly represented;**
- **To improve the catchment-scale conceptualisation of wetlands**

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Wetlands…

Restoring Sustainable Abstraction Programme

Habitats Directive

Water Framework Directive

Assessing impacts of abstractions on wetlands

Ecological status of groundwater bodies affected by condition of GWDTEs

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Wetland Characterisation

- Lots of wetlands for which we need to know…
- How they interact with their surroundings and how dependent they are on groundwater
- How can we get an idea of the interactions between wetlands and groundwater for a large number of wetlands?

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Floodplain Wetlands

- For floodplain wetlands, there is a continuum between sites;
- Common factor of being located in the same catchment, on the same river;
- So by looking at the catchment scale, get an initial idea of how wetlands on the floodplain interact with surroundings and compare to each other

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Surface-groundwater interactions

- Catchment hydrogeological studies consider spatial distribution of groundwater- surface water interactions;
- Carry out incremental flow surveys along a river, looking at accretion between points;
- Generally focuses on emergence of groundwater in rivers (passage through floodplain is incidental)

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Floodplain-groundwater interactions

- Extend the methodology to see if groundwater interactions with wetlands also occur in the same parts of the catchment as those where the river is accreting;
- This would give an initial idea of which parts of the floodplain had the most groundwater connectivity, and where surface water contributions were more important

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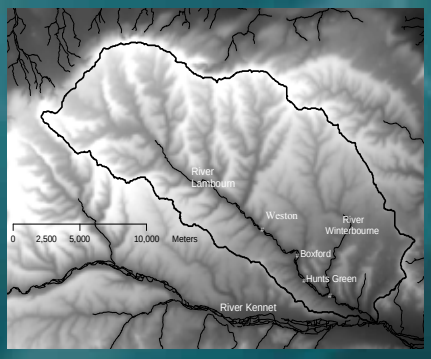
Lambourn Catchment



- Flow surveys along River Lambourn to develop accretion profiles;
- Detailed studies in three wetlands to understand water sources and processes

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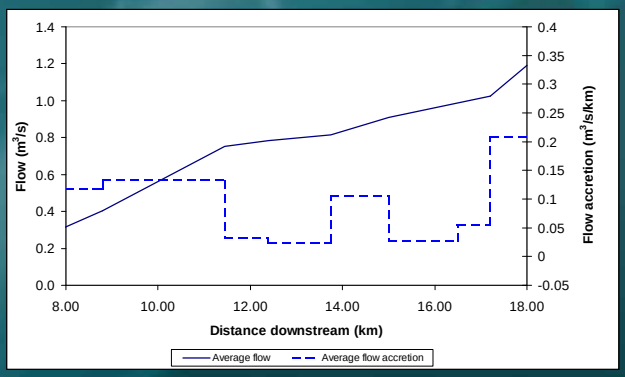
LOCAR flow accretion surveys

- Showed where areas of most interaction between river and groundwater occurred



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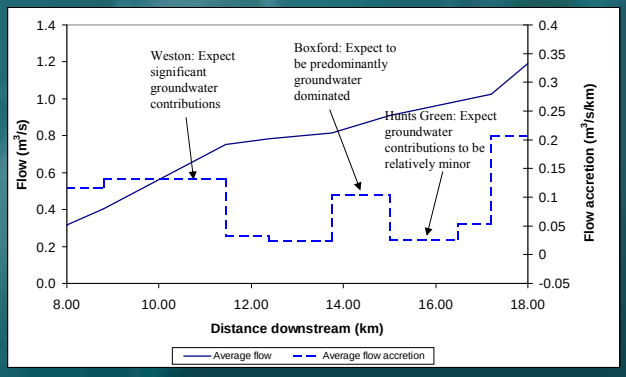
Wetland Studies

- Three sites selected for further research



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Within- Wetland Studies

- **Each wetland study included:**
  - Geophysical surveys;
  - Groundwater and river level monitoring;
  - River flow surveys;
  - Hydrochemistry surveys; and
  - Vegetation surveys.

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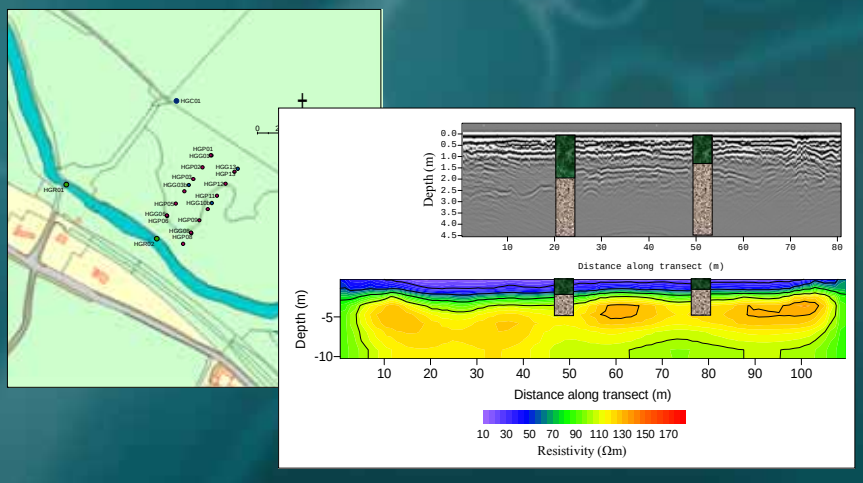
For Example…Hunts Green



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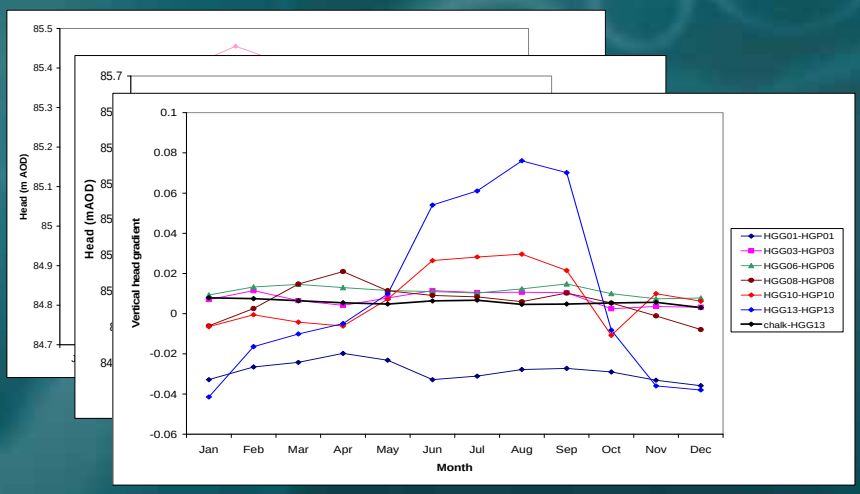
Hunts Green (2)…



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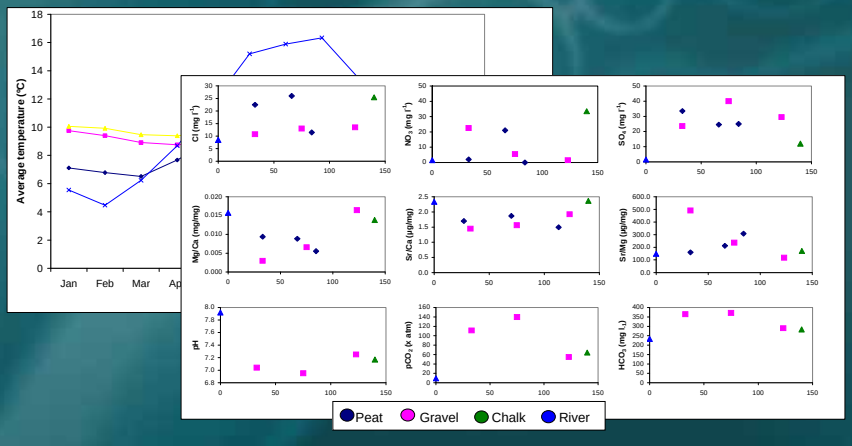
Hunts Green (3)…



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Comparison of "groundwater dominance" between sites

Characteristic	Hunts Green	Boxford	Weston
Water table depth	2	4	6
Vertical head gradients	1	2	3
Correlation between surface and groundwater time series	4	3	5
Groundwater temperature	3	6	3
Mn and Fe concentrations	2	5	5
Ratios of Mg, Sr and Ca	3	9	6
Other chemistry	2	5	5
Ellenberg scores	2	5	5
TOTAL	**20**	**40**	**36**

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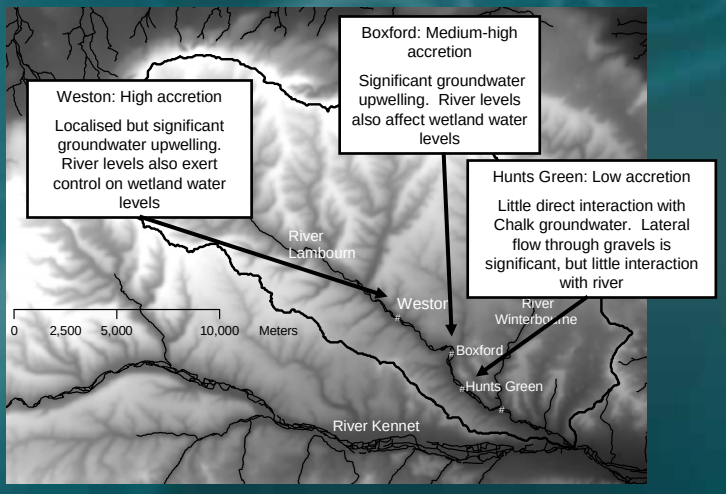
Comparison between sites



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Complications…

- **Chalk is overlain on the floodplain by a flint gravel layer**
  - Acts as extension of the river, with shallow lateral flow occurring
  - So other areas of floodplain still receive some “groundwater” contributions, but not directly from the Chalk
- **Flow accretion surveys affected by scale**
  - Apparent accretion can vary depending on how long a reach is used
  - Springs (point sources) can affect values

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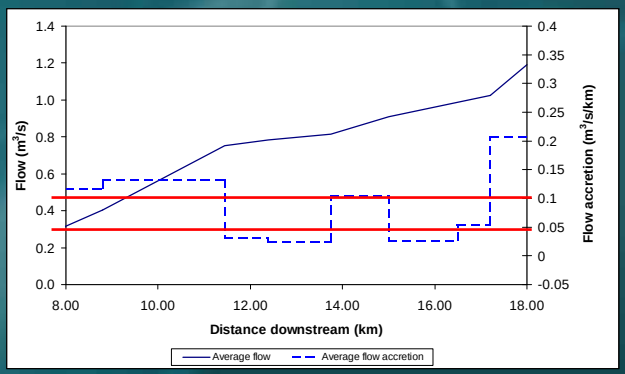
Reminder: Flow Accretion Reaches



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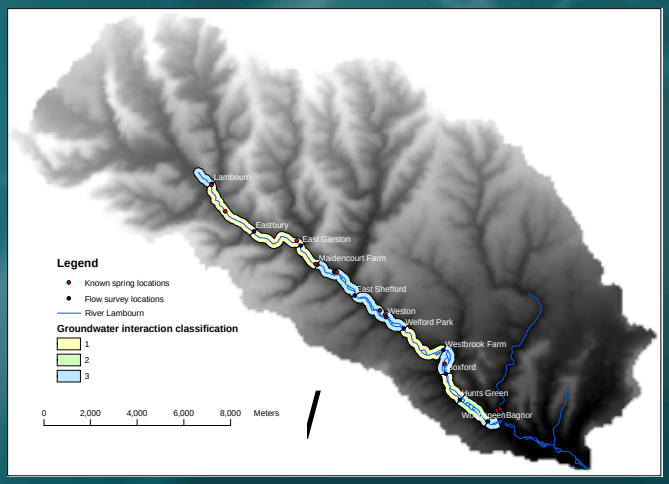
Catchment-scale floodplain characterisation



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Conclusions

- Understanding river flow accretion is a useful tool for providing initial characterisation of wetlands throughout a catchment;
- Does not give absolute answers, but provides relative comparisons along the floodplain;
- Allows identification of wetlands most dependent on groundwater, and prioritisation of most vulnerable sites for further investigation

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Thanks…

- My PhD supervisors Jim Griffiths, David Gowing and Andy Binley
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- Dave Gasca-Tucker, Helen Gavin and Emma Everrard, Atkins
- Landowners and river keepers at Weston, Boxford and Hunts Green

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