Current and future challenges for catchment management

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The James Hutton Institute

Acknowledgements: Marc Stutter, Mark Wilkinson, Steve Addy, Leah Jackson-Blake, James Sample, Susan Cooksley, Scottish Government RESAS

REFRESH

Talk outline

- Drivers behind catchment science today
- Unresolved issues and new challenges
- Case studies: connecting research and practice in the CNP and surrounding area

Drivers of catchment science

- Water *systems* thinking
- Environmental change
- Societal and policy goals
- Unresolved issues
- New challenges

What's in the future?

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Low river flows

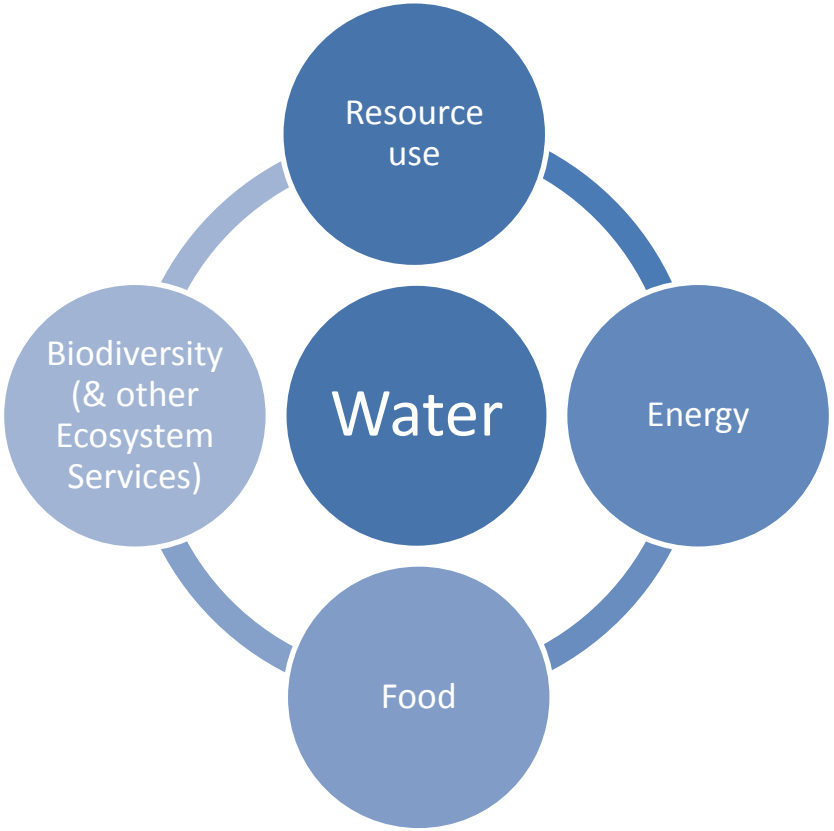
Flooding

Soil degradation: erosion and pollutant mobilisation

Increasing competition for space for multiple goals

Water *at the centre of some big challenges*

- Water quality and ecology
- Water quantity, floods and irrigation
- Maintaining aquatic and riparian habitats
- Linkages between managed and natural water cycles
- Linkages between water and energy



Multiple policies : multiple objectives

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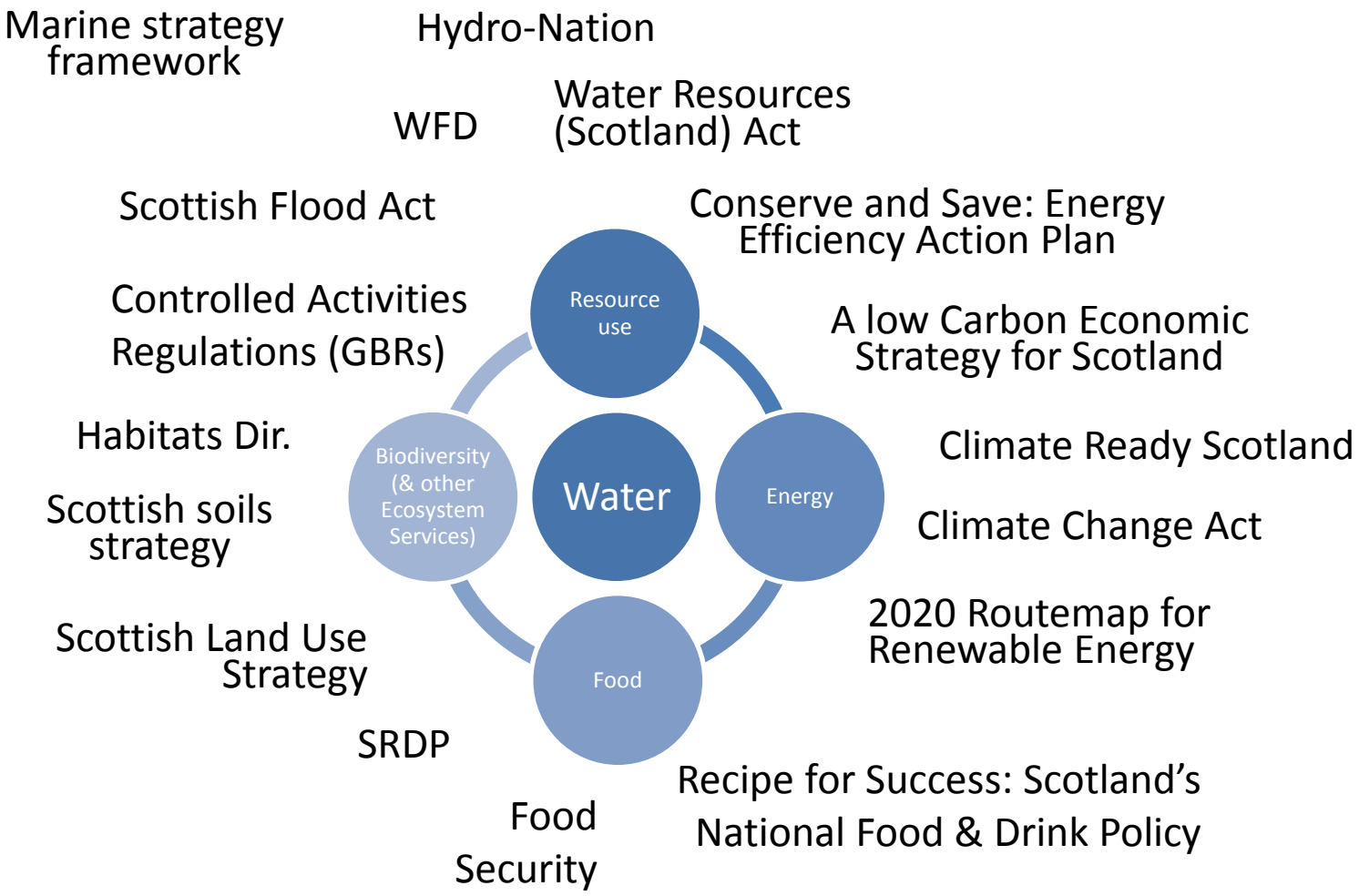

Unresolved issues and new challenges

- Maintaining water quality as part of a sustainable intensification of agricultural
- Improving river and riparian habitat
- Managing water in the landscapes and easing flooding problems

Unsolved issues and new directions of challenges

- Maintaining water quality as part of a sustainable intensification of agricultural
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Case study 1: Mitigation & effectiveness (Phosphorus)

- WFD targets: 'Good Ecological Status' by 2027
- Lots of money spent but how effective are the measures to reduce phosphorus in rivers?
- Acknowledgement: Leah Jackson-Blake

P mitigation decisions

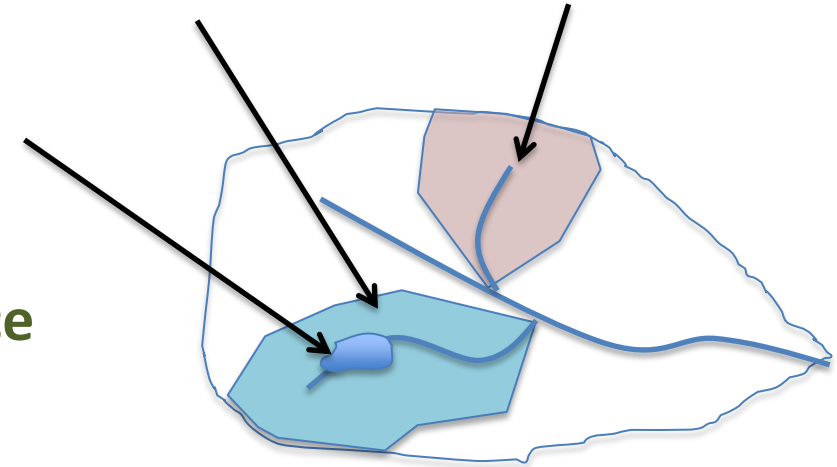
Key decisions to make:

What's more cost-effective in the longer term for reducing stream phosphorus?

Reduce soil P status here?

A 10m buffer strip here?

A wetland here?



A wetland and source control measures?

If the whole catchment is generating runoff then can we seek pollutant attenuation in a small area?

How can process-based modelling help?

- Where should measures be targeted?
- Explore timescales/lags
- Explore possible future scenarios (management, land use, climate)
- Reveal trade-offs, uncertainties and sensitivities

Help make better informed decisions

What measures are most effective at reducing the loss of phosphorus to rivers?

Leah Jackson-Blake

Cells where the percent change was greater than 5% have been highlighted

BroadID	Description	Detailed description	Mean stream [SRP] (mg P/l)	Mean stream SRP load (kg P/yr)	Stream [SRP] reduction (%)	SRP load reduction (%)
Baseline	Baseline	LCM 2007; 2010 fertilizer inputs; climate 1981-2010	0.0234	344.4	N/A	N/A
M1	Convert arable to grassland	20% arable to rough grazing	0.0224	323.0	4.3	6.2
		50% arable to rough grazing	0.0209	291.0	10.8	15.5
		100% arable to rough grazing	0.0184	237.7	21.2	31.0
		20% improved grass to rough grazing	0.0223	321.8	4.6	6.6
		50% improved grass to rough grazing	0.0207	288.0	11.5	16.4
		100% improved grass to rough grazing	0.0181	231.9	22.7	32.7
		100% agricultural land (improved grass and arable) to rough grazing	0.0131	125.5	44.0	63.5

Unresolved issues and new challenges

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Case study 2: Logie Burn meander reconnection project: assessing the multiple benefits of river restoration

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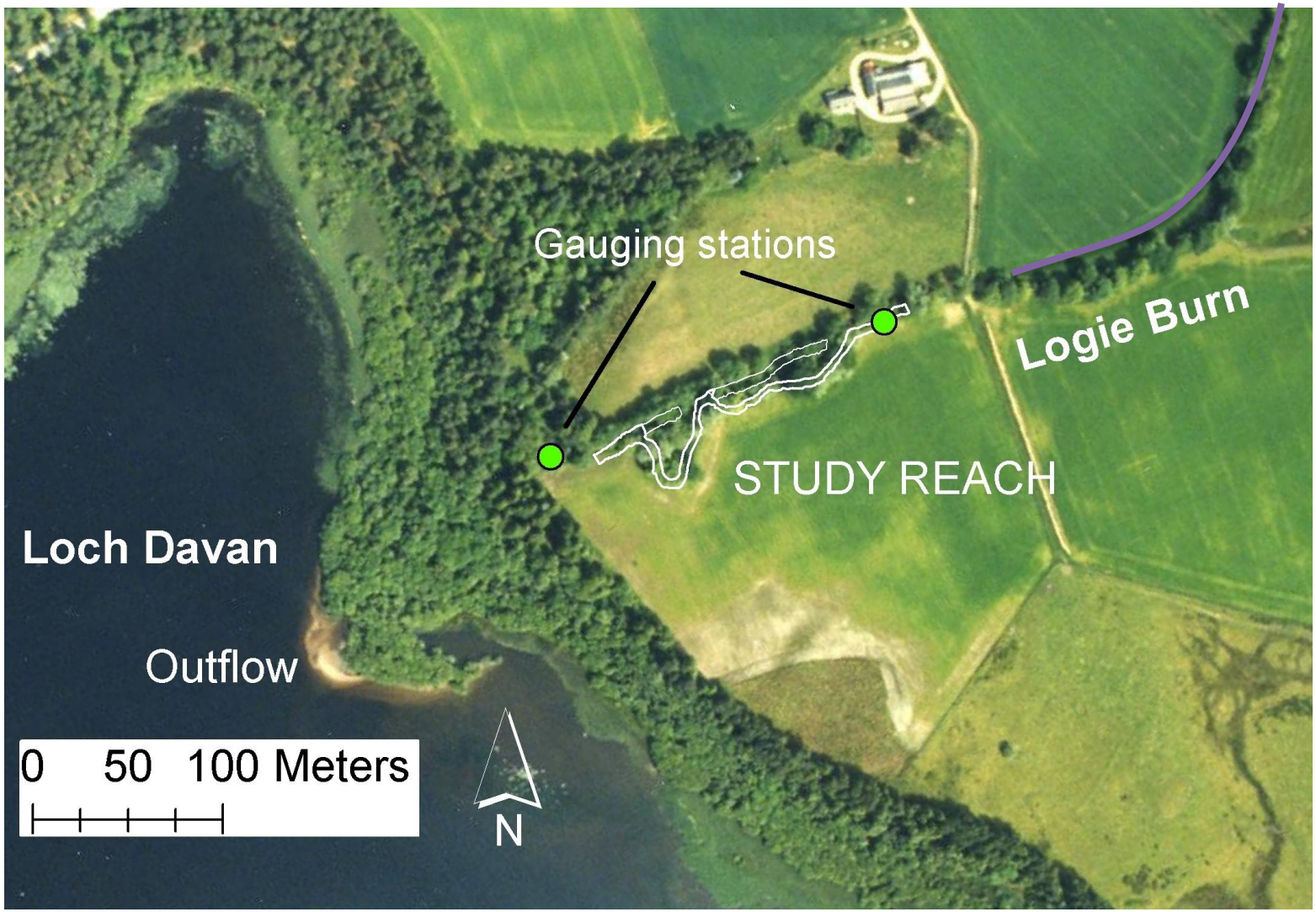
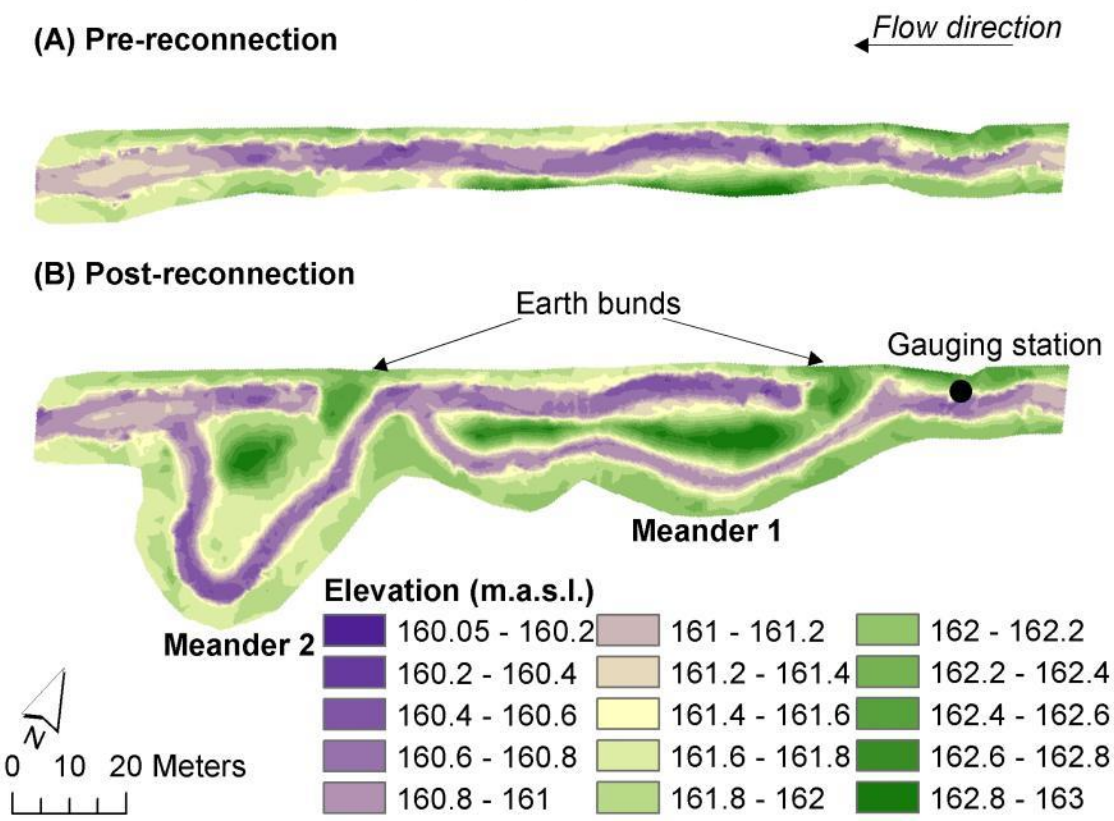


Acknowledgement Steve Addy

Logie Burn remeandering

Changes to channel morphology



Pre-reconnection (2011)

Post-reconnection (2012)

Monitoring of morphology, bed sediments, phosphorus retention, habitats and flows in a degraded agricultural stream since 2011.

Modelling maximum river temperature and ecological response to land use and climate change in the Gairn catchment, Invercauld Estate

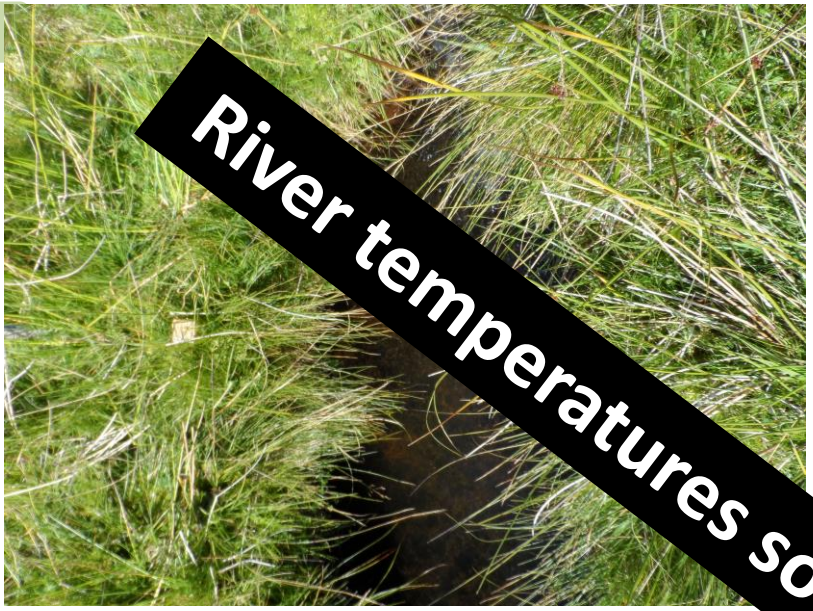
Rachel Helliwell[1], James Sample[1], Jackie Potts[2], Markus Hrachowitz[3], Gabrielle Mawby[1], Mariya Pavlova[1]

[1]The James Hutton Institute, [2]Biomathematic and Statistics Scotland, [3]Delft University of Technology (TU Delft)

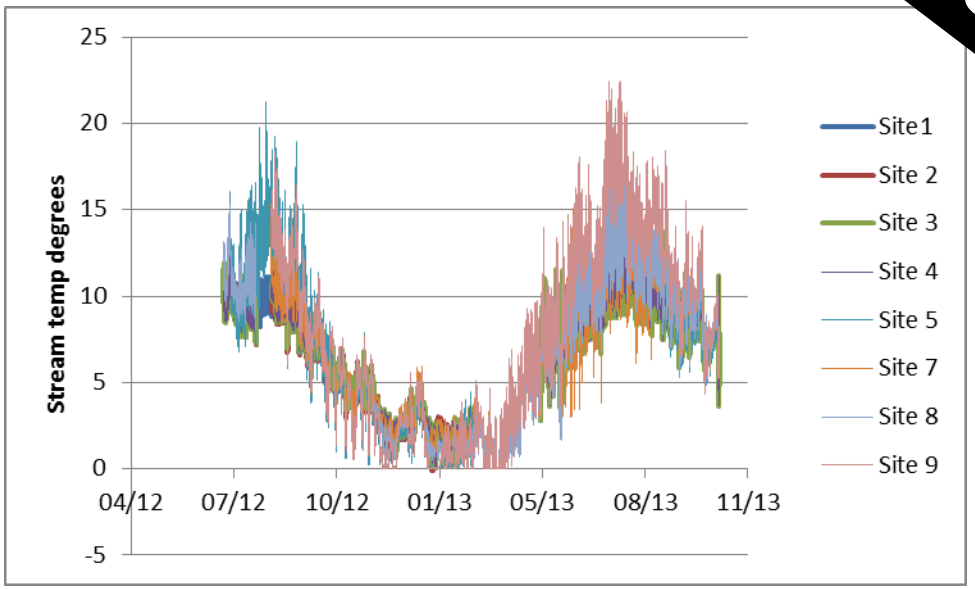
Objectives

1. Identify the catchment characteristics that control stream temperature
2. Use different scenarios to explore the possible effects of riparian land use and climate change on mean maximum stream temperature and their associated implications for salmonids

Riparian planting in the Gairn catchment (EU LIFE project)



River temperatures soared to 27˚C in 2014



Monitoring:

- Stream temp measured @ 9 sites in the Gairn catchment
- June 2012 – October 2013
- 15 min intervals

Ecological thresholds:

- Maximum daily summer temperatures broaching lethal threshold for salmonids (24.7˚C Trout & 27.5˚C Salmon)

Clim s:

- 1.8 SRES A1B emission scenario
- 4˚C increase

Land use :

- Woodland Expansion Advisory Group
- 4 SRES scenarios (WM, NE, GS)
- EU LIFE

Unresolved issues and new challenges

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A loss of water holding capacity in our landscapes

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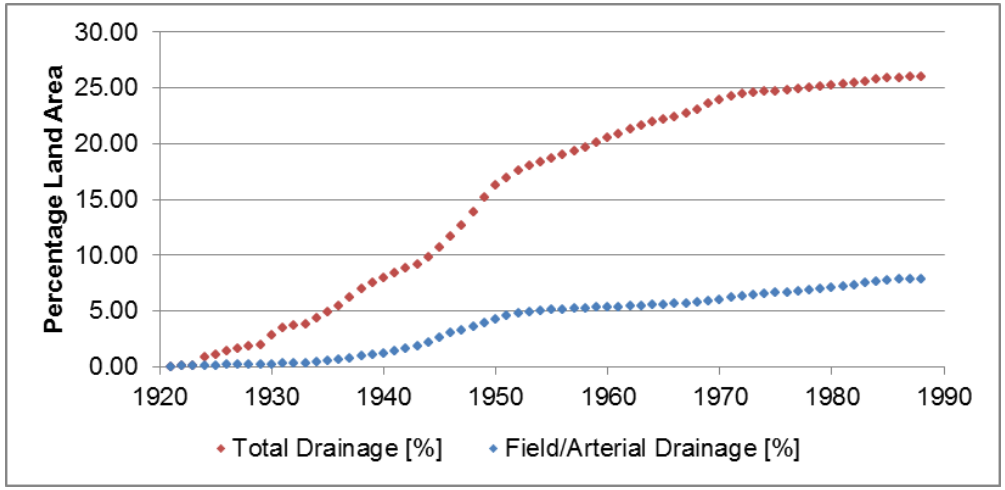
- Water moves faster through drainage systems as they have been "improved“ increasing peak flow
- Moving water off land faster is seen as better (e.g. by farmers and developers), but the water has to go somewhere
- There are implications for:
  - Sediment dynamics
  - Ecological habitat, both physical and chemical
  - Flood response speed
  - Riparian connectivity



Cumulative drained land in Scotland according to drainage grants (1921-88) – Lilly et al. (2012) Report on drainage & GHG abatement in Scotland. ClimateXChange.

Vision for Natural Flood Management:

Promote rural and urban landscapes with space to store water and slow down the progress of floods

Vision for Holding Water:

Coupled rural headwaters and more populated areas giving space for structures and other measures to slow, store and filter water on the recognition and value of a wide range of benefits

Acknowledgement: Mark Wilkinson, Paul Quinn


Slow, store and filter

Holding water – a common approach?

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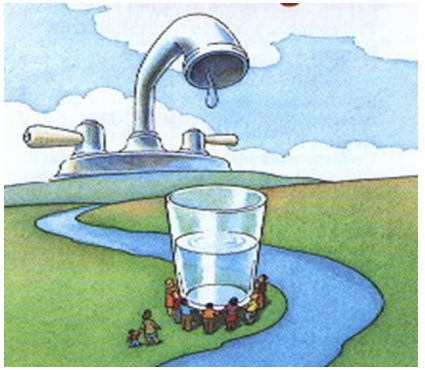
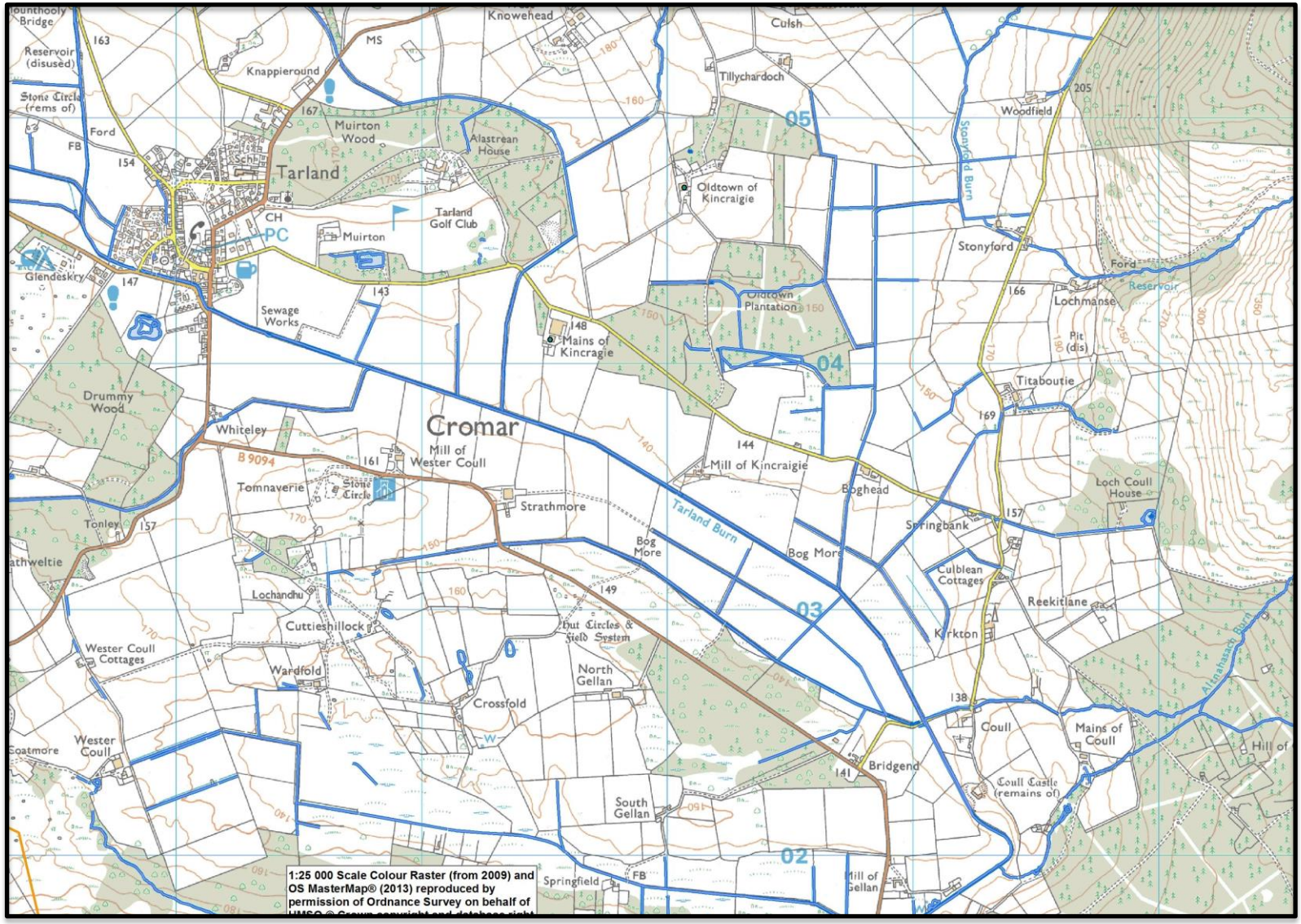
Application to many problem solving activities

- Buffering high flows…..and low flows
- Reducing soil loss, and coupled to soil measures, increasing soil biodiversity and nutrient attenuation
- Improving drinking water quality and quantity
- A role in small scale energy generation?

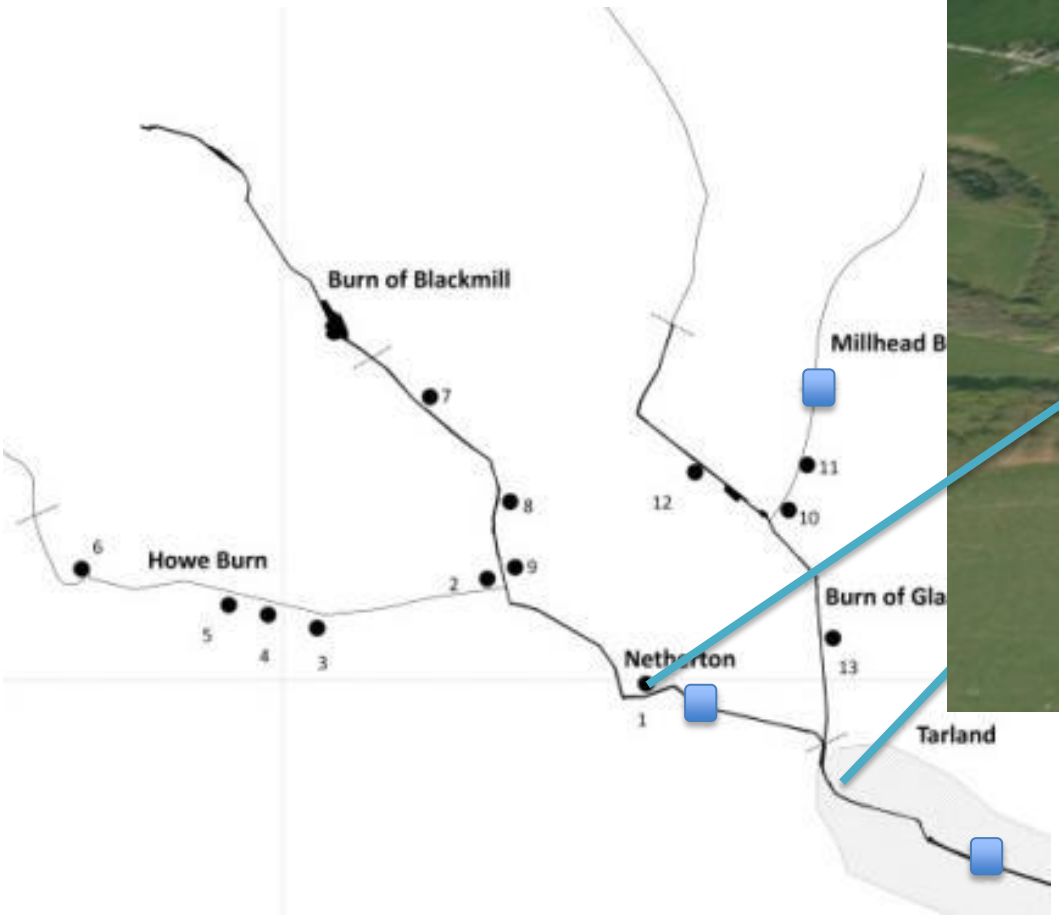


Tarland: 2011



Prediction at the sub-catchment scale

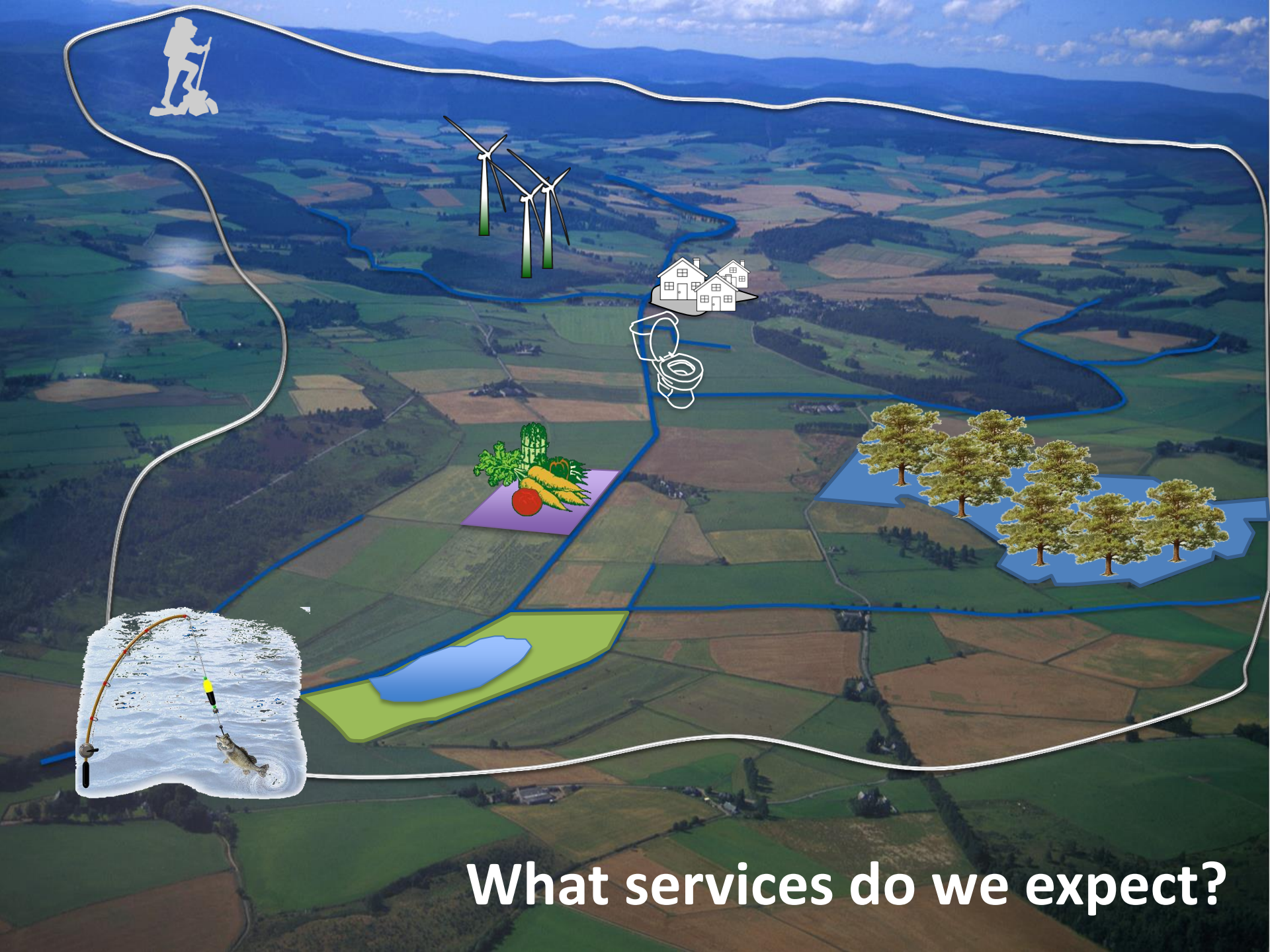
- Modelling (coupled 1D and 2D hydrodynamic model) and visualisation tools to demonstrate catchment scale impact (Tarland – 25km^2)

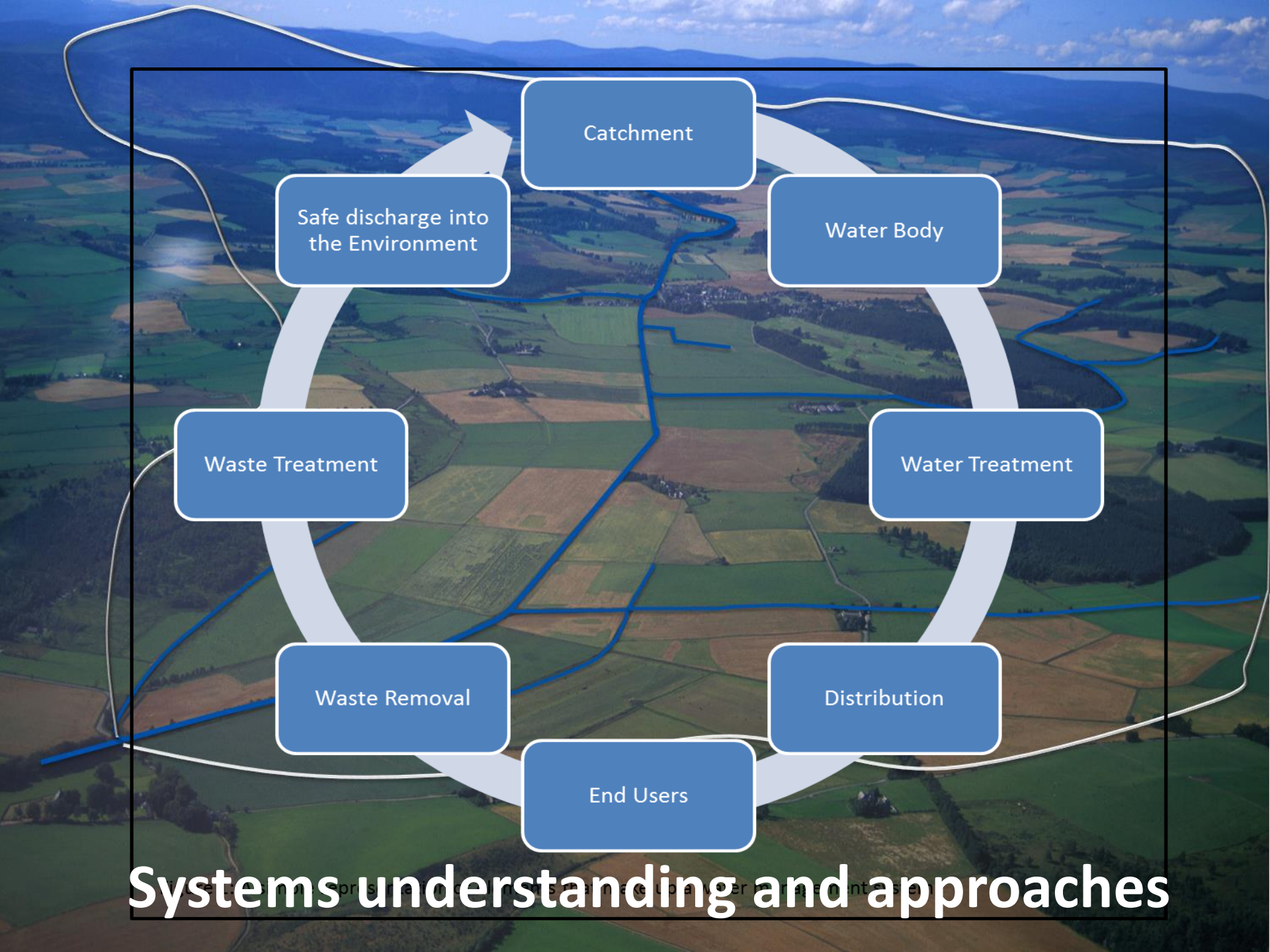


Discharge monitoring

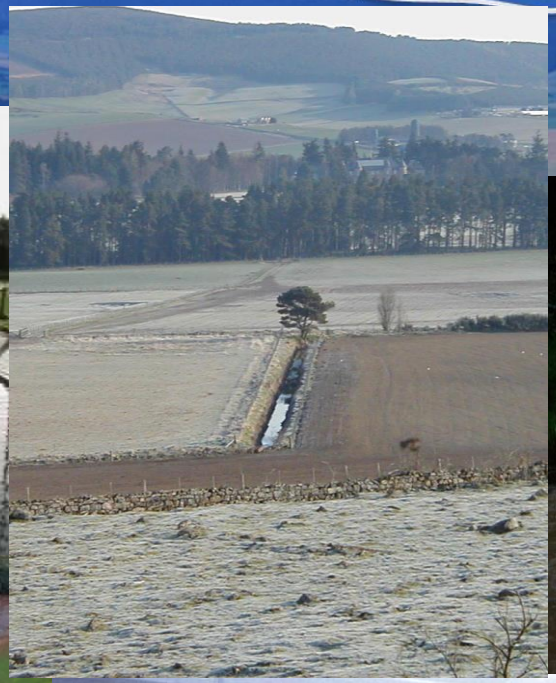
- Preliminary results: network of ponds (4,000m^3-6,000m^3) attenuate flows by as much as ~12% (1 in 2 year design event).


Pathways to *catchment management in the future….*?

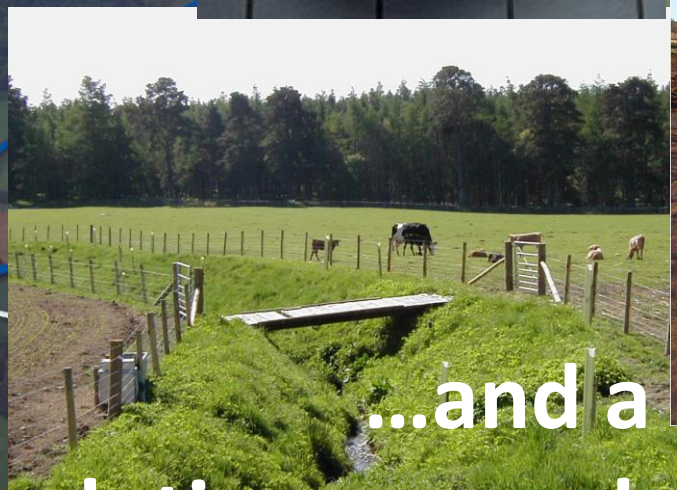

What services do we expect?



Systems understanding and approaches



Comprehension of the problems.....



…and a proactive approach for solutions……evaluation…and refinement

EPA United States Environmental Protection Agency

How to Dispose of Medicines Properly

DON'T: Flush expired or unwanted prescription and over-the-counter drugs down the toilet or drain unless the label or accompanying patient information specifically instructs you to do so.

DO: Return unwanted or expired prescription and over-the-counter drugs to a drug take-back program or follow the steps for household disposal below.

1ST CHOICE: DRUG TAKE-BACK EVENTS

To dispose of prescription and over-the-counter drugs, call your city or county government's household trash and recycling service and ask if a drug take-back program is available in your community. Some counties hold household hazardous waste collection days, where prescription and over-the-counter drugs are accepted at a central location for proper disposal.

Courtesy Upper Valley Voices and Appalachian Voices

Drug Take-Back Event

2ND CHOICE: HOUSEHOLD DISPOSAL STEPS*

1. Take your prescription drugs out of their original containers.

2. Mix drugs with an undesirable substance, such as cat litter or used coffee grou

3. Put the mixture into a disposable container with a lid, such as an empty marg tub, or into a sealable bag.

4. Conceal or remove any personal information, including Rx number, on the containers by covering it with permanent marker or duct tape, or by scrat

5. The sealed container with the drug mixture, and the empty drug contain be placed in the trash.

* Drug Disposal Guidelines, Office of National Drug Control Policy, October 2009

DOs and DON'Ts

Tips to keep your tank in working order, reduce the number of times it has to be emptied, protect the environment and save you money!

- ✓ **Find your septic tank, the soakaway and where it discharges.**
- ✓ **Check all parts of your septic system regularly.**
- ✓ **Ensure access lids are secure and in good working order.**
- ✓ **Have your tank emptied when necessary.**
- ✓ **Only use disinfectant and toilet cleaner labelled 'suitable for septic tanks' to avoid upsetting the bacterial balance of your tank.**
- ✓ **Always use household cleaning products labelled 'environmentally friendly' or 'low phosphate'** - *or try natural cleaning products such as bicarbonate of soda, vinegar or lemon juice, they are cheap, effective and environmentally friendly.*
- ✓ **Use household cleaning products in moderate amounts** - *try using less detergent in your washing machine and dishwasher.*
- ✓ **Try to use less water** - *space out laundry/dishwasher loads to avoid lots of water washing through the system at once.*
- ✓ **Use a sink strainer as food scraps cause sludge to build up more quickly** - *put them in your compost bin or green cone.*

- × **Never flush anything other than human waste and toilet paper down the toilet** - *everything else should be bagged and binned.*
- × **Never dispose of grease or cooking oil down any drain** – *wipe out pans, pour fat into a container and put it in a bin.*
- × **Never put paints, solvents or any chemicals down any drain** - *dispose of them at a civic amenity site*
- × **Don't use caustic soda or drain cleaners to clear blockages** - *try boiling water instead.*
- × **Never connect rainwater drainage pipes into your septic tank.**

Encourage everyone using your tank to follow this advice!

USEFUL CONTACTS

FREE INFORMATION AND ADVICE
Aberdeen City Council
01224 522168

Aberdeenshire Council
0845 608 1207
environmental@aberdeenshire.gov.uk

Scottish Environment Protection Agency
0800 80 70 60
www.sepa.org.uk/water/water_publications.aspx

REGISTERING YOUR TANK
Scottish Environment Protection Agency
0800 80 70 60
www.sepa.org.uk/wfdreg

EMPTYING AND OTHER SERVICES
Look in the Yellow Pages under:
- Septic Tanks
- Drain and Pipe Cleaning
- Plumbers
- Sewage Consultants

www.theriverdee.org

The Dee Catchment Partnership is a voluntary association of agencies, organisations and individuals working together to ensure the long-term, sustainable management of the River Dee catchment.

THE SEPTIC TANK GUIDE

dee catchment partnership

A neglected septic tank is a health risk for you and your family and causes harm to the environment.

Regular maintenance is essential to keep your system safe and working properly.

Encourage everyone in your household to follow the advice in this leaflet!

Happy tanks say thanks!

Make friends with your septic tank!

.....plus community involvement

Thank you

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http://www.hutton.ac.uk/research/themes/managing-catchments-and-coasts