



The  
University  
Of  
Sheffield.



in partnership with  
Environment  
Agency

# Fitting groundwater into the landuse jigsaw

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# The hydrogeologists' perspective on groundwater

- It is:
  - (almost) everywhere 😊
  - Vital for ecosystem functioning 😊
  - Of major importance for water supply 😊
  - Dependant on landuse for recharge 😊
  - Polluted by inappropriate landuse ☹️
  - Very slow at self cleansing ☹️
  - Not recognised or understood ☹️
- Climate change will:
  - Reduce recharge ☹️
  - Increase concentrations ☹️



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# Landuse management for groundwater

Policy instrument	Statutory?	Effect
Source protection zones	No	Minor. No retrospective changes
Nitrate Vulnerable Zones	Yes	Minor, possible 7% reduction in leaching
Water Protection Zones	Yes	None, only 1 exists (Dee)
Drinking Water Protection areas	Yes	None, no actions are required
Contaminated land regime	Yes	Some contaminated sites have been remediated
Development control	Yes	Many contaminated sites have been remediated
Pollution prevention and control regime (PPC)	Yes	Unknown



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# Cutting up the jigsaw



Lerner & Zheng, 2011. Integrated catchment management: the path to enlightenment. *Hydrological Processes*,



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# Joining the jigsaw together again







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# The pieces of the jigsaw



- Water resources
- Conservation
- Agriculture
- Woodlands and forestry
- Flood risk management
- Energy infrastructure
- Residential and commercial
- Transport infrastructure
- Recreation



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# LUF: Challenges for water resources

- Population growth
- Demand growth
- Climate change
- Carbon sequestration
- Ecosystem services
- Common Agricultural Policy
- Urbanisation



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# LUF: Policy options for water

## Resources

- Disincentivising evapotranspiration
- Encouraging infiltration
- Catchment Sensitive Farming
- Technologies to reduce crop water use
- Natural water storage

## Quality



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# LUF: Overall water policy options

- Better integration
- Consider water availability in development
- Price water scarcity
- Best available strategies
  - eg governance of surface and groundwater resources
- Technological solutions
  - eg re-use, recycling
- **Suggested priorities**
  - Factor water resources into decision making
  - Plan to reverse aquifer degradation



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# LUF: Achieving sustainable land use

- Full value of land in decision-making
- Value is consistently assessed
- Align private incentives with social objectives
- Promote multifunctional land use
- Combine regulatory, institutional and economic mechanisms
- **But how?**



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Hardin, 1968. *Science*, 162, 1243

W F Lloyd, 1833. Two lectures on checks to population. OUP.

# THE TRAGEDY OF THE COMMONS



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# Voluntary control on commons

Variables	When it works
Size of resource system	Moderate size, bounded
Productivity of system	Scarcity but not exhausted
Predictability	Able to see consequences
Mobility of resources	It mustn't run away
Number of users	Transaction costs versus available resources
Leadership	Influential elders or graduates
Social capital	Shared moral and ethical standards
Knowledge	Shared knowledge
Importance of resource to users	Must be high
Collective-choice rules	?



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Draft National Planning Policy Framework

## **The presumption in favour of sustainable development**

**... Planning must operate to  
encourage growth and not  
act as an impediment.**

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