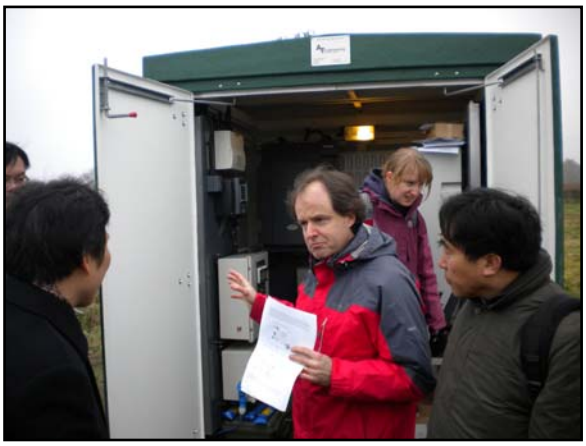
Developing a Catchment Management Template to Mitigate Non-Point Source Pollution in China
A scoping study funded by the International Sustainable Development Fund (Defra) and Ministry of Agriculture, China

Measures to Mitigate Non-Point Source Water Pollution in China

Summary of a Workshop
University of East Anglia, Norwich, UK
18th March 2010



Prepared by:
Laurence Smith

Centre for Development, Environment and Policy, SOAS, University of London, Thornhaugh Street, Russell Square, London, WC1H 0XG
Email: l.smith@soas.ac.uk

Measures to mitigate non-point source water pollution in China

Friday 18th March 2011

The Colton Room, Norwich Sportspark
University of East Anglia, Norwich NR4 7TJ

Workshop programme:

09:00 Arrival and Coffee

09.30 Welcome to the workshop

09.35 UK-China Cooperation on Sustainable Agriculture - Framework and Implementation
Dr Yuelai Lu

UK Research and Experience

09:45 Research and Environmental Management at the Catchment scale - the Demonstration Test Catchments Programme as an example
Robert Harris, Defra/University of Sheffield

10:10 Catchment Science and the Wensum DTC
Dr Kevin Hiscock, UEA

10:30 Catchment models, data and uncertainties
Dr Tobias Krueger, UEA

10.50 Discussion

11:00 Break

11:20 Catchment Hydrology, Resources, Economics and Management (ChREAM): Integrated Modelling of WFD Impacts on Rural Land Use and Farm Incomes
Paulette Posen, UEA

11.40 The Westcountry Rivers Trust: sustainable adaptive catchment management
Dylan Bright, WRT

12.10 England Catchment Sensitive Farming: Reducing the Risk of Pollution from Agriculture A Voluntary Approach
James Grischeff, Natural England

12.40 Discussion

13.00-14.00 Lunch

China research and experience

14.00 Principles and Policy for Circular Agriculture
Gao Shangbin, Agro-Environmental Protection Institute, Ministry of Agriculture

14.20 Non-point Source Pollution Control Technology for Intensive Agricultural Areas in China
Wu Wenliang, China Agricultural University

14.50 Discussion

15.10 Break

15.30 Progress of the Scoping Study, plenary discussion and planning of next steps and workplan to follow scoping study.

16:30 Close

Workshop Summary

Welcome and introduction to scoping study: ..... Laurence Smith
Welcome to all and in particular to our visitors from China. The pace of development in China has lead to rapidly increasing levels of non-point source pollution from many economic sectors. This is especially true in catchments where there is intensive agricultural production. However, many of the same issues and challenges are common to the UK and many other countries. A conference on China-UK Circular Agriculture was held in Beijing on August 30th to September 2nd 2010 under the auspices of them China UK Sustainable Agriculture Innovation Network (SAIN) - Working Group (WG4). After the conference it was agreed that pending future decisions on funding for in-depth research this interim scoping study should be proposed to further the findings and conclusions of the conference and associated field visits. The purpose of the day is to continue the dialogue, the exchange of experience and research planning.

UK-China Cooperation on Sustainable Agriculture - Framework and Implementation ..... Dr Yuelai Lu
(For more information see presentation downloadable at: http://www.watergov.org/resources.html)
The UK-Chain Sustainable Agriculture Innovation Network (SAIN) was launched in November 2008 by agricultural and environmental ministers of China and the UK. It is a mechanism to bring about closer collaboration on sustainable agriculture between the two countries and contribute to global sustainability. There are six on-going research projects and it is hoped that this study of non-point source water pollution can develop as a further full research project.

Research and Environmental Management at the Catchment scale - the Demonstration Test Catchments Programme as an example..... Robert Harris
(For more information see presentation downloadable at: http://www.watergov.org/resources.html)
Challenging water quality targets are set in EU and domestic legislation. 40% of water bodies are at risk of not meeting good ecological status due to agriculturally derived nutrients and sediment. There is low confidence in the effectiveness of many of the measures available to mitigate agricultural diffuse pollution. The Demonstration Test Catchments are a five year collaborative project between Defra, the Environment Agency and the Welsh Assembly Government to understand these interactions and trade-offs, develop and test farming systems that reduce agriculture's footprint on the water environment, and to inform the development of robust policies. To do this, requires collaborative and multi-disciplinary approaches. The DTC brings together over 40 organisations from across the country, each contributing a unique range of specialist knowledge. The project is focused in three river catchments: Eden, Wensum and Hampshire-Avon, representing a range of England and Wales's landscapes and farm types.

Catchment science and the Wensum Demonstration Test Catchment Project .....Kevin Hiscock
(For more information see presentation downloadable at: http://www.watergov.org/resources.html)
A major problem is that water nitrate concentrations continue to rise unabated in many areas of Europe. Diffuse pollution from NO3 is a significant water quality problem (and maybe for water resource management) in UK. In UK c. 10% of public supply boreholes are affected. So far mostly dealt with by blending and treatment but future opportunities are reducing fast and treatment for "pollution" is not an option under the Water Framework Directive (WFD).

An example of applied catchment science is a study on 'Tracing the sources and fate of diffuse nitrate contamination in a lowland agricultural catchment using a dual-isotope method' by Sarah Wexler, Kevin Hiscock and Paul Dennis of School of Environmental Sciences, University of East Anglia. This study showed that denitrification can be an important natural attenuation mechanism in lowland rivers, and is possibly occurring in the riverbed sediment.

The Wensum Demonstration Test Catchment Project aims to evaluate the extent to which on-farm land management measures can cost-effectively reduce the impacts of water pollution on river ecology while maintaining food production capacity. Objectives are to:

- Develop a conceptual model of the Wensum catchment.
- Plan an experimental monitoring approach for selected sub-catchment areas.
- Arrange access, instrument and manage flow-proportional and storm event sampling and analysis of a range of diffuse pollutants.
- Plan packages of on-farm measures for diffuse pollution mitigation through farmer liaison.
- Establish methods of knowledge exchange for wider dissemination of results and guidance.

Catchment models, data & uncertainties.....Tobias Krueger
(For more information see presentation downloadable at: http://www.watergov.org/resources.html)
There are many sources of uncertainty, and opportunities to enhance modelling and use of models through stakeholder participation. Ingredients for success in catchment modelling include:

- Embrace & communicate the iterative & preliminary nature of modelling
- Choose models based on modelling objective & data availability
- Embrace multiple working hypotheses (ensemble of models)
- Embrace data uncertainties
- Propagate all uncertainties through models & audit models post-hoc
- Open up model assumptions, limitations & uncertainties to stakeholder scrutiny
- Participatory modelling can yield better input data & greater acceptance of model results
- However, in the end it may be all about personal trust rather than deep understanding and how durable is this trust?

Catchment Hydrology, Resources, Economics and Management (ChREAM): Integrated Modelling of WFD Impacts on Rural Land Use and Farm Incomes.....Paulette Posen
(For more information see presentation downloadable at: http://www.watergov.org/resources.html)
The objectives of the ChREAM project were to:

- Develop integrated hydrological-economic model of relationship between rural land use and water quality
- Examine alternative strategies for securing the objectives of the EU Water Framework Directive
- Provide policy-relevant guidance regarding how various strategies impact on rural land use and farm incomes
- Assess economic values for the social benefits that may be generated by implementation of the WFD.

Outcomes were that:

- Farm modelling results revealed marked variability in the economic impacts of river nitrate reduction options
- WFD implementation may entail major land use changes resulting in substantial economic impacts
- Benefits estimation revealed public willingness to pay for environmental improvements
- Spatially explicit approach permits assessment of optimal targeting of policy implementation to areas of particular concern
- Agricultural land use modelling has been extended to cover England and Wales
- Further impacts on land use and water quality are to be assessed in the context of climate change.

The Westcountry Rivers Trust: sustainable adaptive catchment management …Dylan Bright
(For more information see presentation downloadable at: http://www.watergov.org/resources.html)
The objectives of the trust are to: secure the preservation, protection, development and improvement of watercourses in the Westcountry; and to advance the education of the public in water management.

Improvements in land and water management can be achieved through a variety of approaches:

- Regulatory Protection -you commandeer land or the right to do certain things on land, for one purpose (SSSI, NVZ, WPZ, CROW Act) - Cost prohibitive on a catchment scale, unfair if not universally applied.
- Community Conservation - you find win-wins for land owners that save them money and improve the environment, and foster land management change - delivers economic benefits but land protection is a by product and voluntary. Society needs to guarantee changes, how without resorting to Regulation?
- Paid Ecosystem Services (PES) - beneficiaries pay for providers for ecosystem services – has potential but needs a clear economic case for investment.

The trust works in partnership with the regulatory agencies and has achieved a great deal through community conservation. Currently efforts are being made to apply the ecosystem services concept and to develop applications for PES.

England Catchment Sensitive Farming: Reducing the Risk of Pollution from Agriculture A Voluntary Approach …….James Grischeff
(For more information see presentation downloadable at: http://www.watergov.org/resources.html)
The England Catchment Sensitive Farming Delivery Initiative is a joint venture between the Environment Agency and Natural England funded by Defra working in 50 priority catchments. It delivers practical solutions and targeted advice to enable farmers and land managers to take action to protect water bodies and the wider environment.

Catchment Sensitive Farming Officers supported by independent specialists work within the farming community to deliver free advice tailored to the area and farming sector. This advice includes workshops, farm events and individual appraisals. CSF also provides a capital grant scheme to adapt farm infrastructure that offers up to 60% funding for successful applicants. Priorities for capital works are identified for each catchment.

Achievements have been substantial but continuing challenges are:

- Engagement of the next level of farmers
- Proper understanding of the problem within catchments – need a programme that is flexible enough to reflect the new science
- Need for a broader integrated approach – community engagement within the catchment; flexible integration of Incentives, Regulation and Advice
- Short term project when trust and consistency is needed.

Development of Circular Agriculture in China ..... Gao Shangbin
(For more information see presentation downloadable at: http://www.watergov.org/resources.html)
The basic characteristics of circular agriculture in China are based on the "3R":

- Recycle：No waste discharge for a lifecycle
- Reuse：Straw; Dung
- Reduce：Fertilizer; Pesticide; Machine.

A diverse range of models and technologies are being developed and tested for different regions and agricultural systems. Full support is given by legislation and planning. There are considerable achievements and improvements that have been made. Problems to be overcome include achievement of a better balance across all areas in China, improvement in the methods and standards of ecological compensation, improved monitoring and warning systems, and further improvement in assessment methods and technologies.

Non-point Source Pollution Control Technology under intensive agricultural areas in China …….. Wu Wenliang

The non point source pollution is relatively serious in some places in northern and southern China. Most studies in China have only focused on the site-specific non point source pollution research. It is essentially necessary to develop management strategies to mitigate non-point source pollution at catchment scale in China. The presentation presented data to describe the problems faced and illustrated the management strategies being developed in different regions.

Key discussion points during the workshop

- Investments are being made in the UK and in China to improve the knowledge base relevant to control of non-point source water pollution. Emphasis needs to be placed on data accessibility – making data and advice available to farmers.
- Stakeholder participation is vital. Its important to model development was illustrated. But how to close the loop and make sure improved knowledge, decision support tools and stakeholder engagement do lead to real improved outcomes?
- Landcare programmes in Australia illustrated the need for a broad, integrated and community based approach. Work in the UK has been more narrowly focused. It also suffers from short termism.
- Provision of extension advice and community organisation in China is challenged simply by the distances and numbers of farmers involved. The range of technical and land management options is also constrained by farm size. Land retirement may rarely be feasible.
- The role of intermediaries is very important. In the UK we debate the effectiveness of government agencies as intermediaries. However, CSF has shown that government can deliver.
- Some of the UK research highlights the potential trade-off between improved environmental quality and food production. The need for such trade-offs has become accepted, but is also challenged by recent global food security concerns. But national policy in China is not prepared to compromise on food production and current food security, not least for the benefit of the world market. Control measures will need to be well targeted and effective. Broad cut backs such as a 20% reduction in fertiliser use are less relevant (although cultural and capacity factors in rural areas do often result in over use of fertiliser).
- In the UK small livestock farms in the west require very different advisory and regulatory approaches and technologies, as compared to large arable farms in the East. There is similar regional diversity in farming and agro-ecology in China.
- The large arable estate in Norfolk visited by the study team was illustrative. The manager wishes to do as much as possible for the environment, but without compromising the efficiency of farm production. The aim for most farms has to be to target measures so as to maintain commercially viable production whilst protecting the environment. There are clear benefits from high-tech best practice precision farming. This needs training and capacity on the part of the farmer.
- The UK has not yet established its priorities and what level of trade-off is acceptable. There is a need for bioregional planning and zoning of areas for productivity and environmental protection.
- Recent increases in commodity prices have made once marginal land more viable.
- China must continue to achieve growth in production and incomes, but has the potential to also achieve reductions in emissions and energy use.
- Although there are obvious differences, there are also many commonalities in the nature of the problems in UK and China, and in the types of solutions needed. For example, the importance of soil testing and fertiliser management.
- It is important to note that on average 70% of rural household income in China now comes from non-farm sources. This challenges the use of financial incentives. For example, incentives to better manage fertiliser use are weaker. The opportunity cost of farm labour and

farm management time is high. Cost savings can be insignificant compared to urban wages. In many cases it is the elderly and women who are now the farm managers.

Completing the scoping study and next steps.

The scoping study aims to produce a number of working papers documenting summarising current knowledge, practice and approaches in the UK and China by the end of May. Details have been discussed during this week. It was agreed that the UK-China team would pursue funding for a more substantial research project. This would seek to test the principles and approaches of the 'catchment management template' defined by the recent RELU funded research project (see *http://www.watergov.org).* Ideally this will be a five year project with case study locations in north and south China. Further meeting and information exchange can take place in the UK in late May, and a visit by 2-3 UK team members to China in July was suggested.

List of Delegates

First name	Surname	Organisation
Hoi Wen Au Yong		University of East Anglia
Dylan	Bright	Westcountry Rivers Trust
Hadrian	Cook	University of Kingston
Shangbin	Gao	Agro-Environmental Protection Institute, MoA, China
James	Grischeff	Natural England
Karen	Hampson	University of East Anglia
Robert	Harris	DTC secretariat, Defra and University of Sheffield
Martin	Haworth	National Farmers Union
Peter	Hazell	SOAS, University of London
Kevin	Hiscock	University of East Anglia
Xin	Lai	Agro-Environmental Protection Institute, MoA, China
Bruce	Lankford	University of East Anglia
Huashou	Li	South China Agricultural University
Lisha	Li	University of East Anglia
Lutang	Li	Northwest A&F University, China
Andrew	Lovett	University of East Anglia
Yuelai	Lu	SAIN Secretariat, University of East Anglia
Charles	Lugo	University of East Anglia
Paulette	Posen	University of East Anglia
Brian	Reid	University of East Anglia
Sabrina	Rothausen	University of East Anglia
Laurence	Smith	SOAS, University of London
Sarah	Taigel	University of East Anglia
Lianhai	Wu	Rothhamsted Research North Wyke
Wenliang	Wu	China Agricultural University
Dianlin	Yang	Agro-Environmental Protection Institute, MoA, China
Jun	Yang	University of East Anglia
Edward	Yuan	Fudan University
Yanzong	Zheng	University of East Anglia