Catchment based assessments of water quality in support of policy implementation

Greg Hughes

Cambridge Environmental Assessments

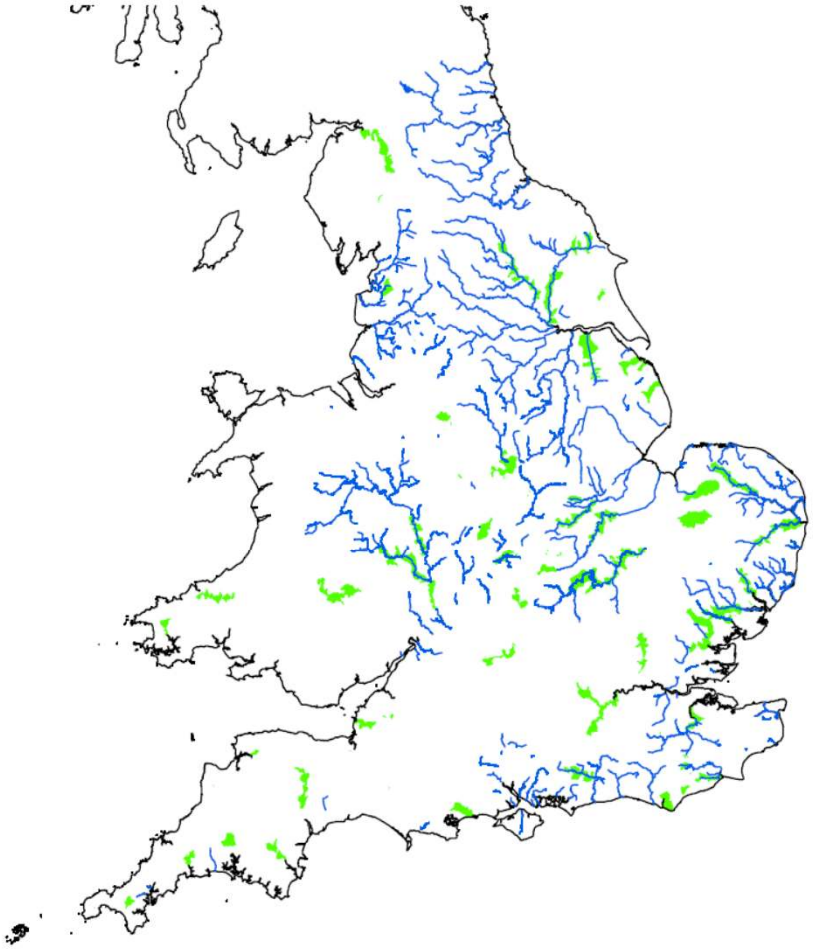
Talk Outline

- Introduction
- Two recent project examples
  - Welsh Assembly Government
  - Water Company client

Regulatory Pressures

- PPP's registered under 1107/2009 are being pressured by other regulatory drivers
- Water Framework Directive
  - Good Ecological Status
  - *Article 7*
  - Priority Compounds
- Water Supply
  - Drinking Water Directive/Water Supply Regulations
- Sustainable Use Directive
  - *Article 11*

DrWPAs where pesticides are putting WFD Article 7 compliance at risk



Source: Environment Agency

- **15% at risk of non-compliance**
  - **metaldehyde**
  - **MCPA**
  - **chlorotoluron**
  - **mecoprop**
  - **carbetamide**
  - **2,4-D**
  - **propyzamide**

Changing Environment

- Individual product stewardship programmes
- Voluntary Initiative programmes
- Catchment Sensitive Farming programmes
- *Agri-environment Schemes*
- *Water Company Schemes - PR09 saw the introduction of catchment management approaches as opposed to end of pipe solutions; PR14 to have a bigger emphasis on these approaches*
- Farm assurance schemes

- Defra Catchment Based Approach

Catchment Implications

Exploring impacts of behaviour change/field scale mitigation on water quality:

1. *Policy level analyses – what is the likely impact of the agri-environment schemes on water quality given that these promote a change in farmer behaviour*
2. *Water Industry – cheaper/sustainable way to ensure clean(er) water on abstraction*
3. AgChem Industry – Demonstrate to regulators that given sufficient time to implement them, stewardship approaches can deliver

WAG AE & WQ

- Contribution of agri-environment schemes to maintaining and improving water quality
- High level of uptake (2009) – TC, TG and OFS accounted for 33% of holdings and 44% of agricultural land
- Limited evidence of environmental outcomes
- Considered soil, water and greenhouses gases;
- Only considering pesticides emitted to surface waters;
- Modelled diffuse emissions of pesticides to surface waters to calculate changes in emissions at catchment and national scale due to the WAES.
  - Informed by a tailored farm practice survey
  - Evaluated through monitoring of aquatic macrophytes, macro-invertebrates and habitat diversity at 80 stream and 80 pond sites

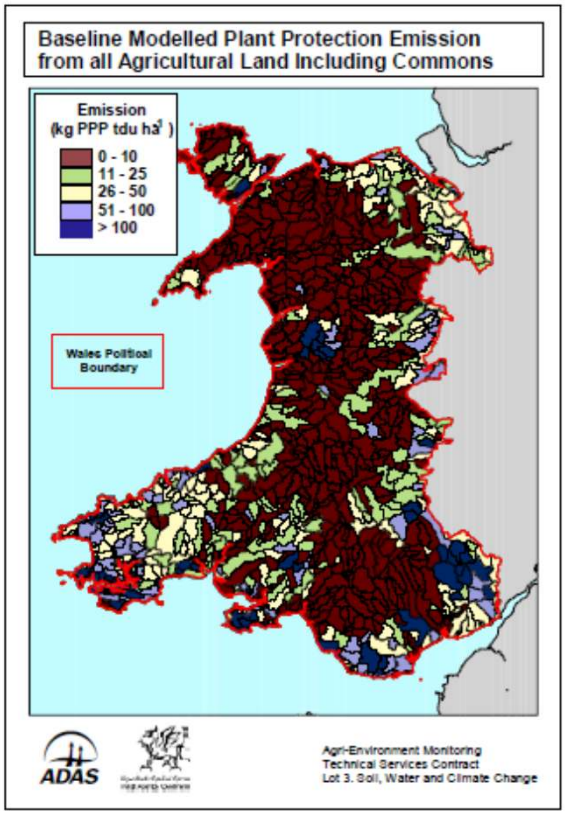
Modelling Methodology

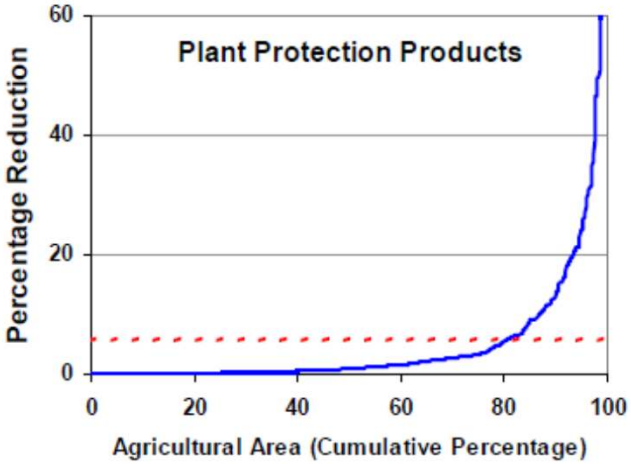
- Meta-model export coefficients from detailed process based models
- Common descriptions of farm systems that are representative of typical practice in Wales
- Export coefficients derived for farm scale simulations for each 1km grid square across Wales.
- The coefficients therefore spatially explicit, and sensitive to local environment conditions affecting pollution risk.
- When used with catchment scale agricultural census and practice data, the spatially explicit export coefficients provided an efficient and easily scalable estimate of pollutant losses.

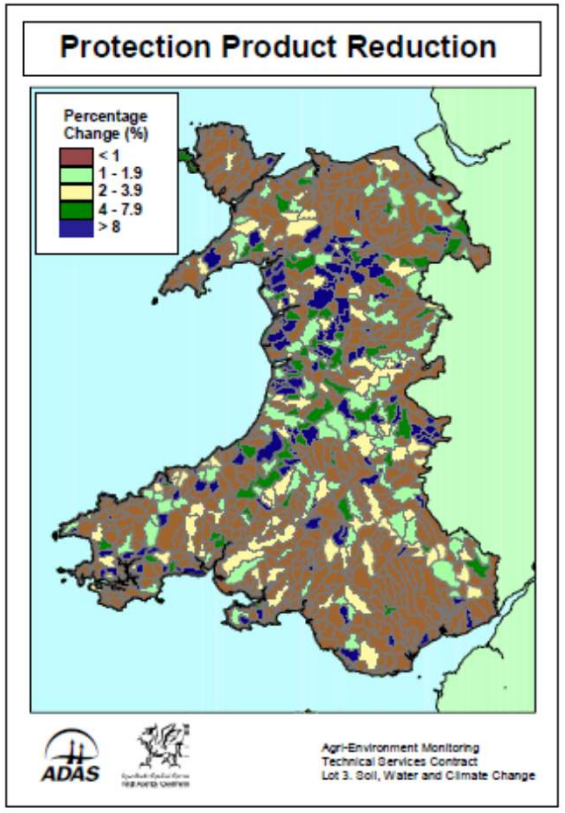
Modelling Methodology

- Total emissions explicitly disaggregated between each of the source types, areas and delivery pathways
- Allows representation of the targeted impact of mitigation methods
- Pesticide changes largely accrue through reductions in inputs on entering the OFS and some scheme options e.g. buffer strips
- Expressed as TDU's
- Baseline versus WAES

Modelling Results

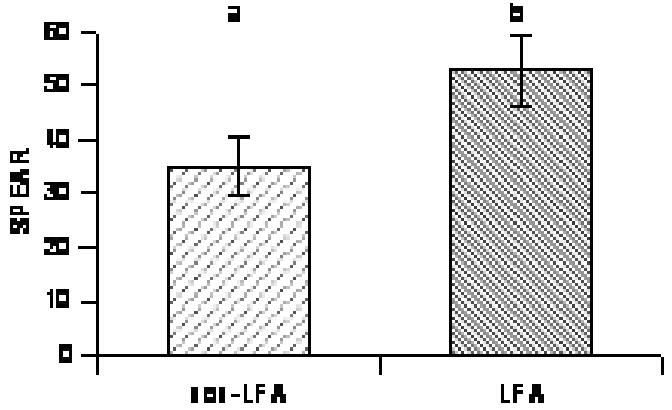


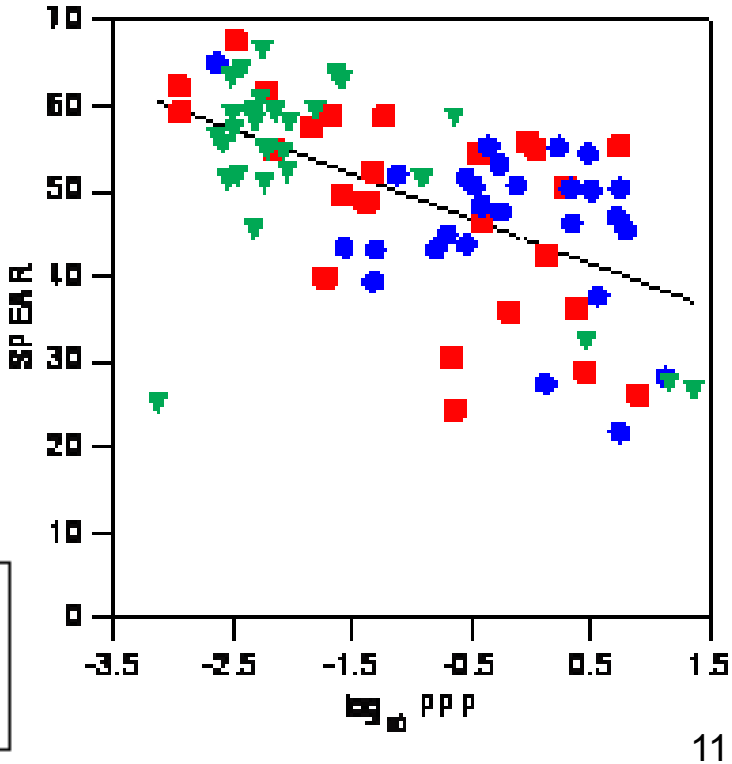




Monitoring Results

- SPEAR suggests TG and LFA less impacted by pesticides
- LEAFPACS/RIVPACS ecological quality ratios indicate only LFA less impacted
- Local factors not WAES





Water Company

- Modelling the potential for catchment mitigations to deliver improved raw water quality
- PR09 budget for catchment management
- Larger complex catchments
- Scoping study to identify likely mitigations and possible improvements in raw water quality
- Economic assessment to explore costs of implementation
- Farm practice survey conducted to identify attitudes to mitigation options, levels of compensation, pesticide usage, levels of agric. drains, …

Mitigations

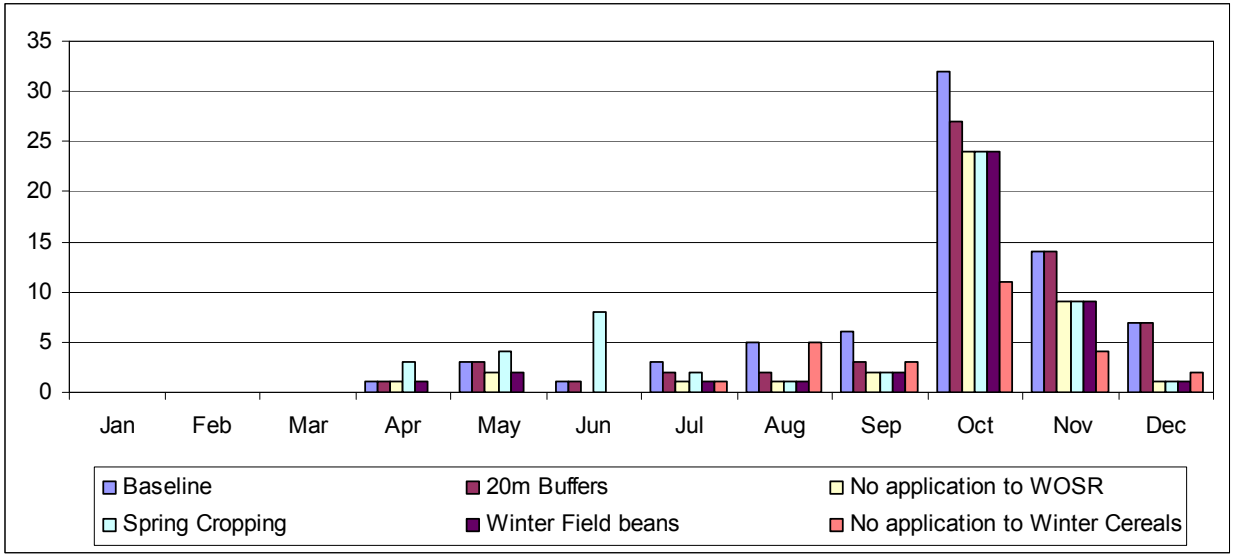
- Most likely mitigations identified – success and uptake

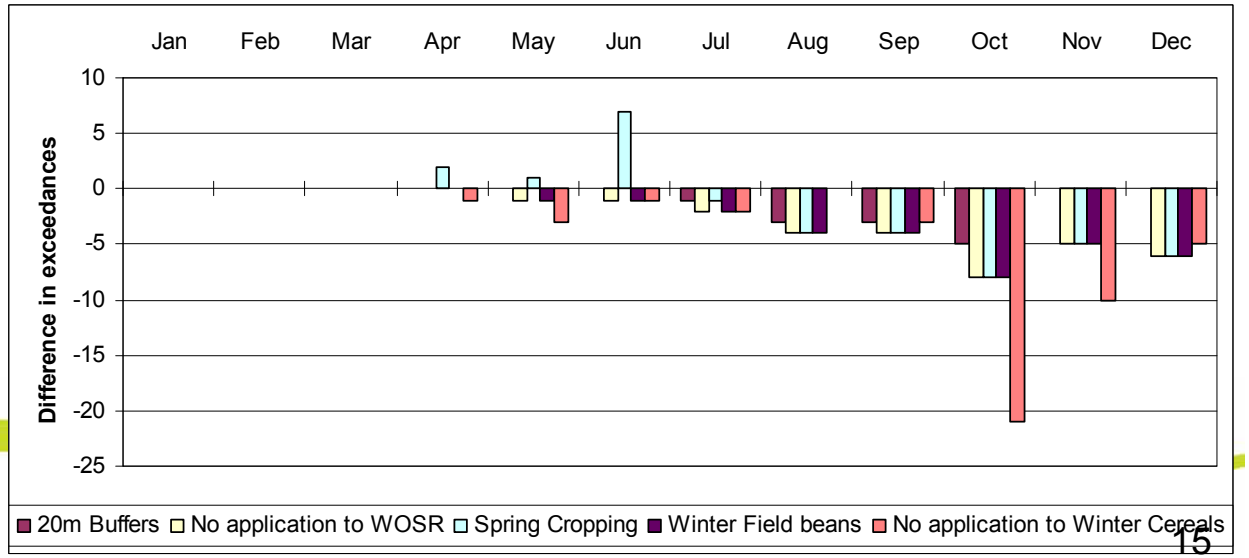
1. Implementation of buffer strips
2. Product substitution
   - All crops, WOSR, WCereals
3. Grow WFB instead of WOSR
4. Switch WOSR to SOSR

Modelling Methodology

- PRZM for surface runoff
- MACRO for drainflow
- 4 compounds (metaldehyde, propyzamide, carbetamide, clopyralid)
- 12 crops
- 13 years of abstraction/flow data
- Limited monitoring data for model evaluation

PCV Exceedances





Cost of changing practice

1. 20m buffer strips	£330K
2. Product substitution	
– All crops	£250K
– WOSR	£50K
– WCereals	£160K
3. WFB instead of WOSR	£1M
4. SOSR instead of WOSR	£1.4M

Summary

- Relative difference between baseline and mitigation modelling runs show the potential for catchment management
- None of the options solved all of the water quality issues in all of the catchments all of the time.
- In combination with operational refinements may deliver greater benefit

Real-time Operational Water Management

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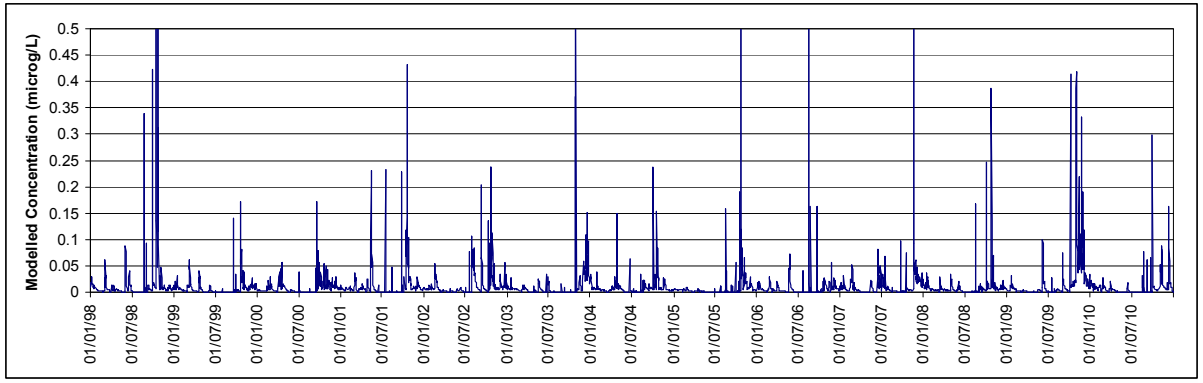
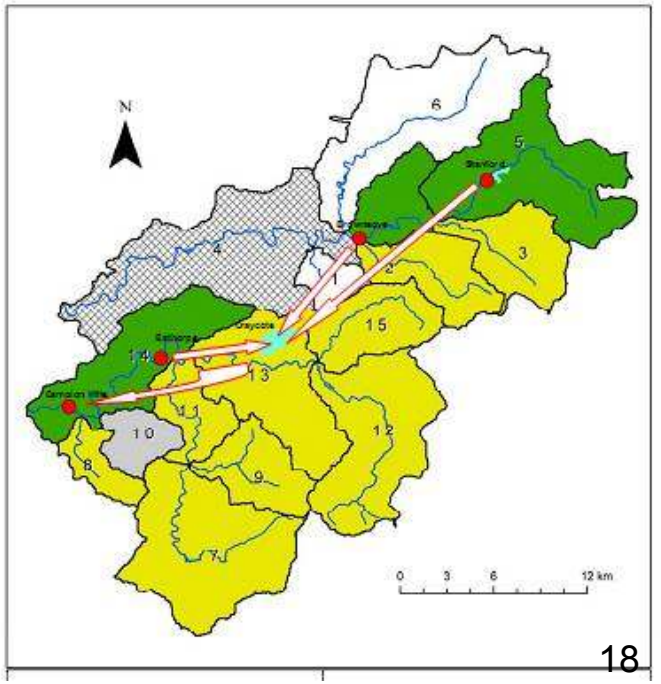
Water company catchment management programmes under PR09 and PR14

- Management and mitigation of sources
- Manage abstractions into bank side storage/reservoirs





Real-time Operational Water Management

- Online catchment portal [field scale]
- Farmers/Agronomists incentivised to input
  - Field characteristics (Precision farming…)
- Farmers/Agronomists incentivised to input
  - Proposed crops for coming season
  - Proposed crop protection plan
- Farmers incentivised to input
  - Crops drilled
- Farmers/applicators incentivised to input
  - Pesticide applications

Thank You