

Catchment for Water Forum



Workshop 1 - Summary

Thank you everyone who attended the workshop on 1st July, it was a highly successful day - fantastic to see everyone so engaged and interacting.

Thanks also to people who have contributed to the process via email before the workshop, and to those of you who have been in touch with more information following the workshop.

We have gathered a lot of information so far in this project and here we summarise these contributions in a brief note for your information.

NEXT STEPS...

1. Please review the key questions raised by each user group.
2. Please would you let us know if you do not agree with any of the points raised, if you feel there are any major gaps or generally if you have anything further to add after reflecting on these notes. The deadline for feedback on these summary notes is 15th August.
3. Our next steps within the consortium will be to condense these questions and points raised so far into a few key questions / theme areas to investigate further between now and October.
4. In the meantime, **we need your help to identify key datasets and models that could be used to answer some of these questions.** We will then be able to investigate the potential for getting them included within this framework. If you have any suggestions of datasets and models that could be applied to answer some of the key questions, or specific case study examples of where they have been put to use, please would you email catchmentforwater@gmail.com with the details by 15th August.

We look forward to updating you with progress over the summer.



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Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL



The James Hutton Institute



University of Reading

Introduction

This project aims to improve the access to and integration between data and models that help address the key questions in catchment management for water quality and wider ecosystem services. Identifying what these challenges are is a key first step for the project.

- The aim of the day was to introduce the project and get a common understanding of the drivers, direction and outcomes of the work.
- The scope of the project is limited to catchment management activities for water quality, but including the co-benefits and trade-offs for wider ecosystem services.
- The key focus of this workshop was to discuss the main catchment challenges and questions that need answering through the outcomes of this project.

Introductory presentations were given from the funders, on the project, on the background to the models currently available and on the initial long list of key questions from initial discussions with policy makers, regulators, the water industry, implementers and researchers.

Summary of the key points raised during the Forum introductory session:

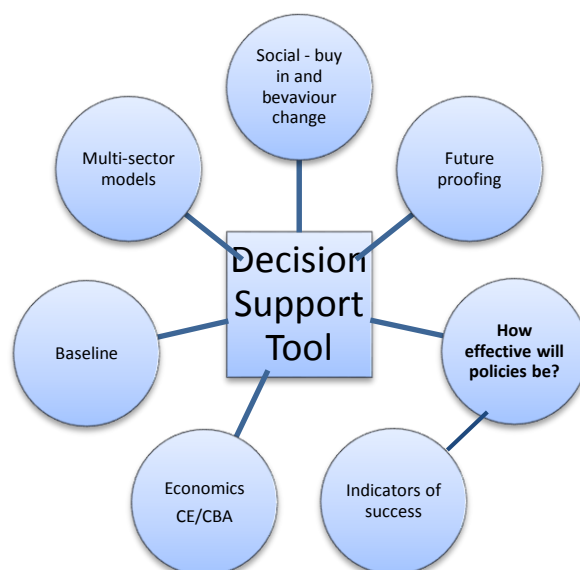
- This is not about new models, it's about making modelling capability available and more transparent - the enhancement of the collation, integration and presentation of the evidence base so people can see and understand why decisions are being made.
- The other idea of this project is also to translate what is developed in the research community and make these readily available – transfer of the knowledge between research and users
- Who are the models for – who are the decision makers? With Catchment Based Approach the decision maker audience is broader than it used to be. The remaining challenges are about behaviour and therefore the solution is about dealing with these issues in the proper social context. Water management has a big social construct; we need to take the people with us. Catchment management is now very local and involves people who live in the catchment and we need to be able to engage on the right level. People are key– it is behaviour change that will improve water quality. Links need to be made to the catchment approach and models need to be transparent and robust enough to start engagement and engender trust
- From a water industry perspective, regulators need to be fully engaged. Our understanding of the problems and solutions needs to be sufficiently robust (as in formed by models and or data) such that if necessary, we can challenge Europe better on timelines for implementation - it's better to do the right thing, late, rather than the wrong thing on time. We need this project to help make progress about communicating which models need to be used.
- Clear advice and guidance is needed to accompany models so that people can carefully communicate the limitations of models
- A plea from the audience on data sharing and availability – this aspect is fundamental and hopefully this is going to be resolved through this process. Data is such a problem in terms of making outputs available to end users.
- The focus is on water quality, but should not forget water quantity and flows alongside this as this is important to understand pollutants at a catchment level and also impacts of low flows on water quality.
- Levels of confidence in model results – Water Companies need to take decisions about spending bill payer money on catchment management and in doing so can affect farmers/land manager's livelihoods, so it's vital to demonstrate confidence in models. So this isn't just about who is the user in this framework but also who is the audience of those users.
- Scotland and Northern Ireland have challenges that aren't always seen elsewhere – e.g. with issues with colour in Scotland. Northern Ireland also has an interest in source apportionment in lakes and effectiveness of measures.
- This framework should not forget the near-shore – e.g. bathing waters and warning systems
- Analytical and visualisation tools need to be written in open source code and shouldn't be locked into this framework – they are usable from elsewhere so they can be integrated into other visualisation tools and frameworks and made use in the widest possible sense.

Summaries of the key points raised in the afternoon sessions are set out in the following sections.

Workshop group 1: National

The key points for the National group are listed below:

1. **Decision Support Tool** – Multi-sector/pressure/response with (or that can link to) cost-benefit/cost-effectiveness for appraising policy options. Needs to be spatially explicit and incorporate social models/behaviour change. ‘Where do I get most bang for buck’ - Scenarios
 - a. Criteria (including social and legal) need to be agreed up front for model acceptability
 - b. Baseline and temporal contingencies (i.e. incorporation of external factors) are a critical component e.g. links to WFD no deterioration requirement
 - c. Need buy-in from audience at different levels/scales – how? What does Good Ecological Status mean in terms of recreation? Investment in achieving moderate status is likely to have greater benefits than getting to good.
2. **How wrong would we be?** Using different data sets e.g. agricultural census versus farm specific data or using real-time stream sensors versus grab samples **not** in terms of estimated load etc but in terms of the need and type of intervention
3. **Other questions included (and may well be part of 1)**
 - a. Source apportionment within the agricultural sector is needed
 - b. Other pressures including urban and morphology will need to be included
 - c. Morphology is a major pressure – can models help e.g. predict link to ecology?
 - d. Land use and management change beyond agriculture e.g. forestry
4. **When will my policy be successful?** Links to the Decision Support Tool above
5. **How will we know it has been successful?** Need outcome indicators to show direction of travel as well as modelled prediction. Need to understand why there are deviations from modelled prediction.
6. **Future proofing** – climate change and other impacts
7. **Other issues**
 - a. Social and economics important – optimising uptake
 - b. Catchment scale useful for optimising uptake – then upscale. What is the level of uptake required? And where?
 - c. Source apportionment and ecological impacts
 - d. Time lags
 - e. Link models to monitoring
 - f. Link local and national models
 - g. Multiple outcomes
 - h. A need to monitor and evaluate past policies and appreciate ongoing impact on today’s signal



Summary of key questions raised by the group previously through discussions / feedback (national group)

- **What models exist and what do they tell us?** How robust are they and well do they represent real life (are they well calibrated?) and what are the limitations of applying the model to specific circumstances
- **Are there missing measures from the first RBMP? Effectiveness of measures & certainty in outcomes** w.r.t. WFD classes? What sources of diffuse pollution are not covered by current measures? And do we have tools for source apportionment? Should source apportionment of nutrients also be based on ecological impact rather than just contribution to loads?
- **Morphology is a significant pressure.** Can models help with the link to ecology and response to measures?
- **Drinking water** - How effective is catchment management at improving water quality and maintaining water supply? Can we detect long term changes in raw water quality?
- **Climate and land use change** – impacts on effect of measure?
- **Combined impact of multiple pressures, biological response and effect of multiple measures**
- **Impact of specific policy mechanisms** – mileage in existing policy e.g. baseline, incentives, NELMS etc – how far will existing policy mechanisms get us and what more is needed to reach our targets?
- **Cost of reaching our targets and how this falls to different sectors?**
- **Scaling up** from field → catchment → national (scientific knowledge as well as economics) and is it appropriate to use these tools to do so or do we lose too much information in this process?
- **Synergies** across policies and measures; are there win-wins for biodiversity, soil, flood risk, climate change etc policy areas by implementing specific measures / mechanisms.
- **Tradeoffs** - How to trade off one outcome e.g. biodiversity, when optimising for another e.g. WQ – are there datasets and models out there that could inform a model that seeks to quantify the level of synergy that could be delivered by options? And to what degree is the level of environmental outcome achieved compromised when trying to deliver multiple benefits?
- **Costs and benefits of measures that incorporate a full range of Ecosystem Services**
- **Decision support tool** – combining model outputs for science and economics into decision making tool that visualises and communicates the weight of evidence used in decision making.
- **Tool to conceptualise and explain the key issues and bring stakeholders into the process:** working to a common understanding of the issues and what to do about them
- **Account for ecosystem services** and natural capital in a standard and understandable way
- **Social aspects of measures uptake** – what makes people choose measures? How can we motivate people to select the right measures? How can we spatially target certain mechanisms and justify doing so?
- **Improve reliance on actual data of evidence** rather than just modelled data e.g. event based data and Demonstration Test Catchment datasets
- **Greater clarity on what is in the modelled diffuse component**
- **Better link to activity** causing the issue when it comes to diffuse, not just sector
- **What biogeochemical processes are going on** in the catchment that might look like “diffuse” pollution?
- How to move away from concentration based limits to ecological based limits
- How long does ecology take to respond?
- How will climate change affect the baseline for “good status”

Workshop group 2: Catchment (Regulators)

Synopsis:

The question posed within the group was: what do we need to understand in order to progress catchment management and planning at a catchment level? The detail of the questions is given in the table below, however it was agreed at the end of the session that the top 6 questions / theme areas for prioritising were:

- Priority 1:**
1. Integrated Management Planning and role of models to influence behaviour
 2. Modelling future pressures – impact on objectives (e.g. what are realistic objectives given future pressures e.g. agricultural intensification or climate change)
 3. Improved modelling of socio economic consequences and drivers
- Priority 2:**
4. Source apportionment availability and model outputs that breakdown to seasonal / activity level, not just sector / system snapshot.
 5. Common consensus on what measures will deliver – including ability to target specific parameters / objectives / ESS etc.
 6. Multifunctional benefits / synergies /ecosystem services

Other headlines: The wider questions that were raised during the workshop session are set out below.

Theme	Specific question raised within the group discussion
Future pressures and extrapolation of impacts	Impact of the future on WQ – e.g. agricultural intensification and climate change
Effectiveness of measures / mechanisms	How effective is the current programme and how far will it get us? The difference between implementation in full and the reality of implementation (“messiness” factor) Scenario modelling of effectiveness of measures: Planning timeframe scenarios need to be modelled to show land management measures longevity for example – what will the effect be in 5 yrs compared with 25 years. Scenario modelling needs to let us understand how fast, how far and how effective we need to be.
Source apportionment	Source apportionment – need this to be available and we need a way of modelling not just sector responsible but activities within that sector. Also needed not just spatially but also temporally and how the apportionment changes under different flow and weather conditions.
Socio-economics	Economics data is normally top-down coming from a national dataset, however when planning at a catchment level it is more appropriate to use local economics information and upscale; in this way, stakeholders can see that local level economic considerations are taken into account in catchment planning rather than standard-national level data. Need scenario modelling of sector financial impacts – not just agricultural sector but all sectors contributing
Evidence of outcome	Monitoring data and visualisation just as important as modelling. Examples of how models have led to action and outcomes. Need to capture actual data on effectiveness of measures as this then reinforces model outputs when convincing farmers who often distrust models until verified by data. CHANGE – need these models to map change to reflect implementation of measures and progress
Uncertainty, confidence and communication	There are issues around confidence of models and underlying data and we need to be able to communicate confidence in a way that convinces stakeholders that the model may not be perfect, but it’s good enough. Cost benefits need to be couched in terms of ranges rather than absolute.
Ecosystem Services	Use of ecosystem services to translate model outputs
Contextualisation of the problem and solution	Outputs of models need to be couched in a way that reaches individual stakeholders – e.g. for the farming industry the currency of discussion needs to be profitability, not necessarily Kg phosphate / year for example. Costs and benefits are difficult to measure and express in a common currency across

	sectors but if we're going to get shared ownership of the problem and solutions at a catchment level this needs to happen.
Inclusion of local catchment characteristics, objectives and data	We need a national level framework in terms of core datasets and models to use in catchment planning, but with the ability to combine local level data and thereby improve the weight of evidence to achieve local persuasion. Models need to be able to be adjusted in terms of input data to fit specific catchments – e.g. take account of actual numbers of cows, % dairy etc so that planning can happen on a catchment –specific basis rather than a “standard” farm type e.g. how FARMSCOPER works
	Policy area priorities need to be set at a local scale – e.g. bankside grazing exclusion to protect water quality can jeopardise certain biodiversity objectives e.g. for vegetation management for damselfly. Local and site specific priorities need to be captured and considered when picking suitable measures
Integration / focus / scaling	Need the ability to have multi objective models and integration but not lose the resolution of single focus where there may be a localised and specific issue. Integration of models across different water categories – especially important e.g. bathing waters and near shore issues where for example Faecal Indicator Organisms are an issue and the source (and controls) are further up the catchment.
	Tools need to be multifunctional to allow the wide array of catchment stakeholders to come together and engage, rather than sector specific. A shared understanding of the problem and a shared evidence base of the potential solutions for discussions to go ahead.

Summary of key questions raised by this group previously through discussions / feedback (catchment planner / regulator group)

- Understanding combined impacts of multiple pressures and multiple measures
- Costs and benefits of measures that incorporate a full range of ecosystem services including benefits for water treatment and water industry
- Link between land use activity and ecological water quality on a catchment specific basis
- Source apportionment – ecologically based?
- Decision support tools -scale and nature of interventions required?
- Scaling up and down
- Prioritisation →decision basis
- Targeting measures on a catchment/site specific basis?
- Taking account of uncertainty in ecological outcomes
- Course and fine sediment dynamics
- Urban diffuse pollution - toxics
- Can we demonstrate the link between land use activity and ecological water quality on a catchment specific basis?
- Understanding of ecological response times in general and ecological benefit
- Relationship between hydromorphological functioning and GES
- Cost/Effectiveness of diffuse pollution measures at a catchment scale rather than a site specific scale
- Need to understand the C/B of measures in the context of wider ecosystem services
- Not just spatial but temporal detail – e.g. a failure of EQS in summer will need a different remedy compared with a failure in winter, yet we use annual averages most of the time.
- On what basis should we prioritise catchments for the protection of aquatic ecosystems?
- How can we target mitigation measures on a catchment/site specific basis?
- How can we resolve the challenges between the need for the targeting of mitigation measures and the difficulties in implementing and administering a targeted approach?
- Can we evaluate the resilience of aquatic ecosystems and the probability of recovery?
- How can uncertainty in ecological outcomes be incorporated in decision making processes?
- We can predict climatic trends, but this may not accurately reflect localised or extreme weather events which would increase risks to water quality. This uncertainty gives more of a focus on the need to increase farm resilience

Workshop group 3 Catchment (water industry)

The key questions raised by the group were as follows:

1. How do we make data (who does what, where, when) more readily available (and up to date e.g. from water companies). What about qualitative data?
2. How do we get repeatable outputs from models? Calibration, consistency, good practice, model development protocols, learning from other fields
3. 'Develop' protocols for risk assessment and mapping
4. Capture uncertainty in effectiveness of measures – understanding timescales of response and implications for economics
5. How do measures affect peaks?
6. What spatial scale should we be targeting for understanding processes and evaluating standards (don't look at water quality in isolation – bigger picture)
7. What are the implications of climate change and agricultural intensification for water quality?

Summary of key points raised by this group previously through discussions / feedback (catchment planner / water industry group)

- What is the value of models?
- Cost of developing and maintaining models is high and this is a barrier to their use as well as uncertainty on which models to invest in.
- Water company staff can rarely dedicate much of their time to modelling work and knowledge and skills are also a limitation
- Value consistency of approach so results from different studies and initiatives can be compared.
- Important to model costs of measures as well as impacts to feed into business planning (e.g. technical feasibility of measures, disproportionate costs)
- Pesticides are a key issue for water companies but models in this area are mainly looking at risk. Important to also look at impact of measures in relation to both surface and groundwater.
- Can high risk contaminant sources in specific environments be identified (influence of soil types, hydrology, rainfall, cropping patterns, farming practices such as tillage and under-drains, topographic features such as slope and proximity to water courses); and also the fate and behaviour of specific contaminants in the environment (use, timing and methods of application, leachability, persistence, biodegradation etc)
- Can models help to target measures and provide an estimate of the level of confidence that they will work – no point in investing customers money if uncertainty high
- What are the uncertainties associated with modelling the impacts of different measures?
- Can models be used to help decide where to invest in sampling and other evidence gathering?
- Can a consistent modelling approach be developed to look at sources of pesticides and their transport to receptors (e.g. surface water abstractions and boreholes).
- Can the ecological benefits of measures be modelled to help identify where best to apply measures

Workshop group 4**Land holding**

Synopsis – modelling as a form of persuasion to address change at the holding scale. Steps 1 to 6 are a looped process. Step 7 has to happen at the end.

1. Conceptual model – persuasion there is a problem and why? Verification to support underlying beliefs. (Scored poorly)
2. Land management and use/what do we target? Triage phase. (Not being dealt with elsewhere)
3. What tools are available that map to elements of the problem –info in a repository is required?
4. Can we work with the modellers? Collaborative modelling – pair-wise working (e.g. ECM+ – farmers believed output as involved in process). Collaborate during learning phase and application.
5. What is the farmers role – what is the measure for each farmer to implement, when will the measure yield benefits, convince the measure will work, what level of uptake is required, what tools best achieve uptake of measures/buy-in?
6. What are the co-benefits – is there a tool to help persuade farmers to enact change?
7. How can we achieve final sign off by the regulators, but focus on benefits?

Headlines – to achieve successful land use/management change;

1. Need concept to be clear and transparent
2. Need tools that make difference between land use and management explicit
3. Tools that are modular – map elements to problems in hand.
4. Public access to model and modellers
5. Tool that makes explicit quantification of small set of target measures
6. Tool that gives estimate of extent of uptake and timescales
7. Tool must encourage action and response
8. Information of co-benefits so more of an incentive to engage
9. Ideally tool will be useful for regulatory signoff.
10. Choose case studies – don't want to risk detrimental impact to modelling reputation.

Other things of note:

- Produce a 'Strength of Evidence' table. Score evidence. What would you need to do to verify that piece of evidence?
- Modelling for persuasion.... What to believe and what to do?
- Do we need a large IT platform to deliver this? Work in Cloud? (e.g. Google in Cloud). Can run models on Cloud but need to pay to run.
- Can you identify different types of problem – ones that need to be tailored to situation, ones that are 'reproducible'?

Summary of key questions raised by this group previously through discussions / feedback (implementer / land holding group)

- **Access to actual data** (e.g. compliance data, walkover data etc)
- **We don't need more models**, we need existing models to be made available, with source data, and support is needed from model developers to interpret model outputs / help when something doesn't look right
- **Source apportionment** – need access to SAGIS and input data
- **Guidance needed** on when to use a specific model and when not to;
- **Transparency in partnership working**: need access to same data and information upon which decisions are made
- **Mechanics of pollutant loading and effect of measures for land managers**
- **Effectiveness of measures needs better understanding on a site/catchment basis** (not just theoretical FARMSCOOPER basis)
- **Communication and engagement** - ability to share data to a village / town / river level without data protection / licensing issues.
- **Confidence in models and ability to communicate and engage stakeholders is crucial**
It is experienced people on the ground that matter most



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List of workshop participants (pm)

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Nicola Dunn	NFU
Stuart Kirk	EA & Defra
Vince Carter	Forestry Commission
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Simon Eyre	Anglian Water
Jonny Burke	Southern Water
Alister Leggatt	Affinity Water
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