



ADAPTATION TO RAPID CLIMATE CHANGE: GRASSHOPPERS AND RESILIENCE

**Report on the Rapid Climate Change Project Workshop
Plas Hafryd Hotel, Narberth**

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Summary

The Rapid Climate Change Project is a one-year ESRC-funded research project to investigate adaptive capacity in the UK to extreme climatic change. The aim of the project is to examine how organisations and networks in the rural sector might respond to the stresses involved with rapid changing circumstances, such as a hypothetical sudden climactic cooling in Europe introduced because of a state change in the North Atlantic ocean circulation.

As well as developing a theoretical and methodological framework for assessing the institutional constraints and opportunities that shape adaptive behaviour to rapid climate change in the UK, the project aims to provide a space to think through the implications of different climate change scenarios for local, regional and national stakeholders. The project leader is Dr Mark Pelling, a human geographer with expertise in social adaptation to climate change.

The first stage of the project, the construction of a framework, is now complete. The framework identifies opportunities to expand the understanding of adaptation by drawing on theories of social learning, social capital and organisational development. The second stage of the project involves work with decision-makers and managers to test and refine the framework through a set of workshops on rapid climate change and the rural sector. As part of this, a two hour workshop was held in Narberth with Grasshoppers, a farmer's discussion group.

The workshop consisted of presentation and discussion, around two themes. The first consisted of an exploration of the implications of two climate change scenarios for dairy practice under the New Zealand system, the set of practices which Grasshoppers was set up to collectively explore. These scenarios were developed during an earlier workshop with the Environment Agency Wales. The second theme concerned the characteristics of the members and the group which enable adaptation to change. This report draws together the background material behind the presentation, in conjunction with the responses of those present. Final research outputs will be available from June 2004.

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Workshop Rationale

The members of Grasshoppers, as a group, have demonstrated an ability to respond to changing economic conditions within the dairy sector. They have achieved this by changing their farming practices and developing an organisational form that supports them in doing so. Their current mode of practice is probably better adapted to climate warming than conventional dairy production in the UK, and significantly more flexible too. Nevertheless, under any extreme climate change scenario, there would be substantial challenges to be faced, and a cooling would place a large stress on the current production system and the livelihood it supports. Given the proven adaptive capacity of the group, exploring how they might meet such a challenge and the social and individual resources they could draw on to do so offers an important opportunity to throw light on how farmers and other managers could respond to rapid climate change.

The workshop as research

From the researchers' point of view, the workshop forms an important research activity alongside interviews, compiling secondary data and literature review. It presents an important opportunity to ground-truth theory, establishing whether processes highlighted by theory have much importance in practice. As such, it was emphasised during the workshop that the discussion was considered research data. In return, a commitment was made by the research team to circulate this report to those present during the discussion for comment and to ensure that data arising from the workshop is anonymous. The expected research outputs which will draw on the experience of the workshop include this report and various academic papers. The report will be used as a working document within the research project, and will be available to research participants, as well as being placed in the ESRC data archives. There are no plans to publish it any further.

It is worth emphasising that this research comprises a social science investigation into the response of policy and management systems to climate change. It is designed to further understanding of the social capacity to respond to environmental stress, rather than move forward the physical science of climate change. Therefore although knowledge drawn from the physical sciences was used to establish a hypothetical cooling scenario for use in the project, it is acknowledged that this represents an unlikely series of events within the next 100 years. However, this is what makes it interesting social research, because an unlikely, extreme scenario is expected to draw forth more understanding of generic adaptive capacity with organisations, networks and policy systems, than those scenarios for which contingency plans are in place.

The workshop as a learning process

As well as a research exercise, the workshop was designed to offer participants an opportunity to learn more about climate change, and the effect it might have upon their livelihoods. This was done through presenting scenario information from a previous workshop, through offering the opportunity to ask questions and by triggering discussion within the group on the effect of different seasonal temperature and precipitation patterns.

The workshop was also designed to be enjoyed, following on after one of Grasshoppers' monthly meetings and a meal. The tone was light and informal; with space for participants to leave if need be. Although a programme was circulated in advance, the intention was to respond to the interest of those present and adapt the agenda to emphasise those topics that appeared of most interest. As a starting point, the following three questions were proposed in the programme:

- What would dairying look like in a cooler Wales?
- How could farmers respond to the challenge?
- What benefit do the members of Grasshopper get from their association, when things are difficult?

Adapting to climate change

In the public consciousness, dealing with climate change is largely tied to the idea of mitigation. That is by reducing the amount of greenhouse gas in the atmosphere by reducing their emissions, or by increasing the rate they are absorbed from the air – by planting trees, for example. However, there is an increasing awareness in policy and research circles that some degree of climate change is inevitable, and questions are being asked about the extent to which social and natural systems will be able to adapt, and what action will be necessary under different types of climate change, in order to limit the damage done and take any opportunities that arise.

Types of adaptation

There are many different types of adaptation, and an important distinction is between generic and specific adaptation. That is adaptive capacity can be considered in terms of responses to particular risks, as well as in terms of more generic capacity – the characteristics of a system which can be said to enable it to adapt to a wide range of interacting stressors. This opens the question of whether there is a trade-off between generic capacity and capacity to deal with specific risks, or whether the two types of adaptation are complementary.

In order to explore the tensions between generic and specific adaptation, the focus of this workshop was not about particular adaptive strategies per se. It was designed to examine how adaptive responses arise from the formal and informal institutional settings in which Grasshoppers operates. This fits with the focus of the project on the opportunities and difficulties presented by the conjunction of managed and unmanaged spaces in policymaking and management.

Another important distinction is between anticipatory and reactive adaptation. Given the focus on rapid climate change, the project concentrates on the former, looking at the organisational and cultural elements that might help build adaptive capacity before climate change hits hard. Almost by definition, if one waits until rapid climate change begins, it is too late to do much about dealing with it, and one's options are perhaps more restricted than they need to be. However, a consideration of reactive adaptation is also important, because assessing how systems might react in the future reveals opportunities and weaknesses that can be addressed in the present.

Adaptation and unmanaged spaces

A key research question for the project is how different forms of social relationships enable adaptation and change. Therefore attention was paid during the workshop to the institutions – the rules of the game – that enable members of Grasshoppers to learn and adapt as individuals and as members of the group. In particular, the research team were interested in gathering evidence about the relative importance of and relationship between formal and informal institutions. It is suspected that the ability to respond to unknown risks (as opposed to one's that have been planned for) lie at the boundary between the formal and informal, within less managed spaces where there is enough order to act effectively, but enough space to change quickly.

That is, our research suggests that opportunities for learning and communication arise from the informal networks that interpenetrate the formal structures of social life. In much of the academic literature, this 'shadow system' is treated as either too complex to adequately describe or a source of corruption and inefficiency. However, there is a range of evidence within management studies that shadow networks are not only potentially beneficial, but that they form an absolutely crucial part of any effective organisation.

The theoretical development within the project proposes that informal institutions are neither so complex that they can be treated as random noise, nor an inevitable source of corruption and inefficiency. While less managed spaces are resistant to management, understanding how they give rise to learning and adaptation may suggest ways that they can be strengthened or mitigated against. Studying shadow systems, in conjunction with the formal organisational structures it lies alongside, therefore offers an opportunity to better understand adaptive capacity and the potential of the UK rural sector to successfully adapt to rapid climate change and other extreme circumstances.

Grasshoppers and the New Zealand Grazing System

Origins of Grasshoppers

Grasshoppers is a dairy farmer's discussion group that meets roughly once a month. The group began about six years ago, on the back of a visit from a party of New Zealand proponents of a new set of dairying practices. A few of those who attended meetings with the New Zealanders were enthused to change the way they approached dairying. As a result, Grasshoppers was established to enable its members to compare their dairying and business practices and to explore whether what became known as the New Zealand grazing system would work for them in Wales.

"When the people from New Zealand came over here, everyone had the opportunity to meet them"¹

"All farmers had access to them, but less than 1% took it on"

Since its early day, the group has evolved. Although not all members of Grasshoppers joined with the intention of changing their practices, the

¹ Quotes of this form are drawn from the notes made by the research team at the Narberth workshop.

intensive scrutiny of the group on each others' businesses has converged on a reasonably standard set of practices:

"It's changed a lot. To start with, everyone was doing their own thing. Now we're fine tuning.. So it's just more of the same."

Group support is essential, because:

"The NZ system is a tremendous challenge"

Meetings consist of a farm visit, where each member takes a turn to host the others around their farm. They characterise the meeting as sharply critical, but value the opportunity to get advice and criticism from the others. Over time, the culture of the group has encouraged innovation and careful management of resources. Together with the nature of the individuals who have joined, the result is a group of farmers who are successful at a time when the UK dairy industry is under severe pressure, and when most dairy producers struggle to sell milk over the cost of its production.

The New Zealand Grazing System

The New Zealand grazing system centres on careful manipulation of herd numbers in relation to the ability of a holding to support grazing.

"Under the NZ system, we measure grass growth on a scale from 0 to 100, with 100 being the maximum. So in May, you get maximum growth, this dips down to 60 in the late summer, and then down to zero in December. In January, it starts to pick up again, climbing back up to 100 by the next May. We stock at a rate which is supported by the grazing at a rate of 75. That means we grow enough grass over the summer to make hay for the winter. We also don't do an Autumn calving, which means that we don't get milk for three months of the year, but that's more than made up for by the lower input costs. When the cows are dry, their feeding demand is about halved."

The combination of conserving hay for the winter, turning cattle out earlier in the year than standard practice and calving only once a year (cows that are not giving milk consume about half the amount of feed), means much lower input costs. In particular this includes little or no spending on winter feed and reduced labour costs to care for intensively housed cattle. Thus although less milk is produced than under a more intensive regime, the profits are greater, and the farmer has more time to pursue other interests.

Rapid climate change: Warming and cooling scenarios

In terms of the geological climate record, the last 10,000 years have been relatively stable, but there is now considerable evidence that the global climate is changing rapidly. There is still some debate about the role of human agency in this, but there is an increasingly strong consensus that humans are at the very least contributing to climate warming. This is bolstered by the close fit between models that include human greenhouse gas emissions and existing climate records. The 1990s were not only the hottest decade this century, but the paleo-environmental evidence shows that they were probably the hottest for the last 10,000 years.

Defining 'rapid' climate change

Nevertheless, from a social science standpoint, rapid climate change is difficult to define, because of the long timescales involved in climate change processes relative to the human timescale. Climate change over several decades can be considered extremely rapid in geological terms, and yet still exceed policy and management horizons by a considerable margin. There is no consensus amongst the climate research and policy communities on what constitutes rapid climate change, and the IPCC definition is fairly tautological, defining rapid climate change in terms of changes that are abrupt, unexpected or rapid. The difficulty is tying this to particular timescales and physical sets of circumstances.

Therefore, within this project, we have defined rapid climate change in terms of the worldviews and expectations underpinning the policy and management systems that we are interested in. That is, rapid climate change is a counterintuitive shift in climate, falling outside of established planning boundaries and therefore potentially requiring an active response. It is thus a relative term, coming into existence when the scope of any analysis is set and changing as the boundaries of the system being analysed are redrawn.

In terms of dairying at the farm level, rapid climate change therefore consists of changes which challenge the livelihood strategy of farmers and where effects become known within the management frame of the farmer. When asked about management horizons, the consensus at the workshop was that these were quite short.

"We have a management cycle of 1-5 years. Changes in less than 1 year are impossible."

"We're dealing with a biological system, then put climate change on top, there is a flexible mindset... we have to adapt virtually on a day to day basis. Planning ahead all the time – 6 weeks is my planning horizon. This is very different to where we were 5 years ago: now we're proactive, then we were reactive."

This suggested that climate change could be considered rapid when it began to affect business results:

"At the end of the day, it's a problem when it hits you in the pocket."

Thus on the face of it, incremental global warming could not be considered rapid, similarly even an extreme cooling scenario with a lead-in time of a decade should really be considered rapid relative to the management of Grasshoppers farmers.

On the other hand, there is was considerable evidence that the New Zealand system is sensitive to climactic trends:

"We run a herd to maximise grazing, soil temperature is the key."

"Grass begins to grow when the soil temperature reaches 4.5°C."

"The late summer dip in productivity is due to lack of moisture."

“We get a peak of humid heat in May. A cooler summer would give you a flatter curve.”

**Thus one could consider rapid climate change in terms of how quickly and with how much warning critical thresholds are reached, which enable or prevent particular livelihood strategies to be adopted relative to management time horizons. Furthermore, climate change on the scale of decades could conceivably have an effect in terms of life events such as retirement and decisions about the inheritance of the farm.

Climate change scenarios

Two scenarios for the future of the Welsh climate, developed during an earlier workshop at the Environment Agency, were used. The first scenario was based on a mainstream ‘high emissions’ model; that is, a widely accepted model of the future of the global climate, assuming that greenhouse emission continue on existing trends. The second was based on a ‘reasonable’ hypothetical version of climate cooling induced by a switch in circulation patterns in the North Atlantic (THC or thermohaline circulation) some time in the middle of this century. The effects are discussed below, and details of the scenarios are given in Appendix 1. Some figures showing the result of the switching of the North Atlantic circulation are given in Appendix 2.

It should be noted that although the two scenarios were presented side by side for purposes of comparison, this by no means assumes that they are equally likely. The scientific consensus, backed up by extensive research, is that anthropogenic climate warming is currently taking place, and that the models underlying the warming scenario here represent the best available knowledge of current and future climate trends. At present, much less study of THC climate cooling has taken place, but the consensus is that it is very unlikely in the near term, and less over a policy priority over the next 100 years than warming.

Climate warming scenario

The warming scenario suggests a steady rise in average temperature over the next 70-80 years. The result is a climate which is around 1°C-3°C warmer overall, with drier summers but greater overall precipitation. Comparing Cardiff in 2080 with present-day cities along the Western European seaboard, this gives a climate like present-day La Rochelle or Biarritz² in terms of temperature, but significantly wetter than either during the winter and drier during the summer. Extreme weather is likely to increase, along with the general variability of the climate.

The workshop in Cardiff explored a range of potential consequences for this scenario for the rural sector in Wales, which are given in full in Appendix 3. The most significant for dairying are:

- Late summer grazing reduced – may be compensated by increased grass production overall
- New pests and diseases (overwintering possible)
- Heat stress amongst people and livestock
- Soil loss due to flooding

² This comparison is for the purposes of illustration only.

- More difficult to use the land effectively
- Increased diversification opportunities
- Crop diversification possible, especially on the coasts.

At Narberth, the participants at the workshop considered whether the effects of warming was already becoming apparent:

“Six years ago if you had suggested that we could grow grass in January, a lot of us would have told you to take a hike.”

“There used to be a month of frost a year, this morning was the first frost for 2½ years.”

“In the early 80s we used to get four weeks of frost, that simply doesn't happen now.”

Generally it might be expected that dairy farming could benefit from climate change. Although pasture production is likely to be lower at the end of the summer, grass production as a whole is expected to increase by 20-30%³, especially if pasture managers take into consideration the comparative advantage of different sward mixes under increased temperature and atmospheric carbon dioxide. The New Zealand systems would be particularly advantaged, because of the opportunity to capitalise on increased grass growth and because:

“Warming would effectively shorten the winter season.”

That is, there would be less need for winter housing for stock.

Climate cooling scenario

The cooling scenario follows from a change in the circulation pattern in the North Atlantic. At present, the Atlantic seaboard of Europe enjoys a 'heat subsidy' from the tropics, carried in by the Gulf Stream. This circulation depends on a return flow of colder, polar waters. The paleological record shows that this pattern of circulation is one of two stable states in the North Atlantic, (see Appendix 2) and that there is a history of switching from one to the other and back again.

A shutdown of the present circulation pattern could be induced by the introduction of vast amounts of fresh water in the Arctic Sea, through a combination of the melting of the Arctic ice-cap, increased precipitation over the North Atlantic region and an increased flow of river water from Siberia as the permafrost there melts. The result would be a shift to a second state where the heat subsidy would cease to be available. Because the shutdown state is stable, the change would be very difficult to reverse, and the result would likely be a significant cooling over an extended period. The evidence is that this is scenario is unlikely this century, that the later it happens, the more it will be compensated for by warming, and that the past analogue applies to a different set of conditions (ie lots melt water from retreating glaciers in N America).

³ See Hopkins, A., Topp, K. & McGehan, M.B. (2003). **Influence of climate change on the sustainability of grassland systems**. DEFRA Project No. CC0359, Institute of Grassland and Environmental Research, Okehampton

Nevertheless, in order to explore the impact of rapid climate change, the project has drawn on one of the most extreme physically plausible scenarios possible. Under this cooling scenario, a 2° C rise in temperature would be followed by a 4°C drop sometime during the middle of the 21st century. This is analogous to a Welsh climate similar to SW France before the shutdown, and like N Scotland or S Norway afterwards. The models on which this scenario is based are not as well developed as for the warming scenario, but they suggest strongly that seasonality might increase with more ice and snow and winter. Extreme winters (like the winter of 1963, with snow on the ground from Christmas until Easter) could become as frequent as 1 in every 7 years. There would be a ten year lead in period from the time when it became clear that the change was happening, until the full effects were felt.

Potential impacts on dairying include:

- Either reduction in stock or capital spending on winter housing.
- Loss of winter growing season – less grazing implies less protein production.
- Soil loss due to flooding.
- New opportunities for secondary employment.
- Transport disrupted.
- Less access to services during winter.

At the workshop, it was suggested that cooling would disadvantage the New Zealand system compared to intensive dairying:

“Mr Average would be better off.”

“Our system depends a bit on the overwintering of grass, so that the cattle can begin to graze on grass that grew at the end of the last season, while the next lot of growth kicks in. We would need to use more winter feed if cattle were to graze outside longer (there would be a shorter period for the grass to recover over the winter).”

“The main effect of your scenario would be to raise the cost of production, it would negate our current gains.”

However, the group also felt that the indirect effects of climate change would be the most significant. If cooling in Europe was accompanied by a drying of the tropics, this would have a dramatic impact on the economics of commodity production:

“The change is likely to be economic.”

“The most important impact of cooling would be the changes it caused to the global food system. Economics would drive what we do, this is much more important in terms of what we do than the direct effects of the climate. Somewhere else could be better for milk or be able to produce food inputs so there would be shifts (the implication being the group members would be adaptable enough to leave milk production).”

Higher commodity prices would change the rationale for adopting the New Zealand system, and might even mean a shift away from livestock farming altogether, if other types of farming became more profitable in Carmarthenshire.

The challenge: maintaining livelihoods in a changing climate

In short, climate change of any sort brings both risk and uncertainty. Under different climate change scenarios, there are likely to be many significant effects on the viability and efficiency of the New Zealand system. The challenge is all the greater, because of the uncertainties surrounding climatic change, and in particular rapid climate change. That is, the problem is perceived to be more to do with sudden changes, than long term trends, and these are by their nature harder to predict:

“When is a bad year climate change?”

“A problem would arise with a sudden change, rather than a gradual one.”

Changes in the conditions which make the New Zealand system successful would in turn require change in the way that the system is currently implemented by Grasshoppers, either to capitalise on new opportunities, or in response to decreasing returns under different climactic conditions.

However, what came across strongly in the workshop is that it may be the indirect effects, such as the impact on human health, the need for more active management of wild species, and changing market conditions, that are ultimately more important. These would all result in new political and economic pressures on farmers, across a range of timescales. The challenge would be to adapt to change as new pressures arose, while conserving the ability of members of Grasshoppers to maintain their ability to make a satisfactory living. From a policymaker or researcher’s point of view, this indicates a need to bring together different areas of interest that have traditionally been treated as separate, with their own distinct institutional settings.

Assessing adaptive capacity

A core aim of the project is to develop and ground truth a theoretical perspective that reveals the capacity of organisations and individuals to respond to uncertainty. While there are many tools to deal with managing risk (which is quantifiable), there is a dearth of methodology to assess and respond to environmental hazards such as rapid climate change, where risks and costs are hard to quantify as basis for decision making. This is because although rapid climate change hazards are generally considered very unlikely, the science behind understanding them is less developed than for more mainstream scenarios.

Therefore, starting from the assumption that it is not plausible to prepare contingency plans for every eventuality – and that even where contingency plans are in place, they may prove to be based on inadequate assumptions – our research boils down to the question, “What else is possible?” That is, do we have to wait until events which have not been anticipated or taken seriously to arise before we can say anything about them? Or is there any way of assessing and perhaps improving the ability of social units such as organisations, businesses, economic sectors, families and communities to respond to unknown and uncertain hazards?

Through an exploration of the academic literature on resilience, learning and change, a theoretical framework has been developed in the project that

emphasises the importance of both formal and informal institutions and relationships as a source of capacity to successfully adapt and change. The mainstream thinking on institutions tends to discount culture and non-formal social structures as either too complicated to understand, or in purely negative terms – a source of tension, resistance and corruption – and instead focuses on formal management tools and institutions. The rapid climate change project instead takes the line that informal structures are a vital part of understanding adaptive capacity to respond to uncertainty. That is not to say that informal institutions do not have a negative side, but rather that that is not all there is to them, and as a neglected aspect of adaptive capacity, they require further exploration and study.

In order to explore the shadow systems that lie alongside the more visible formal institutions and organisational structures in the rural sector, the project framework points to several themes that are expected to draw out important adaptive features of different institutional settings. The themes of *community* and *network*, *trust* and *exclusion* are used in this report to draw out what seems important about Grasshoppers in terms of *adaptive capacity* and *learning*. These categories have been chosen because they unpack experience of social realities and cut across formal and informal relationships. Using the categories does not mean deciding whether something is a community or a network, or whether more trust than exclusion is present, but rather examining what seeing things in these terms reveals. Our hypothesis is that doing so will highlight features to do with learning.

In part, the fieldwork within the project is designed to establish that these themes are important. That is by exploring different organisations and contexts within the rural sector in these terms, it is possible to form judgements about how useful the framework is. But equally important to the research is the methodological point that those people who live and work within the contexts the project sets out to study are best placed to make judgements about the shadow systems embedded there. The framework is not something that stands on its own, but is intended to combine the knowledge and understanding of insiders with an external critical perspective that asks questions rather than answers them. Therefore we invite responses to the picture drawn below. It is a work in progress and will be improved if the members of Grasshoppers are willing to challenge the research team on points that have not been properly understood or are being misrepresented.

Community

Community, with the RCC project framework refers to relationships founded in shared identity. Understanding a situation in terms of community therefore focuses on feelings of similarity with other members of a social group, and difference to others. In a community, mutual interest is assumed and therefore sharing is the norm in many cases. Trust and acceptance are therefore common, though equally the penalties for breaching trust or challenging what it means to be part of the group are high. The project theory suggests that as an environment for learning, communities are often supportive, but also direct learning very strongly. This can be a weakness, because becoming a member of a community means taking on an identity, with all that that entails, and that can include an inability to challenge

particular ideas or examine facts critically where they conflict with strongly held values central to the group identity.

Seen as a community, Grasshoppers seems to have a strong and well developed shared identity. A healthy group identity was evident in the way that the uniqueness of the group was emphasised throughout the workshop, for example:

“Grasshoppers is unique.”

“The group has an intimacy that is quite unique.”

Also, there was no evidence of conflict between group membership and the existing social ties of individual members. Indeed, if anything the opposite seemed true:

“Social issues are important. The wives and children can get together, and there’s a relaxed setting for the family.”

The size of the group and the opportunity to spend time with similar people were important features of the group as a community:

“These groups only work if you have 20 or less.”

“[A group needs to be] small, with likeminded people, prepared to be wrong with change (binds the group as they all went in the same direction against the grain).”

“Important factors for a successful group are like-mindedness and size.”

In the early days, membership was related to individual’s choices when presented with the New Zealand system

“The group was self-selective in the early days. Only one in three of those who were going to the early talks have kept it up.”

*** However, the group has changed and grown since its inception. It was created intentionally, but has moved towards a situation where new members are recruited through invitation, reinforcing a shared and distinct group identity

“The group did not come by accident, it was picked.”

“It is an evolving thing. Newer members have been poached off other groups!”

So the question raised by seeing Grasshoppers in terms of a community is, “A community of what?” What shared purpose is the identity of the group members organised around?

It seemed clear from the workshop that membership does not focus directly on joint commercial activity. That is, while Grasshoppers meets in order to support their business interests, they do not meet to do business. There was some evidence that some Grasshoppers members had co-operated on buying equipment and supplies together, but this is not a core group activity. In terms of what is shared, the group is more concerned with knowledge, improving practice and mutual support in meeting the challenges of the New Zealand system, than with more tangible resources:

“Sharing information is really key, something I realise from these other farmer groups compared to us.”

“Rather than business co-operation, we decided it was better to have a combined search for knowledge.”

“It’s the support you get from the group that makes Grasshoppers special.”

“Group support is essential.”

“The group is good because it is about finance, but more than that it is about personal growth (all group members recognise this and this pulls them together).”

The group themselves linked this feel of being in a learning community to adaptation:

“Openness and sharing information is a major part of adaptation.”

Network

In contrast to groups as a community, seeing Grasshoppers in terms of networks emphasise exchange and difference. In a network, co-operation arises through negotiation rather than an assumption of mutual interest. As a consequence, networks are more tolerant of difference than communities, because it is difference that makes them work. However, more energy is required in order to support negotiation, and while trust develops through continued interaction, it is not as taken for granted as in a community. In terms of learning, networks are perhaps more open than communities to different perspectives, but there is no guarantee that others within the network are sharing everything they might if they perceived an inherent mutual interest. Examining Grasshoppers in terms of networks highlights external relationships, and once again the focus is on information and learning. That is, through Grasshoppers, members are able to tap into a set of relationships with other groups, with different identities. For example:

“The local NFU chairman is on the group but we do not have representatives of groups appointed.”

The strongest links though are with dairy farmers in other countries, drawing on knowledge formed in other contexts, because:

“Overseas is best. The UK is too mainstream (in dairy farming) – and we’re not! Also there is no basic/market research in this area because there is no commercial bias so it is not picked up on.”

“We can pick up on individuals etc overseas.”

At the time of the workshop, the group had a visitor from the United States who was specifically interested in learning more about the New Zealand system, with the intention of starting a dairy operation of his own when he finishes college. Links with New Zealand and Ireland were evident:

“We have connections with Ireland”

“Mobiles/e-mail etc means you can have friends in New Zealand or Ireland. It spreads information transfer... so no-one is alone.”

“The information transfer came from New Zealand – through the discussion groups.”

In this case, it is clear that some of the differences that lead to learning through formal and informal networks are due to contact with other contexts. It provides a wider set of practices and experiences to draw on. For Grasshoppers, this has enabled both improvements in existing practices, as well as more radical change, with shifts in livelihood and lifestyle goals. The questions raised by this observation are: (i) whether an international perspective would prove equally relevant for other groups and organisations interested in adapting to rapid climate change and other shocks, and (ii) whether this same opportunity would be available through comparison with other UK operators.

Because of the experience of the group of international networking, and because of the origins of the group in an examination of a system developed elsewhere, when confronted with the possibility of a severe challenge to the current system used by the group (ie rapid climate cooling), the workshop suggested one way of adapting to the new conditions was to look for examples of successful practice under whichever climatic conditions came to dominate:

“In terms of adapting to a different climate, you could go and look at places in the world where people already live with it. Now we have learnt from New Zealand, but if the climate cooled we would learn from other parts of the world.”

“Or from the UK, there is enough variation in the UK.”

Trust

Trust enables members of communities to interact more efficiently in pursuit of shared objectives. It consists of an expectation amongst people that that regular, honest and cooperative behaviour will apply in their interactions. Trust is said to build an environment in which enhanced learning is possible, because it enables members of networks and communities to share experiences, engage in dialogue (rather than just debate), and make mistakes without losing too much face. Trust arises within community through affirmation of shared interest, and in networks through repeated successful interactions.

In Grasshoppers, trust is closely tied to the duty of confidentiality that group members hold for one another. Trust within the group is closely tied with identity and membership, indicating that it arises first and foremost from the community aspect of Grasshoppers:

“Confidentiality is key, if that is breached that is it, new members are on probation!”

Trust enables Grasshoppers members to be open with one another about their financial affairs, something which has built up over time:

“Each of us knows the financial status of each other.”

“We all share our accounting information.”

“Trust is very important to the group’s functioning and this has taken time to build up. For example, Grasshoppers started with

members sharing limited information on the purely financial aspects of the grass economy. We now share economic and other information on all aspects of farmers livelihoods.”

This is possible because in terms of their dairy enterprises at least, there is little or no conflict of interest between them as businessmen:

“I used to be in another business – we don’t see ourselves as competitors, we are but we are not fighting for single customers.”

“Competition is not a problem so long as there are enough opportunities in the rural economy, today there are.”

“There has been some tension in the group, but its usually been where there has been some competition around non-dairy business enterprise.”(GI)⁴

The trust that has built up over time as a result has extended to other areas of their life than their financial affairs:

“Other than my wife and the nucleus of my family I’d talk with group members first (about a problem).”

“We all know when one of us is having problems.”

As a result, members of Grasshoppers feel they can rely on the information they get from one another (not something they can expect from other members of the farming community), not least of all because they can see for themselves:

“In the group you can trust one another both for accuracy and confidentiality.”

“There is a reliability to group data, an individual might rely on their own data.”

“Farmers are great at lying to suit their own ends. You can’t trust much you hear straight from people who’re not in the group. But within the group, you can benchmark the business against others.” (GI)

“We listen to other people’s opinions within the group.”

“It’s the respect you have for one another. It’s down to the individuals concerned.”(GI)

Within the group, trust also enables honest criticism of one another’s business. This is essential for Grasshoppers’ ability to fine-tune and adapt the New Zealand system. This is a special case because trust often involves the uncritical reproduction of a shared way of seeing the world. Instead, here the value that is conserved is taking risks and challenging individual perceptions, the essence of adaptive action. Radical learning is still possible at the group level, as evidenced by the stated willingness to move on from the New Zealand system to other solutions, if climate change required it.

⁴ References of this form are used to indicate quotes that came from interviews rather than the workshop.

There was some suggestion that the culture of critique was possible because the system was something that the group were learning to do, rather than their previous way of doing things:

“In the group it is not who is right but what is right that counts, and this attitude can only come with time.”

“Recipients (ie hosts of the meeting) get a lot of criticism.”

“It is a lot easier to deal with when criticism is of change, as opposed to the way a person has done things for year.”

It is clear that much of Grasshoppers success as a group results from their capacity over a number of years to build up trust, and create a good environment for learning. That trust is not without limits, and breaches of it threaten exclusion from the group.

Exclusion

The reciprocal side of trust is exclusion. In the case of communities, identities are defined as much by what they aren't as what they are, and so communities are founded in exclusion as much as in trust. This is true of Grasshoppers, which seems defined by a feeling of difference to others, as well as in an appreciation about their own strengths:

“Other groups have collapsed.”

“Others had fear of failure.”

“Risk tolerance in this group is higher than outsiders”

“We can't find any research on what we do in the UK, because we're not mainstream enough.”

“If you speak to farmers outside of the group, you put on a veil.”

“We're less top down than other groups”.

Those who are not trusted because they do not share the identity of a community can feel all sorts of subtle and not-so-subtle pressures from those on the inside. In the case of Grasshoppers, exclusion is particularly strong around alignment with the culture of open criticism of farming practice:

“If someone's not up to par, then ...”

“The group is closed. If you do not cope with the group (culture of critical assessments of each others farming practices) then you would leave.”

This can result in a personal challenge. The cost of membership is maintaining the group standards, and dealing with group dynamics:

I'd have to admit that at some points I've had to ask “Is this worth the extra hassle? Do I need to be a member of this thing?” But if you look at it in the longer term, I suppose everybody goes through points when they're extremely keen, and then not so keen. (GI)

In a network, where difference is a positive because it enables exchange, exclusion is more likely to arise externally. In the workshop, there were several references to communication initiatives by the group in the UK that had not fared well:

“We have as a group tried to involve an agricultural college, but with limited success.”

“You can’t talk to other farmers anymore because they’re boring.”

“We’re not as zealous as we used to be about sharing the NZ system. We thought we were being helpful, but we found we were perceived as being cocky.”

** It should not be assumed from the preceding discussion that trust is an unalloyed good, and exclusion bad or vice-versa. While it is certainly true that the learning culture with Grasshoppers has arisen through trust, it clearly depends on exclusion too. After all, potential members who cannot cope with the group culture are expected to leave. Similarly, while exclusion enables trust and learning, the question is what opportunities for learning are being passed up in the name of maintaining group cohesion?

Adaptive Capacity

During the workshop, the group were notably optimistic about their ability to adapt to challenges such as climate change, as and when they needed:

“Change is not a problem, it is exciting”.

“We’re flexible and adaptable.”

“The reality is we are pretty mobile, if we looked for something in a group like us we are flexible and adaptable.”

“There’re different levels of adaptability.”

“There is not a normal year, but because we are so flexible we can adapt to any year.”

When pressed about this confidence, they ascribed it to successful change in the past:

“The first change is the hard one.”

“Having initiated change, it wouldn’t bother us to change again in whatever direction, if it made sense.”

“There is confidence from past changes working. Have done it once, we could change again if we had to.”

The adaptive capacity of Grasshoppers seems to be founded in a learning culture. The group fosters learning amongst its members, and this brings significant rewards for the effort of remaining an active member:

“Discussion groups (like Grasshoppers) are the best way of learning – you can get to know each others businesses, better than a lecture theatre”.

“It’s like 20 heads learning at once, and sharing that information back. It would have taken me a lot longer to get were we are today.” (GI).

The learning culture results in and is supported by a set of learning practices on the part of individual members, reinforced by the group values:

“We measure ground temperature and climate a lot more than other farmers. When we see change we change our practices.”

The data we have seen is getting warmer. The response to this is to withdraw fertilizer and put cattle out earlier.”

“We have targets, and keep records day to day and month to month.”

“We farm proactively, whereas we used to be reactive”

“Proactive thinking means a focus on what you can control. As opposed to resisting the weight of the world”

A notable feature of the culture of the group was the willingness of members to change embedded practices to achieve important life objectives, even to leave dairy farming. This seems a strong contrast with many other farmers who feel stuck, feeling unable to make or even see the changes they need to to remain viable.

Secondly, the members of the group were happy to view Grasshoppers as something transitory. The formal structure of the group and even it's composition being something useful for the moment, but not necessary in itself. More important were the informal relationships that group membership had fostered. This suggests to the research team that the relationships giving rise to Grasshoppers as a learning culture, and taking their strength from it might prove a valuable social resource in forming other groups oriented towards addressing new challenges, if need be.

Conclusion

It seems fair to say that the conclusion drawn within the workshop was that Grasshoppers has the capacity to successfully adapt to climate change, even extreme forms of climate change. A strong group identity founded around improvement of dairy practice, sharing of information and networking with other groups overseas has successfully met the challenge of adapting to very difficult market conditions. The judgment made by the group was that the same skills would prove invaluable in adapting to climate change. It was felt that the challenge would be much harder for other farmers, who did not have the support and opportunities offered by the group:

“I really admire people who can do this on their own.”

“I think people outside the group would find it difficult to change.”

** If anything the main challenge at present, given the amount of fine tuning the New Zealand system has undergone, is keeping the group moving forward enough to maintain the interest of the members:

“We’re in danger of getting bored”

“Success has led to other interests. Other little groups could be set up coming from this group. There’s a danger we’re so successful that we’ll be dead in two years.”

“Individuals in the group have enjoyed change and challenge, now without further change would be bored.”

Further Research

This report represents an interim phase of the research: an opportunity for those invited to the workshop to reflect on the knowledge that emerged on the

day, and for the project team to formulate appropriate means for interpreting the information gathered. We invite comment in terms of both the accuracy of the portrayal and the conclusions we draw from it, which we will use to redraft the report as the most balanced representation of these issues we can achieve. This therefore represents a significant part of the data that the research is designed to collect, alongside output from other research processes in place. The Narberth workshop is merely one of several, with further events and interviews planned at DEFRA and the Environment Agency in Bristol. In addition, a set of interviews with several workshop participants and other key informants are anticipated, and will feed into the project as a whole alongside the workshop data.

Additional material and resources

There is a range of additional material available relevant to climate change and the rural sector in Wales. Most can be found on the National Assembly for Wales (www.wales.gov.uk) or DEFRA (www.defra.gov.uk) websites.

This includes:

- Farrar, J. & Vaze, P. (2000). **Wales: Changing climate, challenging choices - A scoping study of climate change impacts in Wales**. Commissioned Report, National Assembly for Wales, Cardiff.
- GNAW (2001). **Climate change Wales: Learning to live differently**. Report, The National Assembly for Wales, Cardiff.
- GNAW (2001). **Farming for the future: A new direction for farming in Wales**. Report, Government of the National Assembly for Wales, Cardiff.
- Hopkins, A., Topp, K. & McGehan, M.B. (2003). **Influence of climate change on the sustainability of grassland systems**. DEFRA Project, No. CC0359 Institute of Grassland and Environmental Research, Okehampton
- Hulme et al (2002). **Climate Change Scenarios for the United Kingdom. The UKCIP02 Scientific Report**. Tyndall Centre for Climate Change Research, School of Environmental Sciences, University of East Anglia, Norwich, UK.
- National Trust (2001). **Valuing our environment: The economic impact of the environment in Wales**. Study report, National Trust, Cardiff.
- MAFF (2000). **Climate change and agriculture in the United Kingdom** Ministry for Agriculture, Fisheries and Food, London.
- DEFRA (2001). **National appraisal of assets at risk from flooding and coastal erosion, including the potential impact of climate change**. Final Report, Department for Environment, Food and Rural Affairs, London.
- Willows, R.J. & Connell, R.K. (2003). **Climate Adaptation: Risk uncertainty and decision-making**. UKCIP Technical Report, UKCIP, London.

Relevant work with a more international perspective includes:

- IPCC (2001). **Climate change 2001: Impacts, adaptation, and vulnerability**. Cambridge, Cambridge University Press.

Abildtrup, J. & Gylling, M. (2001). **Climate change and regulation of agricultural land use: A literature survey on adaptation options and policy measures**. Literature Review, Danish Institute of Agricultural and Fisheries Economics, Farm Management and Production Systems Division, Denmark.

Appendix 1 – Climate warming and cooling scenarios

(Prepared by John Dearing)

Mainstream Scenario: Welsh climate in the 21st century

(UKCIP98 predictions for 2080 – 250km x 250 km grid size)

- greater warmth all year round by 1.1-2.9 °C
- more precipitation in winter by 7-24 %
- less precipitation in summer by 7-14 %
- greater annual precipitation by 2-9 %
- a rise of sea level of 18-79 cm
- a higher mean windspeed by 1-4 %
- more evapotranspiration by 13-27 %
- more variability from year to year the number of extreme years will increase
- more frequent and more rain in violent storms intense storms
- more drought years by 10 %
- more very severe gales by 10 %

Drawn from:

Wales - Changing climate, Challenging choices, Summary report February 2000. The National Assembly for Wales

Cooling scenarios for Wales/Central England

'Reasonable' mid-21st century scenario – a 2°C rise in mean temperature followed by a ~4°C cooling.

	max temp	mean temp	min temp
modern (Cardiff)	16	10	4
future pre-shut down	18	12	6
future cooling	14	8	2

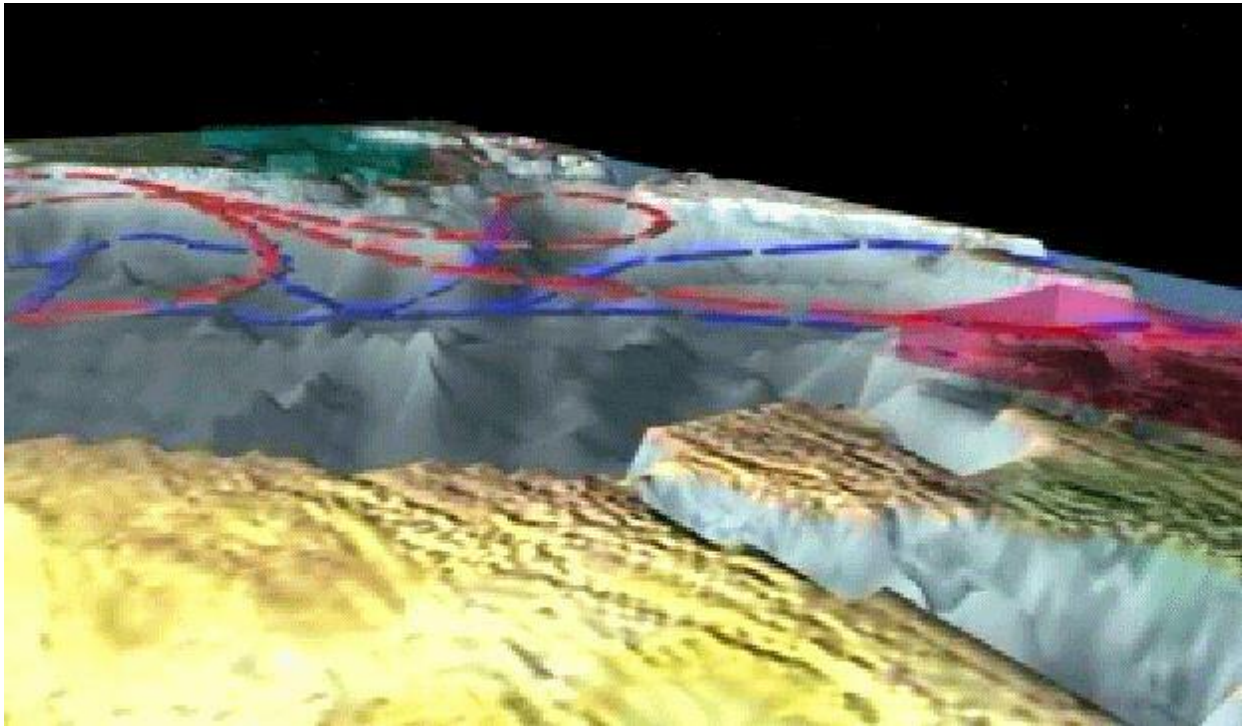
- Still believed to be low probability, high impact in next 100 yr – but THC (thermo-haline circulation) is weakening.
- Future pre-shut down scenario similar to SW France.
- Cooling scenario similar to N. Scotland/S. Norway.
- The above *mean* cooling scenario is as cold as the coldest *single year* in 17th C Little Ice Age.
- Could take place within 10 years after shutdown.
- Probably a more disproportional temperature reduction in winter – i.e stronger seasonality – with more ice and snow days.
- Reduction in growing season
- Dislocation of sectors in more frequent exceptionally cold years (eg. 1963 winter becomes a one in seven occurrence)

Wood, R.A et al (2003). **Phil. Trans. Roy Soc. Lond. A.**, **361**, 1961-1975
BBC Horizon, **The Big Chill**, 2003.

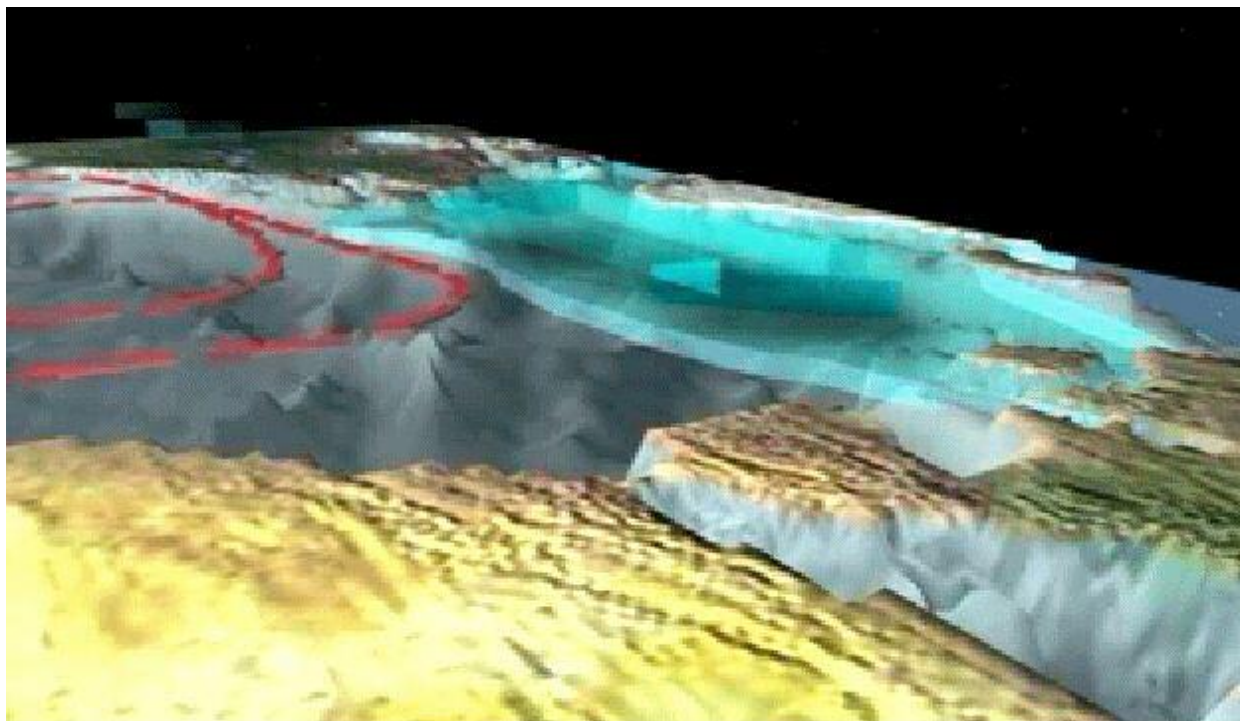
www.worldclimate.com

Appendix 2 – Thermohaline circulation

Normal state – as it is now



Abnormal state – as it will be in 2080?



Change in annual temperature 30 years after a collapse of the thermohaline circulation

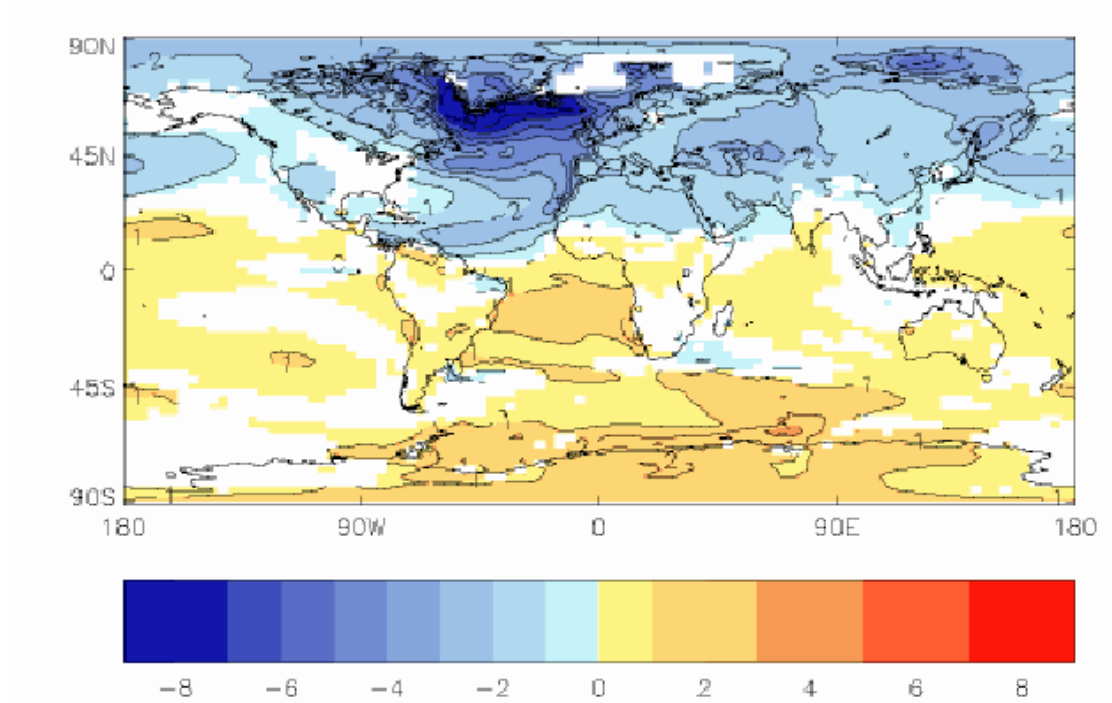


Figure courtesy of Michael Vellinga, Hadley Centre. (from web-site)

Appendix 3 – Warming and cooling scenarios in rural Wales

Possible implications of warming and cooling scenarios for the Welsh rural sector (From the Cardiff Workshop)

Climate Warming Scenario	Climate Cooling Scenario
<u>Climactic effects</u> Increased rainfall and flooding over winter Higher temperatures overall Drier, hotter summers Similar to S France (Atlantic Coast) or North Spain	Increased flooding in spring due to snow melt Lower aggregate temperature Cooler Significantly colder winters 1 in 7 winters 'extreme' Similar to N Scotland or S Norway
<u>Rural development</u> Diversification opportunities Increased rural population	New opportunities for secondary employment Rural de-population Transport disrupted Less access to services during winter
<u>Health</u> Increased respiratory disease in (wet) winter New diseases Heat stress Pollution effects?	Increased respiratory disease in (cold) winter
<u>Agriculture</u> Soil loss due to flooding New pests and diseases (overwintering possible) Late summer grazing reduced – may be compensated by increased grass production overall More difficult to use the land effectively Crop diversification possible, especially on the coasts. But soil quality mitigates against this	Soil loss due to flooding Reduction in stock or capital spending on winter housing. Loss of winter growing season – less grazing implies less protein production
<u>Forestry</u> Timber productivity up while quality down Use of trees for water management?	Timber productivity down while quality up Pressure on forestry management More forestry on marginal rural land?
<u>Biodiversity</u> Links between habitats are important for biodiversity as climate changes, because wildlife corridors allow	Links between habitats important for biodiversity as climate changes More active management of species

species to migrate to more favourable areas as conditions change. Loss of sphagnum moss Pollution effects?	migration needed than under warming scenario Eco-restoration possible?
<u>Tourism</u> Generally beneficial in terms of volume No extended winter season Fares well in comparison to competitor destinations Storm and flood damage to facilities Loss of 'Green Wales' image	Tourist volume decreased overall Possibility of development of winter sports trade Seaside market in decline
<u>Other industries</u> Less trouble with water supplies than in England	Shellfish production crashes (temperature sensitive) Possible loss of 'footloose' industries

There are a number of similarities between the two scenarios. In general terms, both point to a combination of long-term stresses and short-term shocks during a transition to a new climatic state. Both also demonstrate strong seasonal variation in their effects on tourism and agriculture. Furthermore, the workshop suggested that under both scenarios, there would be increased erosion, negative health effects and challenges in conserving biodiversity, as well as new opportunities for rural livelihood diversification.

The differences between the scenarios can be seen in terms of the direction of several trends (eg timber quality vs. production, tourist volume and shifts in the urban/rural population ratio). Warming is more gradual, with a longer lead in time, and offers much less variation in mean temperature than cooling (which encapsulates further warming first). The effect of cooling on the agricultural industry is more likely to be negative, whereas warming may increase opportunities. Finally, there are some scenario-specific effects, such as the loss of shellfish fisheries under cooling.