Baseline Report
Aquarius: Farmers as Water Managers Project

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With input from all the Aquarius Partners

European Union The European Regional Development Fund

Investing in the future by working together for a sustainable and competitive region

The Interreg IVB North Sea Region Programme

Executive Summary:

The workshop asked pilot region partners to share findings under the headings: ecological, economic, sociological, policy & legal, and climate change and then to prepare draft conclusions for their own pilot regions. Partners from different pilot regions then discussed their conclusions with each other in order to identify the most important similarities and differences.

The final plenary session of the workshop agreed the following conclusions:

The need to understand the farmer[1]: what motivates different types of farmers and how to use the most motivated farmers to communicate with their peers.

The need to understand 'good farming practice' and how any changes to the Common Agricultural Policy might impact on how this is defined and how farmers behave.

The need to link climate change scenarios to farm management, despite the difference in timescales and the degree of uncertainty, and how to communicate the impacts of climate change on land-water management, not just the change in weather.

The need to put the farmer in the wider policy, social and economic context whilst understanding their particular business and spatial circumstances; and identify the benefits of farmers acting as water managers for farmers and the wider public.

The need to consider equity and the distribution of costs and benefits, including who pays for measures and how much measures might cost.

The need to share the best way to work together, such as involving farmers in diagnosing the problem, choosing solutions, talking to other stakeholders and sharing knowledge, to help this project and set a foundation for future work.

The need to plan for future trans-national baselines taking account of the available time and expertise and using shared templates, checklists and metrics to aid comparison.

The project is now moving into phase B on 'Key Methods 'using two method workshops in March and June 2010. For more information, please see the website: http://www.aquarius-nsr.eu/Aquarius.htm

[1] Please note that the term farmer refers to all land managers involved in this project.

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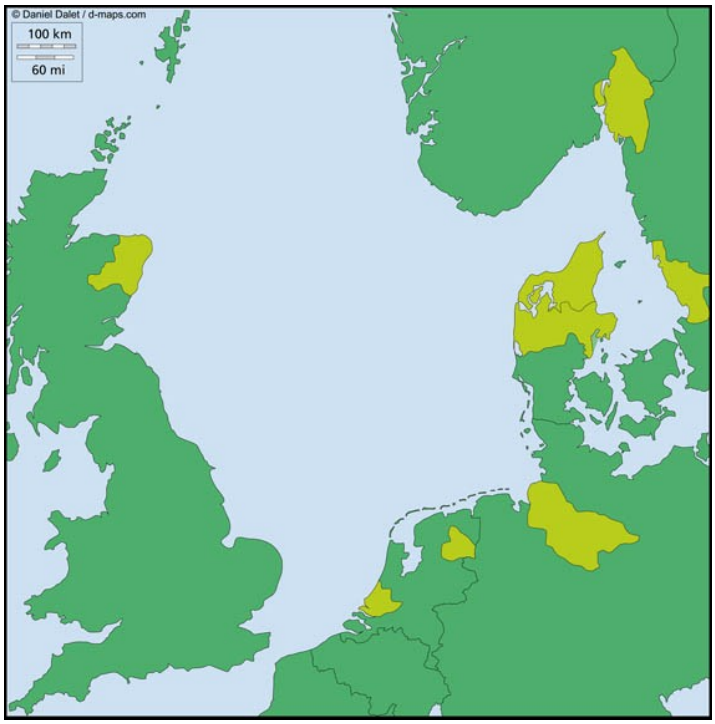
Introduction

The Aquarius project has a common aim to find and implement sustainable, integrated land-water management through engaging with land managers.

Climate changes and stricter environmental regulations pose new opportunities for, and challenges to, farmers in the North Sea Region. Extended periods of rainfall increase erosion and input of nutrients and pathogens to water, and periods of drought hinder the ability of water to dilute diffuse inputs.

If land managers are to maintain efficient and effective agricultural production practices under these changed conditions, they must be willing to adapt their practices and manage uncertainty. This will require land managers to be involved in agreeing on the problems and taking part of action-research to create new solutions. Therefore, "Farmers as water managers" is the slogan for Aquarius.

The project involves 15 partners from seven pilot regions in six nations around the North Sea



The seven pilot regions are:

- Netherlands: Midden-Delfland – an inland catchment, dominated by dairy farms although it also has strong cultural and recreational values; facing diffuse pollution and flooding pressures.
- Denmark: Mariager Fjord – a coastal catchment draining into a fjord with mixed farming, forestry and recreational use; facing diffuse pollution pressures.
- Netherlands: Veenkoloniën – an inland catchment with mainly arable crops; facing water shortages due to irrigation and drinking water demand and nitrification of surface waters due to draining peat bogs.

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- Germany: Ilemal Jeetzel – an inland geest catchment with mainly arable crops and some forestry; facing water shortages due to irrigation and diffuse pollution of groundwater supplies.
- Norway: Vestre Vansjø – a catchment draining into a lake with farming with mainly arable crops and forestry; services the city Moss and the surrounding municipalities with drinking water and has high recreational values; facing diffuse pollution pressures.
- Scotland: Tarland Catchment – an inland east coast catchment with mixed farming and forestry; facing morphological alterations resulting in flooding; and diffuse pollution pressures.
- Sweden: Smedjeåen Catchment – a coastal plain catchment with mixed farming, forestry and hydropower production; facing water shortages in the upper catchment and flooding in the lower catchment.

The project is partly funded by the EU-North Sea Region Programme Interreg IVB and partly funded by partner organisations from the seven pilot regions.

Purpose of the Phase 'A' Baseline process

This report provides some selected highlights from the baseline research that has been conducted in each pilot region. The overall research process is a cycle of planning, negotiating, implementing, monitoring and evaluating the project. The baseline phase allows for the planning and negotiation aspects to be compared across the seven pilot regions.

The purpose of the baseline phase has been to draw together knowledge and experience from a range of sources in order to address the first aim of the project proposal - to 'identify common and particular constraints on farmers acting successfully as water managers'. The baseline phase therefore set out to provide a:

- Baseline description of existing land and water management and its impact on the ecosystem in the project areas
- Baseline description of the direct stakeholders, their socio-economic structures and cultural traditions in the project areas
- Baseline description of the future challenges for the farmers and the environment under changing climatic conditions.

Expert networks on the environment, economics, social, policy & legal and climatic issues set out some shared trans-national questions for each pilot region to answer. The draft data for each pilot region were brought together into 'post cards' from each of the seven pilot regions in November 2009. The purpose of the postcard report was to provide a short summary of each pilot region's baseline to help familiarise the partners with the similarities and differences between each area.

The report formed the basis of discussions at the transnational workshop held in Tarland on 1st – 3rd December 2009. The workshop shared information on baseline conditions, identified problems and exchanged the visions expressed by the local stakeholders for possible solutions allowing farmers to act as water managers. This final baseline report is based on the information recorded during that workshop. It has been verified by representatives of each region as a true account of the transnational learning achieved during this phase.

Transnational Findings:

The findings are presented by trans-national theme (ecological, economic, sociological, policy & legal, climate change) and by pilot region.

Ecological Baselines

The main areas of comparison relate to whether the pilot regions meet good ecological status and what the main pressures are.

	GES by 2015	**Why Not?**	**Agriculture**
Delft	No	Nutrients; pesticides; heavy metals Overstocking of fish Majority of nutrients from agriculture	Majority of N & P from dairy farms Some urban/point source
Denmark	Some rivers not lakes or Fjord	Nutrients for Fjord, rivers and lakes Morphological alteration for rivers	Majority of N & P from dairy farms; although some septic tanks morphology from agriculture
Drenthe	No	Nutrients Morphological alterations Over abstraction/drought	Majority N &P from agricultural Morphology from navigation Abstraction from agriculture
Germany	Unclear	Surface waters: nutrients; sedimentation Groundwater: nutrients Over abstraction/drought for sw & gw	Majority N &P from agricultural Abstraction from agriculture
Norway	No	Nutrients	Majority N & P from agricultural
Scotland	No	Nutrients Morphological alterations	P from both agriculture and septic tanks; morphology from agriculture
Sweden	No	Nutrients Morphological alterations	P from both agriculture and septic tanks; morphology from agriculture & power generation

During the workshop, the nutrient pressures were discussed, with more attention being made to N than to P by many pilot regions, apart from Scotland, Norway, and Sweden. However, P and sediment erosion might increase with climate change. Pesticide pollution was also raised by some pilot regions. Habitat enhancement emerged as an important issue alongside nutrients and morphology. Therefore, common areas of focus are water quality, water quantity (drought and floods) and habitat enhancement. These pressures will be affected by any potential climate changes.

Delft	More rainfall and more flooding combined with milder temperatures may increase P leaching.
Denmark	For Lochs and the Fjord, expect higher losses of nutrients if there are no changes in current agricultural practices. For rivers, expect a bigger difference between water flow in summer and winter and increased erosion and temperature.

Drenthe	Longer droughts, heavier storms, and reduction of climatic water balance during vegetation period are predicted parallel to higher temperatures. Agriculture will need more groundwater for field irrigation, which would harm groundwater dependant small watercourses.
Germany	Heavy rainfall events may increase nitrogen losses.
Norway	Milder winters and more rainfalls with high intensity are expected, and this will increase the erosion risk and phosphorus losses if there are no changes in current agricultural practices. There may also be larger risk for flooding.
Scotland	Increased rainfall and intensity likely to increase flooding (and associated nutrient transport); but there may also be low flows or droughts in the summer.
Sweden	Climate change may increase in the hydrological amplitudes in the landscape (i.e. wetter wet periods leading to increased flooding as well as dryer dry periods leading to increased droughts).

Important differences related to the range of receiving waters affected by farming and land management – including both ground water and surface waters; and both freshwater and estuary or coastal systems. This has many implications, including the response time of the ecology to the pressures put on it – groundwater may take much longer to influence surface water ecology than direct inputs to surface waters for example; and standing waters (lakes or lochs) are more sensitive to nutrient pressures than running waters (rivers). Some waters have additional protection if they are drinking water protected areas or designated under Natura 2000.

Some areas (e.g. Delfland) have water bodies that are too small to be classified under the Water Framework Directive yet still have an impact on the overall hydrology and ecology of the area – although in Germany and Scotland, the Habitats Directive provided alternative legal protection. Some areas (e.g. Delfland, Drenthe, Sweden) have heavily modified or artificial water bodies.

Many partners noted that 'top down' regulations (e.g. the Nitrates Directive and the new Water Framework Directive requirements) were successful in reducing nutrient transport and raising awareness of morphological and ecological requirements. However, more targeted, farm-scale, measures were required to continue improvements. For example, Germany provided examples of a farming cooperative that was rewarded for protecting water in a Drinking Water Protected Area.

There are some interesting differences regarding the multifunctionality of land use in the different pilot regions. Some areas are predominantly agricultural with a strong emphasis on production for the market. In other areas, non-market goods provided by land use including farming, such as cultural landscapes, ecological enhancement or recreational facilities are very important.

Many partners believe that involving farmers in monitoring would increase their interest in changing their practices.

Economic Baselines

This data has proved difficult to collect at the scale of the pilot regions and therefore the data provided in each postcard are hard to compare.

	% of Gross Value Added from Agriculture	Average Net Farm Incomes	Agri-environmental schemes as % of TIFF
Delft	43.7%	€ 58,860. (Dairy much lower than overall average).	No data
Denmark	No Data €216, 500 - average gross output (North Jutland 2004 –2008)	€ 135,000 (Full time in pilot area)	No data € 1,200 per farm in the pilot area
Drenthe	No Data	€ 41,100 (Potato farmers are much lower overall average)	No data
Germany	0.9% for Germany; 1.7% for Niedersachsen	No data	8.9% for Niedersachsen
Norway	No data	No data	25% for pilot area
Scotland	1.36% for Scotland; 1.88% for Aberdeenshire	€ 22,200 (£18, 700) - all Scotland – lower for livestock ; higher from cropping & dairy	19% (2008 TIFF £629.6M – CAP Pillar 2 £119.8M) 9% (2008 – excluding Less Favoured Area Support)
Sweden	In Sweden as a whole; the income of the agricultural enterprise is about 15% of the total income of all agricultural households, the remaining is income of employment (including employment in own agricultural company).	€34,666 (361, 100 Swedish kroner – 2007 – all Sweden)	Out of the net result, the environmental support accounted for 9% - 67% for pig farms, 23% for milk farms and 120% for crop farms in 2007

At the workshop, a number of issues were discussed. Firstly, we discussed whether the pilot regions were representative, with implications for how well national level data would provide information on the economic aspects of the project. For example, the Danish pilot region has more full-time farmers with bigger farms and more intensive management than the national average. Therefore, on one level they are

more economically viable, but they also tend to have more debt. The German pilot region is also unusual in terms of large average farm size and the focus on specialist arable crops.

Secondly, we noted that even where the average farmer was making a reasonable income, some farmers were losing money in all pilot regions, which illustrates the importance of non-economic motivations for farming. Some pilot regions noted that having food security and reducing food miles were two important motivations to maintain farming where it may not be economically viable (see section below). Energy crops may become important as well. Therefore there is heterogeneity between farmers within pilot regions, with some thinking strategically and others struggling to survive.

Many pilot regions have 'part-time' farmers who earn income off the farm, or rely on income earned by their partners or children to support the farm household. This varies between countries, with Norway having a large number of part-time farmers, whereas Scottish farmers tend to be 'full-time' – although the source of the overall household income is unknown. Denmark, German, Dutch and Scottish pilot regions seem to illustrate a trend towards larger farms and/or intensification of production. . In the discussions it appeared that every farmer is dependent -more or less- of agricultural funding to continue their businesses. At this moment the EU is looking at the European agricultural funding to reduce this kind of funding, and in the worst case this will be stopped. The farmer must then find other items which could help them to survive.

In Sweden the commercial farms are growing very fast and becoming more intensive. At the same time many small farms, classified in the national statistics as agricultural households, in reality include many other forms of private enterprises.

There are some important differences regarding succession and inheritance, which affect the amount of debt held by farmers. For example, Danish and Swedish farmers have to buy their farms from their parents at near market value. There are also differences between the pilot regions in terms of land ownership patterns – as Germany and Scotland have high proportion of farmers renting land compared to other areas. In the catchment area about 40 % of the farms are at least partly rented as compared to 53% in Sweden as a whole. Farmers renting land are likely to have a different attitude to environmental improvements or long term investments. However, all pilot regions seem to suffer from low availability of agricultural land to rent or buy, making costs of renting or buying land very high. Finally, farmers in Norway, Germany and the Netherlands can access special discounted bank loans for environmentally friendly farming investments, whereas the other pilot regions have to pay the market interest rates on loans.

Germany appeared to be unusual in their prediction that there would be increased livestock (poultry, pigs) production in the future, and in the trend towards more cooperative farming and other farm related industries, e.g. bio-gas production. In contrast, Delfland dairy farmers were struggling and facing a situation where their milk was costing more to produce than they could sell it for. These differences highlighted the fact that some pilot regions had too much water or nutrients, which are costs to get rid of, whereas in other farming systems, water and nutrients were precious and cost money as inputs. The economic cost of water may well increase under conditions of climate change, especially if summer droughts increase.

All pilot regions seem to be facing greater fluctuations in the net income received from farming, although the perceived trend was declining. All pilot regions were directly or indirectly affected by global trade and global demand, although it was hard to decide if these would have a positive impact on the economic viability of the farming industries in our pilot regions.

Sociological Baselines

The sociological aspect of the baseline is very important in order to understand barriers (and opportunities) to farmers acting as water managers. However, the sociological baseline required an ambitious level of data collection, which not all partners could resource. Therefore, sample sizes vary from a panel of experts (Drenthe; Sweden) through to 50 farmers in the Danish pilot region.

Land managers vary in their perceptions of how their actions impact water quality and quantity. They vary within the pilot regions, but also between pilot regions as soon below. The following tables illustrate the majority viewpoint for each pilot region at the present time.

Land management impacts on:	**The quality of drinking water in the area**	**The variety of plants and animals in the local watercourses**	**Flooding/drought problems**	**The water clarity in nearby lakes and coastal waters?**
Delft	Not at all	Lesser extent	Great extent	Not relevant
Denmark	Great extent	Great extent	Lesser extent	Lesser extent
Drenthe	Not at all	Lesser extent	Great extent	Lesser extent
Germany	Not relevant	Some extent	Not relevant	Not relevant
Norway	Some extent	Some/lesser extent	Not at all	Some extent
Scotland	Not at all	Some extent	Some extent or don't know	Some extent
Sweden	No or lesser impact	No or lesser impact	No or lesser impact	No or lesser impact

Interestingly, there were even more differences in land managers' perceptions of potential changes in water quality and quantity due to climate variation in the future.

Changes in:	**The water clarity in nearby lakes and coastal waters**	**Precipitation and water quantity**	**Frequency of flood events and erosion**	**Frequency of droughts/ drinking water shortages**
Delft	Past – don't know Future – don't know	Past – not relevant Future – worsen	Past – not relevant Future – flood: worsen, less erosion	Past – not relevant Future –droughts: worsen, drinking water no change
Denmark	Past – don't know Future – don't know	Past – no change Future –no change and Don't Know	Past – no change Future – no change	Past – no change Future – no change
Drenthe	Past – N/A Future - improve	Past – N/A Future - improve	Past – worsen Future - worsen	Past – worsen Future - worsen

Changes in:	The water clarity in nearby lakes and coastal waters	Precipitation and water quantity	Frequency of flood events and erosion	Frequency of droughts/ drinking water shortages
Germany	Past – not relevant Future – not relevant	Past – worsen Future – don't know	Past – not relevant/ no change/worsen Future – worsen	Past – not relevant Future - worsen
Norway	Past – worsen Future - improve	Past – worsen Future – don't know	Past – worsen Future - worsen	Past – no change Future – don't know
Scotland	Past – don't know Future – don't know	Past – some change Future – don't know	Past – no change Future – don't know	Past – no change Future – don't know
Sweden	Past & Future – no change	Past & Future – no change	Past & Future – no change	Past & Future – no change

Therefore, the pilot regions identified a common theme about a lack of information or understanding by land managers about climate change and environmental effects. Furthermore, in many areas, farmers and researchers views differ on their definition of the problem, illustrating the need to develop a joint understanding of the issues before agreeing potential solutions. Farmers like demonstration sites as they are often curious, well educated and would prefer to shape solutions rather than be told what to do.

Therefore, all pilot regions also agreed that it was essential to engage the farmers in the projects and develop a common communication platform. In order to achieve these aims, the project partners need to understand the farmers' individual perspectives, particularly that the farmers perceive farming as business, even if they have other, non-economic, motivations as well. Therefore the impact that measures have on farm viability and profitability must be considered and farmers want farm-level rather than regional or national information. The influence of the financial position of farmers and their perception of increasing regulations influencing land management are discussed in the section below. However, culture, traditions and mindset are also important.

The provision of advice was important to all pilot regions, although there are differences in how this advice is provided. The last common theme was the need to consider the impact on land managers relative to other stakeholders in the land-water system, as farmers are part of a broader rural community and influenced by other stakeholders (authorities, consumers, neighbours).

Differences between pilot regions include the farmers approach – whether they act as individuals or collectively and to what extent they would welcome collective engagement. There are also important structural differences between (and within) pilot regions regarding the number of part-time and full-time farmers; in patterns of land ownership and in average farmer age. Another important difference is the phase that each pilot is at - In a number of pilot regions (Norway, Sweden, Denmark, Drenthe) there has been ongoing projects for over five years working with land managers on water issues, so this project is working with farmers that have already participated in discussions about land and water management.

In terms of advice, advisors noted the need to take account of farmers' views in the project and share success stories. There was some variation regarding to what extent advisors already took note of climate change in their advice. There are a variety of measures being suggested to farmers about how to manage water quantity and quality. There tends to be more productive than environmental advice provided, particularly when the farmers have to pay for the advice themselves. Advisors are better ways of disseminating information than via authorities or researchers.

The number of authorities interviewed by pilots reflects the difference in governance structures (see the section below). The authorities mainly consist of the Water Boards; environmental regulators and municipal/provincial/local authorities. The authorities interact formally and informally with a wide variety of other stakeholders (Water boards, Municipals, Farmers organisation, Nature organisations; citizens; Research institutes, advisory companies, union of provinces ; environmental regulators; government inspectors; fishery organisations; national parks; forestry organisations; National Government departments). They were more cautious in general about the measures available; and distinguished between statutory and voluntary measures. Climate change and agriculture is politically important at present, but this may be both a positive and negative aspect for the project. Climate change is not always taken into account when applying policies. Many partners felt that the authorities and farmers needed to talk directly to each other and learn from each other.

The overall conclusion was that a local approach is needed as no one size fits all. Gaps remain in our understanding of the variation in governance structure and the consequences for farmers; our understanding of how different farmers think about the pilot projects; and a deep understanding of what farmers really think.

Policy & Legal Baselines

All pilot regions appear to be dependent on agricultural subsidies for survival (mainly via CAP for all pilot regions bar Norway, which has its own agricultural payment system). Therefore, reductions in payments could have important implications for the viability of farms in our pilot regions. However, changes in modulation from pillar one to pillar two could provide further incentives for farmers to act as water managers. There is a question mark over the longevity of measures once support payments are no longer provided and it is important to have ongoing support and payments.

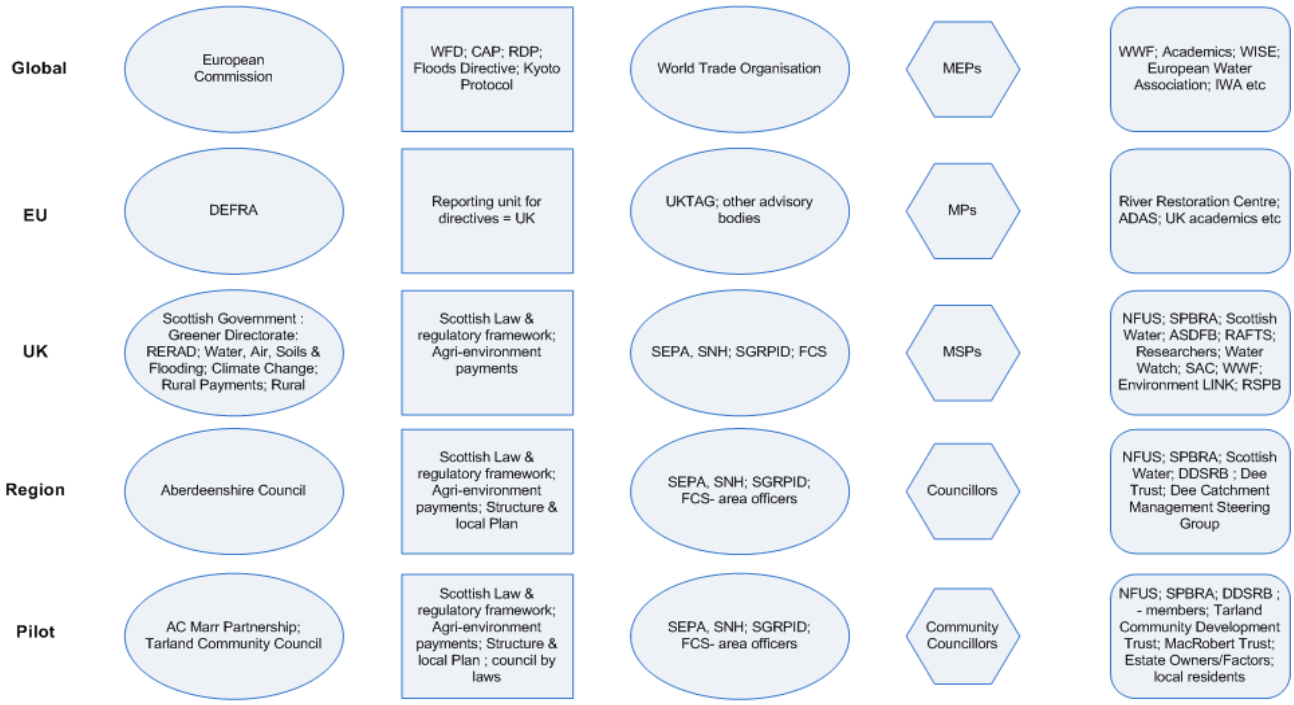
European regulations are very influential – although Norway is not part of the European Union, they have voluntarily adopted concepts like the Water Framework Directive and have passed their own environmental laws to reflect the European approach to land-water management. All pilot regions have some form of Water Framework Directive and Habitats Directive legislation. However, only Scotland has legislation for flooding and climate change, but the other countries are working on these policies at present. The Baltic States also work together and many partner nations are signed up to the North Sea Treaty.

A regulation relating to reducing Nitrogen emissions covers whole countries (e.g. Denmark, Germany) but the Scottish case study is outside the designated nitrate vulnerable zone, and so there are no special restrictions on spreading and storing farm waste and manures. This led to a discussion over the provision of general regulations or targeted regulations. Some countries do not allow or have not adopted targeted approaches to land-water management, whereas others, e.g. Netherlands, promote customised approaches using their payments for blue-green services; and Norway have regional environmental regulations to take account of ecological differences.

Interestingly, Denmark implements Habitats and WFD using the same act - *Act on environmental measures etc. of water bodies and international nature conservation areas.* Denmark has the most legislation listed; and the Netherlands the least, although the Netherland rely more on spatial planning processes. Germany and the Netherlands have a strong federal model, whereas the other countries have national legislation only. All pilot regions have a variety of taxes and grants available to manage agriculture's impacts on water (mostly with an impact on water quality).

One of the outcomes from the workshop was to develop a 'governance' diagram for each region. This will allow the different pilot regions to compare the actors involved in managing land and water; and the different levels at which they operate. A draft example, from the Scottish region, is provided as an illustration. Many pilot regions have one unitary water board for water management. Denmark does not, but water management is the responsibility of the municipality enforcing national water laws. Scottish water management appears to be much more fragmented across a larger number of statutory agencies. These ideas and diagrams to analyses them are being taken forward within WP3 on key methods.

Diagram showing simplied Multi-level Governance for managing Land and Water for Scottish Pilot Region



WFD – Water framework Directive; **CAP** – Common Agricultural Policy; **RDP** – Rural Development Programme; **WWF** – World Wildlife Fund for Nature; **WISE** – Water information system & exchange; **IWA** – International Water Association; **DEFRA** – Department for Environment, Food & Rural Affairs; **UKTAG** – UK technical advisory group; **SEPA** – Scottish Environment Protection Agency; **SNH** – Scottish Natural Heritage; **SGRPID** – Scottish Government Rural Payments and Inspectorate Division; **FCS** – Forestry Commission Scotland; **NFUS** – National Farmers Union Scotland; **SRPBA** – Scottish Rural Property and Business Association; **ASDFB** – Association of salmon district fishery boards; **SAC** – Scottish Agricultural College; **RSPB** – Royal Society for Protection of Birds; **DDSFB** – Dee District Salmon Fishery Boards

Climate Change Baselines

The general findings are laid out below. In terms of temperature, it is important to put this in context, so that increased temperatures are more significant in arctic latitudes than in others; and coastal areas will be buffered from extremes of temperature but more prone to sea level rise problems.

	From past until today	**In the Future**
Year Temperature Note: that most note that the rate in increase has accelerated in the last two decades.	Rising – Denmark (1.5 deg); Delfland & Drenthe (1.5 deg compared to the world average temperature rise); Germany (0,8° - 1,0°); Norway; Scotland (0.6 – 2 deg); Sweden	Rising – Denmark (3-4 deg); Delfland (0.9 – 2.8 deg); Drenthe (2.3 – 2.8 deg); Germany (2.1 deg); Norway (2.8-3.2 deg);; Sweden; Scotland (2.3 – 3.5 deg).
Year Precipitation	Rising – Denmark (8 – 11%); Delfland & Drenthe (18% one year average) Variable – Germany (-5 and +5 %); Scotland (only significant change in winter +36%); Sweden (rising in winter but dropping in summer) No significant change - Norway	Rising – Denmark (10-20%); Norway (10-15%); Variable - Delfland & Drenthe (19% in summer to +14% in winter); Sweden (less in summer; more in winter); Scotland (+ 54% in winter but -4% in summer); Decreasing – Germany (-19%)
Year Evaporation	Rising – Denmark (2-3%); Sweden no information – Delfland & Drenthe; Germany; Norway; Scotland	Rising – Delfland (3 – 15%); Drenthe (+15% in summer); Norway; Sweden; No information- Denmark; Germany Not significant - Scotland
Drought in summer	Not important – Denmark; No information - Delfland Scotland Less important - Norway Important – Germany; Drenthe; Sweden	More often – Denmark (Aug – Sep); Delfland; Drenthe; Germany (all year); Norway; Sweden No change - Scotland
Drought in winter	Not important – Denmark; Delfland; Drenthe; Norway; Sweden; Scotland Important - Germany	Not Important – Denmark; Delfland; Drenthe; Norway; Sweden; Scotland Important - Germany (all year)
Flooding in summer	Not important – Denmark; Germany; Drenthe; Norway Important – Sweden; Scotland; No information: Delfland	Less often – Denmark; Norway Not important – Germany; Drenthe Important – Sweden; Scotland; Delfland?
Flooding in winter	Not important – Denmark;	More often – Denmark; Delfland;

	Germany; Drenthe Important – No information: Delfland; Sweden; Norway; Scotland	Drenthe; Germany; Norway; Sweden; Scotland

The Delfland pilot region also noted changes in sea level rise; changes in wind speed and wind direction; Germany and Drenthe noted extreme weather events such as days above 30 degrees and summer storms; Norway noted decreasing snow cover; and Scotland noted the last day of air frost and field access data.

The Delfland and Drenthe comparison illustrated the importance of climate in the context of other factors e.g. . geology (Drenthe: sandy plateau situated above sea level; Delfland: polders situated below sea level), (tectonical) soil decline (Drenthe has less tectonical soil decline than Delfland) - both share a common climate but the geological differences explain why flooding is more of a problem for Delfland and drought from Drenthe. Ground water and surface water interactions are also important in helping understand the impact of changes in precipitation (Delfland has oxidisation of peat soils due to lowering groundwater levels causing soil decline). This illustrates the need to focus on both indicators of climate change and the secondary effects that these changes might have on the environment.

Climate change scenarios show some advantages for farmers in terms of a longer growing season (Denmark; Germany; Scotland; Norway) and the ability to grow new crops e.g. maize. However, Sweden feels it might be neutral for some crops. Water shortages/high temperatures might be good for some crops (Drenthe; Sweden). Delfland also highlighted trade-offs whereby keeping the peat soils water logged prevents oxidisation. The discussion also indicated that adapting cultivation practices might help overcome some of the challenges of higher temperatures and variable rainfall; in the same way that switching to winter cropping is reducing nutrient leaching. Some pilot regions have existing infrastructure and knowledge about managing flows of water on and off land (Delfland, Drenthe) that make them more able to adapt to variations in water quantity – indeed the degree of engineering in Delfland makes it very different to the other pilot regions. However, 'better drainage' can make downstream flooding more likely.

There will be some challenges:

- precipitation trends suggest potential increased irrigation might be required (Denmark; Delfland (inlet of salinated and/or nutrient rich surface water);; Drenthe; Germany; Norway; Sweden; Scotland) – this may lead to inter-regional conflict for drinking versus irrigation water (Drenthe) or downgrading of protected aquatic ecosystems (Germany) or water quality problems (Delfland)
- warm, moist conditions in spring/summer may mean the need for more pesticides and fungicides (Denmark; Drenthe; Scotland) create problems in accessing the land for cultivation (Denmark, Norway, Scotland) and the growth of toxic blue-green algae (Defland)
- There may be increased salinisation due to upward salinated groundwater flows or the inlet of salinated surface water (Delfland)

- Winter floods or heavy rain may damage new crops (Germany; Sweden; Scotland), increase nutrient leaching to ground and surface waters (Denmark, Norway) and increase of nutrient rich drainage water due to nutrients leaching from drained soils (Delfland).

- Variability in weather patterns will increase risk and volatility of profits (Germany; Drenthe), impact on farmer access/operations (Scotland) and impact on water system control (Delfland).

- High temperatures may scorch crops (Sweden) and causing health risk due to growth of toxic blue-green algae (Delfland).

The workshop highlighted how communicating the uncertainties associated with climate change is difficult yet is an essential part of working with farmers as water managers. In general, farmers are more interested in climate scenarios for the near future (e.g. 2020) than for 2080. However, there is most uncertainty in climate scenarios for the immediate future. It may be possible to use the current variability in climate data to make scenarios for future climate conditions, such as using 'low snow' years from recent past to predict future nutrient transport in Norway. Indicators such as soil moisture, frost days, growing season (start of field operation and access to land) are better ways to communicate than precipitation and temperature. The data gaps identified were: soil moisture data (for triggering irrigation and understanding flooding/erosion); river gauging (to relate run off to river flows); temperature change in water (for ecological impacts); water demand data (who needs what quality of water when). Finally, we still need to improve our understanding of how climate change will affect flooding, water quality and irrigation demand on the ground.

Transnational Learning about Water Management

The workshop included a field trip into the Tarland Catchment. The whole group started at the [insert name] Stone Circle as this gave a panoramic view of the catchment and a brief introduction was given to the topography, land use and engineering works in the catchment. The group then split into two smaller groups, to focus on either flooding and flow management, or diffuse pollution mitigation. The group then held a plenary discussion about what they had learnt.

Flooding and flows

Both Delfland and Swedish case studies also have flooding problems, although there are fewer threats to housing in the Delfland case study (Delfland: flooding problems in villages only occurs when the drainage system hasn't enough volume or isn't working properly). Many people felt that the problems were created by poor planning decisions and the Danes noted that at the municipality level, flooding was often excluded from spatial planning approaches. However, the Netherlands approach to spatial planning prevents this from happening, and new laws in Scotland should mean that this does not happen in future. Neglecting flood risk could be due to a lack of hydrological expertise in the municipalities, or due to the fact that economic arguments might override planning constraints. There are areas in Denmark, Scotland, Netherlands where homeowners can't get insurance due to flood risk and this might increase awareness of risk by home owners.

There was a discussion of the degree to which the upstream flows contributed to flooding in the village of Tarland. This is being explored by the flood modelling but there are limited areas available for upstream storage due to the topography of the catchment.

There was a discussion of how much Natural Flood Management options might cost, how much money was available and who will pay for the measures. In Scotland, the local authority will be responsible for flood prevention and will apply to the Government for funding. In Germany, all those in flood prone areas pay a levy to the water board for flood protection works.

Drought and low flows were a problem in Tarland in the past, with houses dependent on private water supplies running low in the summer; and fish kills in the main River Dee due to low flow and high temperatures. The River Dee is a major source of drinking water for Aberdeen and there are planned urban developments that will increase the demand for water.

Diffuse Pollution

There was a question regarding why there was so much attention to Phosphorus in running waters like the Tarland, when P had little impact on the ecology. However, the sediments that P was transported in were a threat to the ecology. The focus on P levels might be to do with the Natura 2000 designation, particularly with regard to impacts on the Freshwater Pearl Mussel. Currently, many rivers in the UK are failing the criteria for P and therefore failing to meet Good Ecological Status. There are different standards for P levels between running and standing waters in the UK (see UKTAG guidance http://www.wfduk.org/UK_Environmental_Standards). It was argued that ecology should be prioritised

over chemical standards, and that Scotland was doing things differently to the other European countries, possibly due to the history of environmental regulation using chemical standards.

There was some debate regarding how much P comes from agriculture and how much from waste water treatment plants.

Working with Farmers

Tarland is representative of a Scottish land ownership system whereby much of the land is owned by estates and land is then rented to tenants. The group could see that there were both benefits and challenges regarding working with tenant farmers. The advantage is that we can work with estates, which can encourage their tenants to manage water. Potentially, they provide cooperative structures, although in Tarland there is little tradition of working together. The disadvantage is that farmers may be less willing to invest in long term measures if they do not have security of tenure.

There was a more general discussion about how many farmers can a project engage and work with. In Tarland there are 48 land based businesses, but about half are not farmers. Drenthe is working with around 50 farmers and Germany 150. The Danish partners noted that not all farmers are interested in working collectively, so they work with about 10-15 in their sub-catchment. It is important to use key individuals to communicate. The Delfland Water board work with 80 farmers in total, but they plan to work with a smaller number, mainly via the Farmer's Union, in future as they can't resource this contact. Sweden also has about 80 farmers, most of who are interested. However, having 'kitchen table' meetings with this number is very time consuming. Drenthe noted that their farmer network is growing as farmers see the benefit of working with the research farm.

Pilot Region Baseline Findings

Delfland

Economy/Law/Policy

Financial income of farmers is under pressure:

The farmers on dairy production have 50% of subsidies from the European Union.

- Farmers suffer a great loss if agricultural subsidy policy will change

- Farmers income on dairy will go down

- Who will pay the damage if a land will suffer from flooding long and short period?

- Nobody seems to be able to meet the WFD deadline 2015 (policy)

- Different approaches for WFD

- Differences in phase in the projects: 2 effects

1. Transnational comparing is difficult;

2. The chance is that it enables transnational learning, especially for those who just started.

Sociological

- Local approach to farmers is needed.
- No one size that fits the complete approach/ no standard approach.
- Cooperation with the farmers needs time and patience.
- It is better to invest in small group of farmers, than expand.
- Coach to Coach
- The farmers understand the problems better from peers.
- Serious effort in a small group of farmers.
- It is about building relationships with farmers.
- Possibility to invite farmers and facilitate transnational exchange between them.
- Farming is a business; don't bother the farmers if it isn't necessarily.
- Gap is we lack a deep understanding of what farmers really think and want.

Ecology

- Nobody could meet the WFD deadline 2015 but we do improve
- Attention for nutrients is more prioritised of the other partners compared with Delfland
- It seems easier to invite farmers for the nutrients issue. Rather than for the ecological one.

- Lack attention for ecology
- Problems are different.
- Context is different
- Way of organising is different.
- But several partners have similarities. Bilateral contact between partners may add to the outcome to higher success, by specific knowledge exchange.

Climate Change

Way of organising things is different

- Effects for climate change are different specific for municipality of Midden-Delfland.

But in an other part of Delfland this problem is huge.

Local: The open water storage will be calculated in a cost benefit analysis

- No specific data is needed
- Technical solutions
- Effect for Climate
- Peat oxidation decreases the soil subsidence.
- Water storage will delay the decreasing of the soil.
- Wind direction affects the rainfall and water management control system

About 10 years ago Delfland suffered from excessive water flooding.

Which resulted in a large programme (ABC) to solve this problem?

Already now we see the benefits/effects of this programme.

Land-use was the bases of the programme and water storage quantity.

Denmark

The ecological status

We have a holistic approach from field to fjord.

In Denmark we have good information on where the problems are and where the problems come from when it comes to quality matters (nutrients).

Lack of knowledge on transport processes from root zone to fjord.

When it comes to quantity (droughts and flooding) this has not been an issue in the Danish baseline. This is due to that it is not a problem in the specific catchment. … But we will consider if there is to high extraction of water.

Economy

Structure development has been heavy

The income for farm families from farming is only approx 25 pct. (pie chart). Obs on full time farmers!

High debt: 80 pct. of income is used for paying interest rates. Obs!

Self understanding: Develop or close down

The subsidies form environmental funds counts for very low of the total income

Learning: It can be more difficult to make farmers act on environmental field if there are no funds.

General regulation and not so high focus on targeted measures.

The general regulation concern all use of all fertilizers and the farmers are allowed to spread only 90 pct of economic optimum.

Future climate

In the Danish catchment it seems that we haven't the same problems with droughts and flooding as in the other pilots.

The rise in temperature get problems it seems we will get some agricultural advantages for production due to four weeks longer growing season but in the same time the warmer season will switch the use of crops. The possible warmer summers might in the same time face more nutrients to the fjord and more oxygen deficiency.

Sociological

Danish farmers have a high educational level.

A big part of the Danish farmers recognize the close coalition between the production and environment problems.

The Danish farmers are not sure of effects of changed climate.

It seems like there is lower expectations to get finances in Denmark to solve specific problems.

When it comes to the use of advising the Danish use individual advice

The Danish Pilot is to ensure that partners are able to continue in cooperate on their own initiative model on how to handle environmental issues for the farmers which is long lasting.

Learning:

A way to involve farmers could be to provide them with measurement tools so they can see the effect on their production behaviour on the environment.

The ways the projects are organized are very different. It seems that there is a lack of knowledge on how the different organizational set ups are in the different pilots.

The fact that we are in very different faces realizing our project objectives should be in focus and we should try to exploit this.

We need more common knowledge on implications for crops on different climate issues.

Drenthe

The ecological status

Reaching the ecological status is not our main concern in the Drenthe project. At the moment only nutrients are too high, especially N. However, thanks to national fertilizer regulations we expect to almost reach the GES (Global Environmental Standard??) by 2015. Our main concern is water shortage. From the other projects we have learned that we should consider the impact of climate change on water quality.

Economy

The income of the farmers in the Drenthe project is under pressure because of changes in European subsidies. It is expected that their income will decrease with 7 – 15% as a result of the EU policy on subsidies. Also, the income per hectare is relatively low compared to other Dutch agricultural areas. This means there is pressure to increase the size of farms and the crop growth.

Although there are market changes expected as a result of climate change, the northern area of the Netherlands will we be an important agricultural area with good possibilities for crop growth.

Sociological

In order to make plans for adaptation measures regarding climate change it is important to assimilate knowledge about the farmers' situation, the need for growth, the take-over situation, their income and their plans for the future. This also means that measures may differ from country to county, even though the problems could be the same.

The key approach to farmers is to start off with small groups and combine this with field experiments. This is how we reached the 50 farmers participating in our project today.

Our farmer's network has also expanded due to the benefit of working with a research farm.

Farmers are willing to work within the network because by taking data measurements in their fields they acquire a greater understanding of the soil conditions.

Climate change

The Drenthe farmers are aware of climate change. Their greatest concern is the moisture content of the soil as a result of changed weather conditions in combination with sandy soils. The need to increase income by optimal crop growth is very important.

Although heat could also effect crop growth positively, the farmers are suggesting that "crop variety improvement" should be the answer to long warm and dry periods. The main concern is water management.

In the higher, drier areas farmers are willing to use sprinkling to reach the optimal moisture content.

Flooding is not a problem in our pilot area but is a major concern in other parts of the region. We are planning to create special storage areas, with a dual function as nature reservation areas, so that we can

store water temporally. But this is a costly solution and since space is rare in the Netherlands we are also looking for flooding solutions in combination with agricultural land use. But who pays for the loss of crops and income? And under which conditions are the farmers willing to participate? For the moment we are focusing on optimizing the retention of surface water in agricultural areas during extremely wet situations.

Learning

Although there is not much of a difference regarding climate changes in the pilot areas the impact on the farmers is totally different. This is due to a diversity of sociological and economic conditions, soil conditions, crops etc. The knowledge gained concerning these conditions forms the base for a project to find solutions for farmers and water management.

Although problems and solutions in the pilot areas are not the same, international knowledge exchange is important because it can be used in other agricultural related projects in the region.

In our own pilot area we will explore, in more detail, the farmers' expectations regarding climate change and possible solutions in water management.

Paying for measures taken by farmers is crucial. If farmers benefit then payment is not a problem (by example sprinkling).

However, some of the water measures do not benefit the farmers themselves but others are having the benefit. By example because of a better water quality or by less flooding.

The European Commission's proposal, with 8 criteria, for a new classification of agricultural areas suffering from natural handicaps could be a possible solution. The farmers aid in Less Favoured Areas (LFA) provides a mechanism for maintaining the countryside in areas where agricultural production or activity is more difficult because of natural handicaps. In the future areas heavily influenced by climate change could also be part of these areas (for example temporarily flooded areas)

http://ec.europa.eu/agriculture/rurdev/lfa/index_en.htm

Germany

- We became more aware of the importance of **exact analysis of scientific aspects of a problem.**
  The state of knowledge about and analysis of problems seems to be quite different among the pilots.
  For example: knowledge about nutrients in water:

  Their different sources, their individual pathways and their individual quantities and shares of the entire charge. (The expert network on modelling shall work further on this.) Without detailed knowledge about the sources, measures and interventions can only be suboptimal effective. This also requires knowledge about the different fertilisation-strategies of the local farmers.

- With deepening our insight in flooding problems of the different pilots, we became more aware of the **principle "who benefits pays"** in order to finance measures.

  If problems came into being by formerly accepted behaviour of actors, it will be extremely difficult to make them pay for unwanted effects resulting from those times. Example: The straightening of watercourses. The results of lack of or wrong environmental policies of "old days" cannot be deleted by making those financially responsible who are the legal or mental followers.

  We concluded that for payment of today–measures the choice has to be on those, who will be benefiting today (i.e. no flooded villages). Other models of distribution would neglect the factor "motivation".

  Conclusion: the changes during the decades of what is considered "good practice" (of agriculture, hydraulics, local planning, wastewater treatment etc.) has to be taken into account. "Old" legal or at that time "good" decisions cannot be condemned ex post. If this is done, the legal followers are condemned. With this perception of guilt, cooperative solutions shall fail.

- In our discussion we elaborated, that the problem analysis (s. above) has to **include a social analysis of the interior feelings of the different stakeholders**.
  Aspects such as: blame, responsibility addressed to followers, pride about things considered good in earlier days, differences in self-perception and external perception, have to be identified. They are basic for communication and

  For activating the stakeholders' potential for micro-level solutions.

- We concluded role play in the sense of "**changing roles**",
  as a method to not only identify, but understand (=feel) the views and fears of the key stakeholders.

- Very helpful was to encounter the extremely high percentage of part-time – farmers in the Norwegian pilot. This indicates the **great importance of other factors for farmers' motivation apart from economical aspects.**

  They might result from social prestige within the community, from emotional connection to heritage, love for autonomous decisions, love for work within natural surrounding conditions, a good feeling to

do something with (and certainly not against) nature, etc.
Conclusion was that farmers always have serious and good reasons to farm the way they do. Those should be known and included in strategies to deal with climate change and water management.

- From the Scottish pilot we got a better understanding of the **problems resulting from tenancy-farming-systems.**

  Long-term benefits or damages can only play or minor role to an actor (farmer) who only has short term control on the ground and the farm. As the fraction of leased land is growing steadily in our own pilot, we will have to take this in mind increasingly.

- Comparing the pilots and their stakeholders we came into discussion about special knowledge. Specific agrarian knowledge usually is not present a water-administrations. The **employment of specialists from other sectors** should be become normal for authorities dealing with WFD and Habitat-Directive.

- We concluded that it is very important to **eliminate diffuse fears** by means of **talking completely open about costs** to result from measures / restrictions (including financial losses of stopping to do traditional methods). Learning about the magnitude of intended / expected future financial burdens also connects non-farmers to a better understanding of resistances of farmers.

Norway

A lot of part time farmers with high paid jobs outside the farms.

34 % of total family income from agriculture.

A lot of land is rented.

Rented long term (more than 5 years): 23%

Rented short term: 32%

Owned: 45%

Climate changes will increase the risk for erosion and phosphorus runoff. P is limiting factor for algae growth in the lake.

Runoff from agricultural areas is the most important phosphorus source. A lot of effort has already been put into measures in both agriculture and sewage treatment.

Due to cropping of potatoes and vegetables in the area the P-level in soil is high.

The risk of flooding will also increase. Flooding will mainly affect agricultural land, and some roads. In addition to crop damage, flooding causes phosphorus release to surface water.

Climate changes will increase the risk for land-slides (small) along the streams.

1. Even more important to focus on mitigation options for reduced phosphorus runoff. All available mitigation options have to be implemented.
2. Increase the farmers' knowledge about importance of mitigation options. Focus on win-win situations. Focus on the best farmers, from which neighbor farmers can be inspired to implement mitigation options. Information has to be repeated.

Scotland

The Nature of the Problem

The baseline phase has concluded that the Tarland Burn is degraded due to diffuse pollution and morphological alterations. The morphological alterations, and the nature of urban development, have lead to flooding of low lying houses in Tarland and Aboyne in the past. This is likely to be worse with increased storm events. In the River Dee itself, over abstraction at times of low flows in summer is also a potential problem in the future. The challenge is to ensure that the work being undertaken to develop a statutory flood prevention scheme can take account of climate change and recognise the needs of land managers in the catchment, so that 'win-win' solutions are generated. The project is about trying to avoid a statutory approach or compulsory purchase, so it is finding and communicating what's in it for the land managers to act voluntarily.

It is clear from baseline questionnaire surveys and early informal discussions that there is little mutual understanding of the problem or agreement about the potential solutions at this stage, which highlights the need for farmer engagement and ongoing dialogue. The sociological baseline results indicate that some farmers are unsure or sceptical that there is a cause and effect relationship between their actions and flooding downstream; and suggest that most land managers would prefer an engineering or planning solution to the problem. This highlights the need to consider the actions and preferences of other stakeholders as well as land managers. Currently, some land managers refer to the burn as 'ditch' and see flooding as problem of poor drainage maintenance, rather than part of the hydrological cycle and the bigger picture of the channalisation of the Tarland Burn and drainage ditches as contributing to the urban flooding issues.

Natural Flood management would be considered under certain conditions – particularly ensuring farmers had control over what happened on their land, which they were compensated for any loss of production and the extra management costs were paid by the state.

Understanding Tarland and its Land Managers

Undertaking the baseline taught us more about the nature of land use and the number of land managers in the catchment – particularly that there are more land managers/owners than we had realised, although many manage very small areas of land. Overlaying historical data about land use onto potential flood risk sites has illustrated where the trade offs are most apparent – particularly the productive fields in rotation downstream of Tarland. Often the wettest land is also the land that has been invested in most heavily to drain it and keep it productive.

Linking flood maps to land use has also has highlighted where national changes in policy (e.g. the abolition of set-aside) have changed the potential costs and benefits of flooding to the land manager. It has been useful to be able to link the council's technical data with other land use data and see the system more holistically. This will help to avoid designing technical solutions that are unacceptable to the local land managers and therefore not implementable. It is important to consider Tarland and its land managers in the wider context of Scottish institutions impacting on land use – including both the economic incentives

and the regulations in force. The complexity of water management institutions, compared to a single Water Board, might be important here.

The Tarland farming community has been involved in three previous action research projects from 1998 - 2005 – Grampian Rivers project, LIFE, 3 Dee Vision. However, these projects were focussed on water and riparian habitat quality and this is the first project focussing on water quantity. This might explain why there was more awareness about diffuse pollution, and acceptance of the need to put in measures to resolve this pressure, than there was about water quantity issues. Given the diverse views on the nature of the problem and who should act to resolve it, we anticipate that the model and maps used as the basis for the flood prevention scheme may be challenged. Working with local scientists and farm advisors, who have some shared history with the land managers, has prepared given us some insight into what solutions might be considered acceptable to the farmers in the catchment. Aberdeenshire Council has had meeting with the communities about flooding in the area. This has also helped us remember that there are other actors involved in the project, who stand to benefit from any measures the farmers adopt.

Financial and land management considerations are essential aspects of finding a solution. Within these themes, it is important to recognise that the estate managers may have a different view to their tenants, or owner-occupier farmers. This could be a barrier, or an opportunity, as the estate may be willing to take land back in hand to generate additional cover for shooting etc, whereas the farmer would not want to incur the loss of single farm payment. Understanding how compensation payments could be handled will be important. Traditionally, financing SUDs and flood prevention schemes have been handled differently to the way potential natural flood management could be financed through insurance or compensation. However, as we are working with land in receipt of CAP payments, this raises issues regarding EU regulations about competition and payments. There are differences between the preferences of land managers and efficient bureaucracy for the council. The council will have weigh up the consequences of owning land with negotiating insurance as although land costs more, it is easier to finance a capital outlay than ongoing lawyer's fees and ongoing maintenance arrangements. However, in theory insurance is the least cost option and has additional benefits in terms of ensuring ongoing food production and other environmental benefits. It is a flexible solution that doesn't work for the current bureaucracy arrangements?

Next steps:

It is clear that we need to maintain and increase communication with land managers – both at the estate level and at the level of individual enterprises. However, it has been difficult to engage when we haven't got much information to discuss with them, although we hope that the questionnaire and leaflets has raised awareness of the project in the local area. Land Managers are busy people, often under financial and time pressures, so it has been important to balance engaging them with ensuring the project has minimal negative impact on their time and good will. Their engagement should partly from self-interest in an effort to ensure their views are considered, but we also hope that the data, particularly the climate change metrics, will be of practical interest to them.

We have to 'square the circle' of where implementing measures might have an effect, with finding a landowner willing to have the measure on their land. Essential to this process is agreeing what the measure

is, and what it can do in terms of the multiple objectives (solving flooding, managing water quality, improving low flows, providing habitat, maintaining farm viability). At the moment there is still confusion about whether the measure is an engineering feat to reduce flooding or an agri-environmental scheme or both. We still have questions about the nature of the flood storage options available, how to provide sufficient incentives for the farmers/land owners; who should pay for the flood storage; and how to achieve multiple benefits.

It will be important to keep an eye on the national policy process regarding both WFD and flooding. There is interest in our baseline process and in how we answer the above questions. It is also important to share our learning within Scotland, with other projects on the Upper Clyde, the Upper Dee, the Devon, the Lossie and the River Tweed.

Sweden

The stakeholder analyses is an important step in the process to find out different interests, not only the farmers point of view

A summary of results from questionnaire to 28 farmers gave the following answers on the situation today: Water quality is no problem or little problem and no clear changes during the last decades. Flooding is supposed to give problems in the future.

What type of measures will decrease the problems with flooding? Measure ranking

Measure	Farmers opinion	Hydrologist conclusions
Increase storing capacity up streams	Very important, high potential	A possibility, but affects other stakeholders
Dredging	Necessary and effective	Just move the problems downstream, side effects
Deeper and wider water system	Can be a solution	Results in sedimentation and shortage of water summertime
Meandering	Low effect	Low effect on flooding but increase biodiversity

The conclusion is that the farmers opinion and the results of hydrological investigations differs a lot, which is a challenge for the next steps in the project.

Hydromorphological conclusions

The flooding in 2007 was limited to a part in the catchment which is wetland or drained wetland. High water table in lower part of the catchment is as damaging for the crop as flooding by the river. The capacity in the stream is very limited in the flood-prone areas compared to other areas. Factors influencing the extent of the flooding 2007 is evaluated in the project. 35 % of the stream length is affected by dredging and straightening and has most likely increased the flood level in the lower part of the catchment. Dredging carried out in 2009 in 8 km as a response of the flooding in 2007 has limited hydraulic effect and has most likely worsen the shortage of water/lowered the water level during the summer period. Artificially over-widened stream stretches are now facing sedimentation.

Scenarios

We need a practical and pedagogic scenario, for example:

How can farmers act and adapt and agricultural practices to the following scenario: Flooding every fifth year as in June 2007 (87 mm/day), Drought (6 weeks) one summer in between as June 2008.

Conclusions from the sub project Water management plan on farm level

The 10 pilot farms have been very positive to take part in the project and the information they have delivered is important to the next steps:

- The irrigation capacity is much higher than we expected and the total abstraction capacity is nearly half of the minimum flow in the river. The farmers have to coordinate the abstractions.
- The pilot farmers have recognized that they need a joint solution to the problem
- They believe that irrigation can lower the nutrient losses.

The water management plans will be developed together with the farmers.

Transnational Conclusions

What has been learnt from the transnational baseline study?

The workshop design asked pilot region partners to share findings under the headings above (ecological, economic, sociological, policy & legal, and climate change) and then to prepare draft conclusions for their own pilot regions. Partners from different pilot regions then discussed their conclusions with each other in order to identify the most important similarities and differences. The final plenary session of the workshop agreed the following conclusions:

The need to understand the farmer:

We need to understand what motivates farmers to be involved in projects and to act as water managers. Motivation is impacted by their background and the availability of resources. A typology was suggested, whereby some farmers are motivated by knowledge and therefore enjoy sharing knowledge and information; some farmers are motivated by putting things into practice and need demonstration sites; and some are only motivated by economics and therefore need a strong business case to be presented. Experience suggests the first type is the easiest to engage and the last type the hardest to engage in research projects. It is important to use the most engaged farmers to act as 'environment ambassadors' to encourage other farmers and to spread the word about the Aquarius project.

The need to understand 'good farming practice'

We also agreed that there was no shared understanding of 'good farming practice'. Definitions vary between pilot regions despite having a common policy of 'cross compliance' under the Common Agricultural Policy. There are differences between the statutory requirements and voluntary best practice guidance; and farmers may have a very different idea of 'good farming' from the environmental regulators. Due to the reliance on CAP payments, the upcoming CAP reform due in 2013 will have an impact on farming and this should be considered within our project, although many farmers are more focussed on immediate survival than trying to anticipate policy shifts.

Climate Change & Water

We agreed that the data showed the potential for climate change in the future but it was more difficult to communicate what these changes might mean for farming practices, particularly in the near future. Climate change scenarios tend not to match farm business planning horizons. It is also difficult to communicate uncertainty, and to make decisions that might affect business when it is not possible to guarantee success. No pilot region will meet good ecological status in the first cycle, and climate change is likely to make progress towards this goal more difficult. It is therefore important to see this as a long term goal and to be realistic about the pace of progress. It is essential to focus on, and communicate, the importance of climate change and its impacts, not just the magnitude of the change.

Putting the farmer in context

Although farmers focus primarily on their farm-level business, they are influenced by the social, economic and regulatory context in which they live and work. Positive drivers to encourage engagement include the

provision of financial incentives, sharing good practice and success stories (through both advisors and from farmer to farmer), sharing information/data/knowledge; and promoting measures (both general and targeted). Regulations are also a driver to encourage engagement to act as water management, but are perceived more negatively than the above drivers. Sharing good water management options should give farmers more options to adapt under climate change than relying on more regulation. Therefore, it is important to consider how farmers interact with other stakeholders that also govern water and land management. Farmers often want to be respected by their peers and the local communities for their role in land and water management as well as producers of food. For example, combining buffer strips or nature friendly banks with recreational paths can introduce people to the agri-environmental work farmers undertake.

Equity

Engagement and building trust requires transparency. We agreed that farmers are very interested in the costs of acting as water managers and the distribution of both costs and benefits. From the start of any project, it is important to make clear who pays for what. This includes measures on farm, but also measures that impact others (negatively and positively) and how they are paid for. In order to discuss who pays, it is essential to know what the measures might cost. It is also useful to have demonstration projects that share information about the costs of measures and their ongoing maintenance requirements.

Working together

The best way to involve farmers in the Aquarius project is to analyse the problem together to generate a shared view of the problem. We need to build an acceptance of the problem before we seek solutions. We also need to explain the impact of the potential problem. Much of this process is reliant on building and retaining trust between the partners. Often the analysis of the problem, and the basis for seeking solutions, are contested as people interpret the data differently. This particularly true when using simulation models, although using computer based games can help with working with future scenarios and uncertainty. Using 'farmer friendly' language is also important. Having farmer ambassadors and using demonstration sites are most effective ways to get information about the project into farming networks. Sharing information about how to work together and find commonly agreed solution is therefore at the heart of the next phase of the project. If this done well, it will create a positive legacy for future projects in the pilot regions.

Two recommendations were made:

- Ensure farmers are involved in future transnational exchange visits
- Involve farmers in monitoring change using meaningful indicators

Good practice for future trans-national baselines

Reflection on this process suggested that although the process had been very ambitious for the resources and expertise available, it had 'kick-started' the project and allowed us to deepen our knowledge of our own projects and of each other's projects. In future, it is important to set realistic deadlines and stick to them, with a clear work flow set out in a diagram. It may be wise to collect less data but ensure consistency in quality and presentation. Using common units (including currencies and years) would help with

comparison. It would also be helpful to have a common checklist for each partner to check before submitting the final document to ensure consistency.

Next Steps:

The project is now moving into phase B on 'Key Methods'. New expert networks on:

- Modelling
- Planning
- Technology
- Cropping
- Market and financial instruments
- Participation

Have been set up in preparation for two method workshops in March and June 2010.

The workshop also discussed how best to improve trans-national working. The following suggestions were made:

- Develop a PowerPoint & popular report or magazine article about 'inspiring moments with farmers as water managers'
- Use participatory video to tell the story about working with farmers
- Use our website to share existing research on the catchment with one another, divided into relevant topic headings
- Use the email lists and share point to ask questions – wiki page could allow us to build a knowledge base; and we should all list our expert knowledge under our description on share point
- Use the transnational meetings to meet other experts not immediately involved in Aquarius by having spin-off networking events (e.g. a marketplace to provide information about other research and projects of potential interest)
- Focus on the potential impacts of the CAP reform during our meetings in 2011

Annexes

Please find below the entire baseline report for each pilot region starting with Delfland and finishing with Sweden.

Delfland

The Norwegian baseline report can be found at: http://www.aquarius-nsr.eu/NR/rdonlyres/E5F2BF63-E121-4037-80A0-7B59A3018BDA/0/Delfland_Aquarius_Baseline_report.pdf

Denmark

The Danish baseline report can be found at: http://www.aquarius-nsr.eu/NR/rdonlyres/15E69F6F-1289-4BD2-86CD-50B3B3ADA78A/0/DK_Aquarius_Baseline_report.pdf

Drenthe

The Drenthe baseline report can be found at: http://www.aquarius-nsr.eu/NR/rdonlyres/A4BAED85-81B8-4775-B33C-0283585D7A86/0/Drenthe_Aquarius_Baseline_report.pdf

Germany

The German baseline report can be found at: http://www.aquarius-nsr.eu/NR/rdonlyres/93AAF44A-BFEC-4EC3-994C-FD36A022DB95/0/Germany_Aquarius_Baseline_report.pdf

Norway

The Norwegian baseline report can be found at: http://www.aquarius-nsr.eu/NR/rdonlyres/B989E573-7084-4957-9E8F-207E0F2A6284/0/Norway_Aquarius_Baseline_report.pdf

Scotland

The Scottish baseline report can be found at: http://www.macaulay.ac.uk/aquarius/documents.html

Sweden

The Swedish baseline report can be found at: http://www.aquarius-nsr.eu/NR/rdonlyres/6461095A-A4A9-4A6C-938D-8718E9A3C9BA/0/Sweden_Aquarius_Baseline_report.pdf

Useful Project Links

Other projects that might be of interest to the partners include:

http://www.fao.org/nr/water/infores_databases_climwatPRINT.html