VCCCar
victorian centre for climate change adaptation research

VCCCAR think tank report

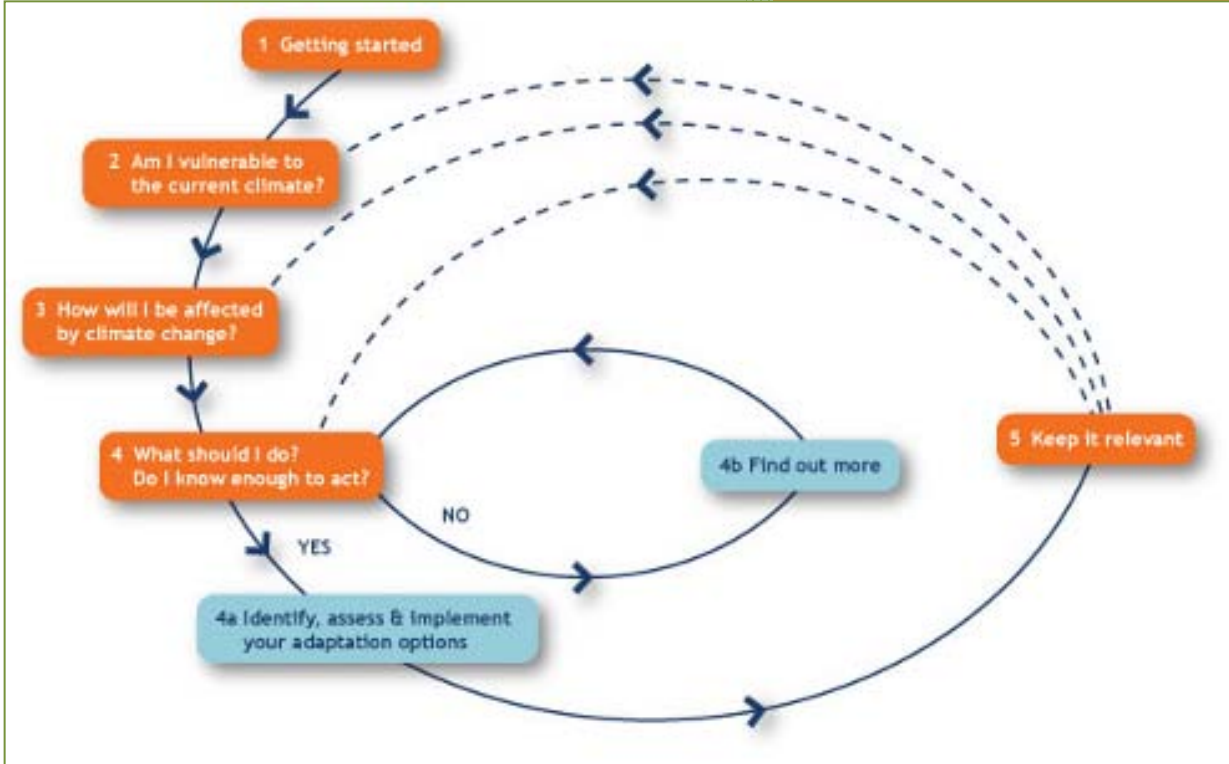# Adaptive learning – a think-tank on preparedness for climate change adaptation in local and state planning in Victoria

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Contents

Executive summary

Adapting to climate change requires new approaches to strategic planning at state, regional and local scales and the development of learning organisations at all levels of government. In this think tank, held at Northcote Town Hall on 5 July 2010, local policy and decision makers worked with overseas experts to consider how to better integrate adaptation in state and local planning. Adaptive learning is a continuing and long-term process. Large scale social change is required to recognise climate risks and effectively respond to them. It should not take disasters to provoke action or create the realisation that governments or communities are not sufficiently well-prepared to deal with the impacts of climate-related events.

Key points emerging from the think tank were:

1. Priority setting

- Responding to climate change involves understanding and managing climate risks, addressing 'adaptation deficits' and building response capacity.

- Responding to climate change involves analysis and identification of new organisational structures for regional and local planning, involving improved consultation and engagement with communities and industries.

- We need better frameworks for assessing climate change impacts – there is a lack of agreement on appropriate assessment techniques.

- There are some immediate, low cost options that could be implemented to improve adaptive capacity. For example, an early warning system for extreme temperatures could be developed relatively easily.

- There is a need to go beyond case studies to generate comparative studies of the costs and benefits of climate change adaptation options using a rigorous and consistent assessment framework.

- The discount rate is a critical factor in assessing adaptation costs and establishing response priorities. Research and analysis is required to determine the appropriate rate.

2. Assessing impacts and adaption success

- There is a need to define what good adaptation reporting will look like for Victoria. What are the measures, indicators or benchmarks that can be used to measure adaptation success (for example, should we only consider the extent to which life and property are saved, or include measures that recognise environmental sustainability). This requires a systems framework for linking the different components of climate impacts and adaptation responses.

- It is impossible to know the 'counterfactual' – what would have happened in the absence of adaptation measures.

3. Assisting learning organisations

- Organisational innovation in dealing with climate change is best facilitated using organic organisational structures capable of fostering a dynamic community of practice.

- It is important to celebrate adaption successes, and to celebrate good leadership that facilitates adaptive learning.

- Effective adaptation requires high levels of communication and cooperation between the three levels of government in Australia.

- The private sector is a major driver of change. Greater interaction between business and government to can identify and address critical vulnerabilities along industry supply chains.

- Effective adaptation requires good people. There are currently very few climate adaptation experts in Victoria. Organisational commitment to training is needed to build adaptive capacity.

- Adaptation requires organisations that work at the boundary between science and policy or practice. Such organisations operate over longer time frames to build high levels of trust with partners and provide for sustained commitment and capacity in advising on climate impacts and adaptation options (international examples include the UK Climate Impacts Program or the CMAS program in the USA). The development of this type of organisation in Victoria is highly desirable.

- Improved capability by government planners is one measure of success in adaptive planning – further training is required to build abilities to think ahead, to analyse, and to act, even when information about future climate impacts is imperfect.

- Adaptive planning and learning needs to go beyond partnerships between universities and governmentand include community members and the private sector.

Introduction

Fifty participants discussed strategies for adaptive planning for climate change at Northcote Town Hall on 5 July 2010, in a think tank supported by the Victorian Centre for Climate Change Adaptation Research (VCCCAR) and organised by Dr Simon Batterbury of the University of Melbourne. The event gave local policymakers and decision makers the opportunity to work with overseas experts to focus on the short-term decisions required to meet long-term adaptation goals in state and local planning.

The think tank was launched by Professor Rod Keenan, Director of VCCCAR, who outlined some of the challenges Victoria faces. Prof Diana Liverman (Arizona and Oxford Universities) and Dr Emma Tompkins (Leeds University and DFID, UK), two acknowledged experts in the field of climate policy and adaptation, provided overviews of adaptation planning and current thinking on enabling mechanisms from the US and Europe.

Rob Roggema, VCCCAR visiting research fellow and former planner at the Province of Groningen, the Netherlands, described Dutch experiences with spatial adaptation planning in a setting where flooding risks have always been serious. Dr Suraje Dessai from Exeter talked about some useful risk management tools that avoid 'predict and provide' methodologies. We concluded with a three-group discussion on some of the main themes raised by the speakers.

This Report describes the main insights from the individual presentations and key action points emerging from group discussions.

Presentations

Introduction by Professor Rod Keenan, University of Melbourne and VCCCAR Director

Rod first outlined Victoria's particular challenges. The state has high emissions intensity in energy & transport and needs to move away from carbon intensive energy systems. The weather brings hot dry northerly winds, and occasional dangerous heatwaves and bushfire. To counter this, Victoria is a well governed well governed state, good at implementing government policy. There are some good policy initiatives, and a growing awareness of climate risks, both present and future. The 2009 bushfires have pushed this home. A Green paper, a White paper, and various policy statements have been produced alongside increased funding for adaptation research.

Speaker 1 Prof Diana Liverman, University of Arizona and University of Oxford

Professor Diana Liverman is Co-Director of the Institute of the Environment at the University of Arizona and spent 5 years as a Professor at Oxford where she was also Director of the ECI, managing several large climate policy projects. She is part of the first generation of climate change impacts modellers, who focused the attention of the policy community on the human dimensions of global environmental change. Her research today is on climate impacts, vulnerability and adaptation, and climate policy and mitigation. It ranges from studies of how the creative industries can contribute to climate change awareness, to the workings of carbon offsets. She advises the Obama administration through chairing one NAS Committee on 'America's Climate Choices'. She received the 2010 Founder's Medal from the Royal Geographical Society in London for contributions to climate policy and science.

Prof Diana Liverman provided examples of how others have tackled adaptive planning and research:

- The America's climate choices study

- The CLIMAS climate assessment for the southwest USA

- Eight years of work on the UK climate impacts program (UKCIP).

1) <u>America's climate choices</u>

This exercise has produced three reports so far. It has been successful in informing the US government of the strong evidence for climate change, and the need to initiate adaptation. This is in spite of public scepticism on the issue and indifferent political action at times. The Adaption sub-report of Climate Choices was produced by a committee of 20. Here are its guiding questions:

- What short-term actions can be taken to adapt effectively to climate change?

- What promising long-term strategies, investments, and opportunities could be pursued to adapt to climate change?

- What are the major scientific and technological advances needed to promote effective adaptation to climate change?

- What are the major impediments to effective adaptation to climate change, and what can be done to overcome these impediments?

- What can be done to adapt to climate change at different levels and in different sectors?

The Report starts with the observed impacts in the US: increase heavy downpours, rising temperatures; sea level rise, and more frequent fires. Future projections include those for drought and wildfire risks, which has been increasingly worrying for the south west states. All of this provides a strong argument for "adapting now".

Liverman recommended using a risk management strategy similar to that developed in the UK (see figure below). It should be iterative (i.e. adaptive) with adequate space for review and change (see also Dessai's presentation below). The Report committee made an explicit decision to focus on equity in climate change adaptation, "Don't aim at a fixed goal of being well adapted because adaptation is a process. The goal should be to be adapting well."

Assess adaptation options using iterative risk management
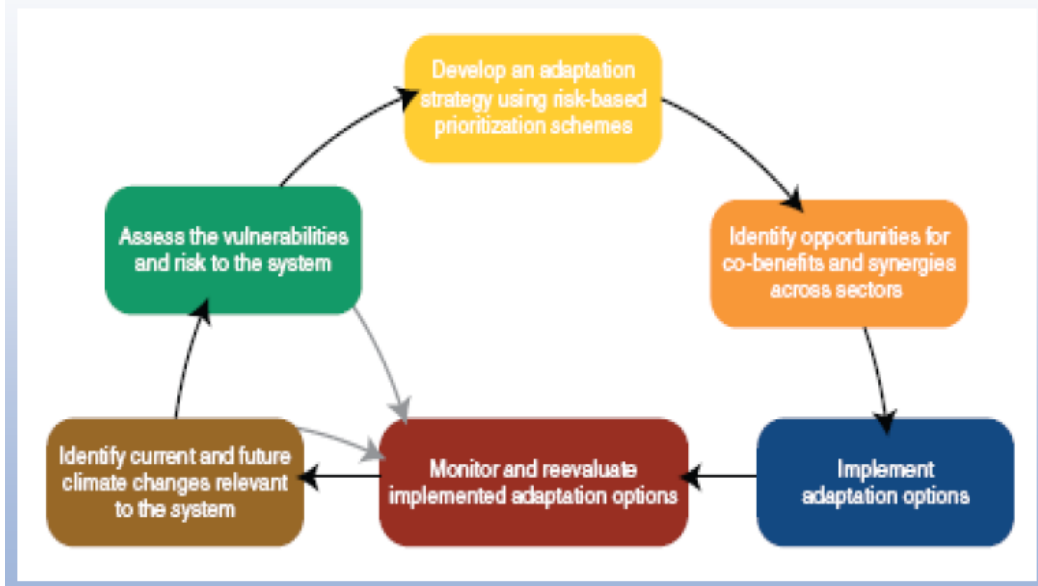
Barriers to "adapting well" in the US were found to be

- Climate change mitigation, not adaptation, is traditionally the priority

- Continued climate scepticism

- The politics of climate change in the US – there are long term neoliberal trends to less government intervention, and smaller budgets

- A current 'adaptation deficit' especially lack of maintenance of infrastructure and declining investment in R&D

- US conventional economics discounts the future, and politics is short term

- Institutions lack mandates, resources, information and professional capacity

- Confusion or lack of agency responsibilities

- Maladaptive regulations and institutions

- Lack of research on adaptation (as opposed to other areas of climate science)

On the third-to-last point, Liverman stressed that the US has too many organisations and institutions with a stake in climate adaptation. This creates confusion and a lack of clarity over responsibilities (parallels with Australia are clear). The result is that local and state adaptation planning is often more advanced that at Federal level. In addition, the reporting process can frequently demonstrate a lack of respect for the findings of social scientists, prioritising "hard" scientific evidence. For example high priority adaptation needs listed in the Report include plant breeding for America's major crop varieties, and better weather & climate monitoring at the local level. The sociology of reducing consumption and emissions, or dealing with the trauma of losses from natural disasters, received much less attention. The lesson is that technocratic adaptation planning can, sometimes inadvertently, leave out many issues.

In the US, this reporting process has given the Federal government a specific list of tasks, which are supplemented with more bottom-up approaches for local jurisdictions. This list identifies exactly what, at Federal level, is needed:

A National Adaptation Strategy (multilevel and multi-actor) where the Federal Government:

- Facilitates cooperation and collaboration across different levels of government and between government and other parties

- Provides technical and scientific resources to the local or regional scale

- Re-examines policies that may inhibit adaptation

- Supports scientific research in adaptation and climate change

- Practices adaptation in its own programs and lands

2)   The climate assessment program for the southwest USA (CLIMAS)

This began as a pilot exercise by NOAA, who funded regional assessment for 9 regions of the country. CLIMAS is the southwest USA one.

CLIMAS only deals with the southwest USA. Its mandate is to engage with a range of stakeholders in the region and to provide them with climate information. After ten years of operation the CLIMAS team has provided useful information - drought and weather forecasts, specific sub-reports on certain regions and biomes. Climate science is asked to do what the public want, as far as is practicable, for example, helping ranchers and farmers respond to climate risks. Lots of work is done with different stakeholders: stockmen; water managers; and more recently with conservation, wildlife, health sectors and Native American tribes.
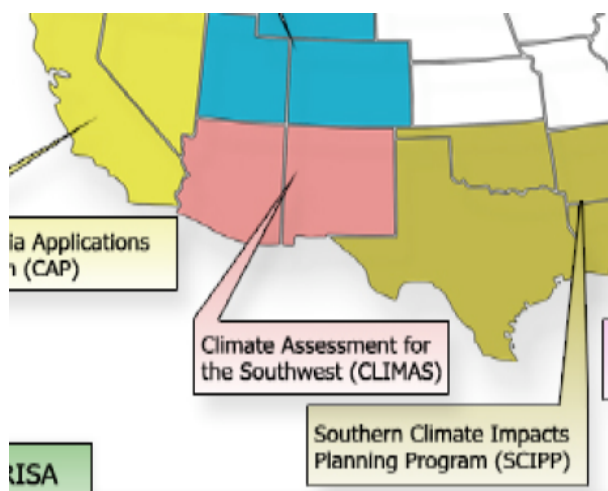
The CLIMAS office works as a translation broker, with lots of outreach, web tools, and there are climate extension specialists employed by CLIMAS. For example there has been recent engagement with native Hopi tribes, who live in an isolated area of northern Arizona, and who are concerned about drought preparedness. With hardly any weather monitoring stations on native land (see map below), CLIMAS staff worked with tribes to do estimates of climatic change and the rough likelihood of certain changes, in the hope that in future there will be more federally funded weather monitoring.
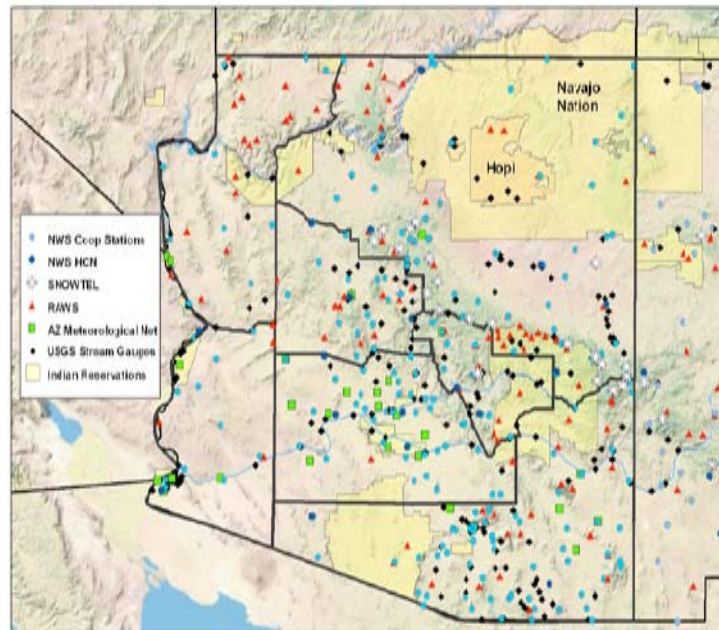
CLIMAS suffers from a common problem for predictive modelling work - some people make management decisions based on forecasts that have wide variance.

Lessons: Building trust with stakeholders has taken many years and has involved getting on the road to remote communities. Simple summaries and basic climate information has been shared widely.

Lessons from recent CLIMAS evaluations

- Building trust with climate variability is a basis for discussing climate change

- Need to go to users

- Referrals and sharing best practices very useful

- Must keep web page new and engaging to maintain interest and complement with in person contacts

- A combined natural and social science team is valuable

- Provide more decision support tools and tailored adaptation advice

- Shared investment and goals are a key to success

3) The UK Climate Impact Program (UKCIP)

UKCIP "Helps organisations to assess how they might be affected by climate change, so that they can prepare for its impacts". It was set up in the UK in 1997 by Department for Environment, Food and Rural Affairs (DEFRA) and has 20 staff based at University of Oxford.

UKCIP provides common climate related tools and datasets, advice and guidance and brings together communities of practitioners. Climate scenarios are given to user groups to allow them to think through vulnerability & adaptation planning. Thus far, uptake by government bodies has exceeded industry.

Hadley Centre climate data has been provided so far for 1998, 2002 and 2009 at different scales across the country. Recently the project moved from more deterministic to probabilistic scenarios for the different regions of the UK. Scientifically this is more acceptable, but stakeholders find these probability results difficult to use.

Reports generated from the online information include costings, risk frameworks, socioeconomic scenarios, adaptation options, business related forecasting (e.g. risk to transport, premises, management), and an online 'adaptation wizard'.
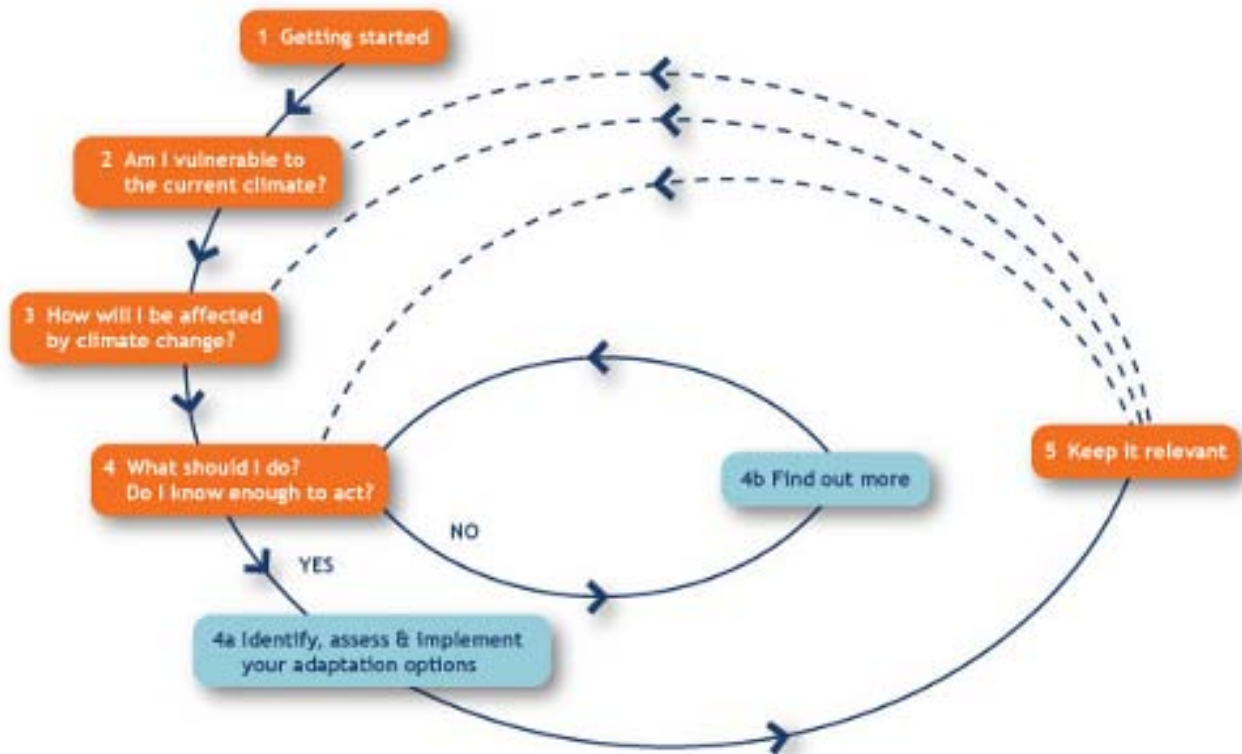
Local climate impacts profiles can be generated, for example for flooding risk in Tewksbury. These have been particularly useful.

Lessons from UKCIP: UKCIP has had good buy-in from its users, and has given lots of thought about how to engage stakeholders. It does not operate a 'predict' then 'provide solutions' model. However, this success can be trumped by higher order decisions. The UK, under Gordon Brown, initiated a high level adaptation committee, with individuals acting as direct advisors to government. To an extent UKCIP's place has been filled by this new initiative, and less than optimally. Institutional confusion, as in the US, has occurred.

Questions to Diana revolved around cost – Diana thinks adaptation planning' done now' is going to be less expensive that left until later, despite the lack of money in most Treasuries in the western world. In response to a question about key priorities in this domain, she said "got to stop just doing case studies. Got to do comparative research...and provide costings." This is particularly important in the food sector, where farmers are angry at a lack of support from government for adaptive planning, and the threats are very real. Drought has made this a key issue in the drier parts of the USA and there has been an inadequate government response.

Speaker 2 Dr Emma Tompkins, University of Leeds

Dr Emma Tompkins (PhD, UEA), is senior lecturer at the University of Leeds, UK and is currently on secondment to the UK government. She works on climate change adaptation, specifically barriers and limits to institutional adaptation, public-private partnerships for adaptation, and drivers of individual action and national policy. She is a contributing author to the IPCC Special Report on Climate Extremes and Disasters (due 2011). She chairs a Technical Advisory Group for the UN/WWF on adapting to climate change in coastal zones, and has written

widely on this topic. Her work also deals with the practicalities of sea level rise and participatory coastal zone management, floods and droughts, notably in the South Pacific, UK and the Caribbean.

Emma provided 3 vignettes of adaptation practice

1.   The process of mainstreaming adaptation

2.   Information needs & research for action

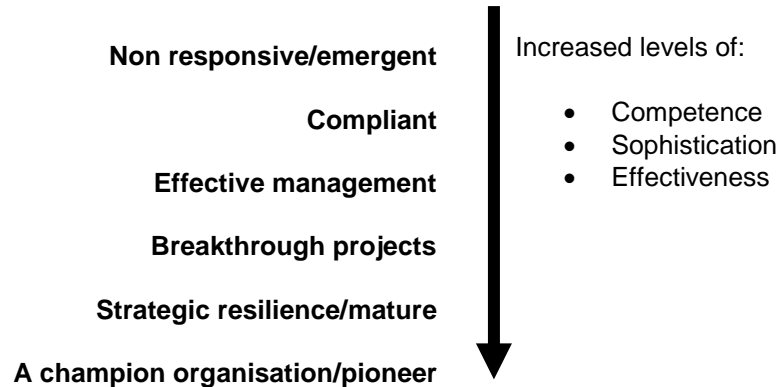3.   Making difficult choices

Her concern was to demonstrate the importance of identifying 'adaptation deficits' before moving on to build response capacity. This includes managing climate variability and risk, and confronting climate change trends.

<u>1)   The process of Mainstreaming</u>

Emma's experience from UK and European institutions is that most organisations in the West will soon, if they do not already, have a climate unit or strategy. This will contribute to identification of adaptation deficits, but does not necessarily lead to better public awareness or action. She referred to a study funded by the Barings Foundation, Towards Climate Smart Children and Youth Organisations. The aim was to help create 'climate smart' children's agencies, and awareness raising (for example, children's play in times of heat stress, something already covered in Australia), and this was frequently done via workshops. There was relative success in instilling messages and awareness across the sector.

A useful tool comes from the Management school at Bath University and consultancies in the area. The PACT framework – "Performance acceleration of climate tools" developed by David Ballard of ABL shows how organisations can proceed towards greater action and skill in managing their own emissions as well as climate associated risks.

Organisational Change
PACT framework

Non responsive/emergent	Increased levels of:
Compliant	• Competence
Effective management	• Sophistication
Breakthrough projects	• Effectiveness
Strategic resilience/mature	
A champion organisation/pioneer	

For Emma, moving through these stages in an organisation involves first creating awareness, better leadership (making people accountable for carbon emissions); establishing agents of change (people who are empowered to do something); working in partnership (learn more by engaging with others); managing operations (e.g. how during floods will your staff get access to clients?); better programme scope & coherence (more relevance); and expertise (provides a memory & expert capacity instantly).

The UK Department for International Development has also gone through a process of adaptive learning about climate issues. The economics of adaptation took a prominent place in discussions, given its importance in the existing aid programs to developing nations. DFID targeted recruitment of co-funded 'climate' positions, people who joined the 'climate champions' network in DFID. Specialists have been hired to climate advisor roles. However there was no clear objective for adaptation planning at the time, no widely shared understanding of terminology (e.g. adaptation, resilience) and importantly, no clarity on how to influence successful adaptations – whether to spontaneously react or whether to develop a regulatory framework. Future challenges for DFID include better clarification of their aims -particularly, what is climate resilient development? Better adaptive learning in the agency is needed – working out ways to evaluate success of adaptation and to redirect interventions to increase this success; as well as alterations to internal organisational processes. The additional, current challenge is that the significant economic downturn in the UK has significantly affected DFID's budget.

2) Information needs & research for action

Emma continued with a discussion of information needs, but also touched on the requirement to measure the success of failure of policy. She saw this as absolutely vital. The important questions for an agency, organisation or government are:

-   Is adaptation happening?

-   By whom and in what way?

-   How can we evaluate the success of adaptations?

-   What are the trade-offs inherent in adaptation?

Her recent UK study points to the main sectors of adaptation policies

Adaptation by sector in the UK in 2005
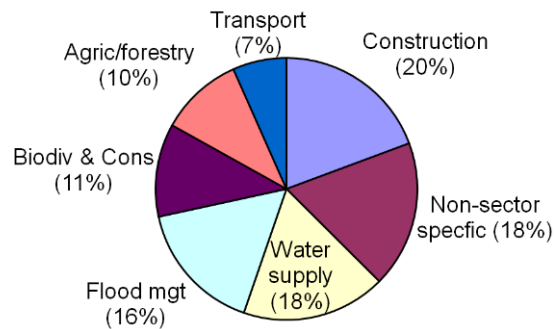
Has adaptation actually happened, for example in the agriculture or irrigation sector? Has adaptation generated outputs? eg. Some new guidelines, some 'how to' reports, or new decision tools. Or, 'outcomes' like greater household resilience? What trade-offs are needed in adaptation decision-making?

3) Making difficult choices

An example of difficult decision-making is the fate of coastal areas in the UK, some of which are already threatened by rapid coastal retreat. While there are a number of government reports and studies, Emma's conclusions on shoreline retreat in the UK are:

- People / firms / government bodies are actually adapting

- So far, there has been little clarity / open discussion over who should be protected, and from what (except Shoreline Management Plans, and EA Catchment Management Plans)

- No evidence of 'success' of adaptations in the UK – also no evidence of mal-adaptation either (NI188 government policy is not adequate to show 'successful adaptation')

- It is still not clear about what is driving adaptation – nor who has the capacity to adapt

We need to:

- Minimise costs, risk and guaranteeing participation in decision making. However these are mutually exclusive!

- Explicitly clarify the trade-offs inherent in coastal decision making under climate futures

Issues:

- Deliberation is very important and can lead to swings in peoples' preferences.

- Deliberation raises the profile of the most critical issue locally, and reinforces thinking about this

- Communities want different coastal governance...this is deeper than 'protect, accommodate, retreat'

For example, the shoreline management plan for Happisburgh in East Anglia is to allow coastal retreat. But the local community is trying to sue the government for their lack of action. This raises the issue of legitimacy of decision-making. There is a mess of institutional scales, timescales and resource constraints around coastal retreat.

1) **EQUALITY:** We should allocate adaptation funds equally to all areas in the UK

2) **REWARD:** We should reward those communities that are reducing their emissions the most

3) **EXPOSED:** We should allocate to those who face direct impacts of climate change

4) **VULNERABLE:** We should allocate the majority of the funds to those least able to adapt to climate change on their own

5) **DISADVANTAGE:** We should target "failing" areas and use the adaptation funds to fill an adaptation deficit

In response to questions on 'mainstreaming' of climate adaptation issues, Emma finds that there are still people in the government department where she is currently seconded that do not find climate change an important issue, given the remit of the organisation is to promote more equitable and sustainable international development in partner countries, and thus service provision, health, education and other sectors can take priority. Also some staff in the climate area in the organisation are currently relatively inexperienced.

Other participant questions / comments:

- A challenge for agencies in planning adaptive responses is the tendency to 'externalise' such risk to others or to other areas - by saying 'it is not going to happen to me'. Thus such adaptive strategies as new building codes are yet to be 'mainstreamed'.

- For water supply, user behaviour is likely to be more influenced by costing and charging mechanisms than by a broader concern with future threats to supply because of long term climatic change.

- Questions / comments also compared government engagement strategies in Australia with those overseas.

Speaker 3 Rob Roggema, VCCCAR Visiting Fellow: Swarm planning for climate adaptation

Rob Roggema (PhD in progress, Delft) is VCCCAR's inaugural visiting research fellow. At the Province of Groningen in the Netherlands he was in charge of Strategy and Regional Planning, and the manager of a Program in Climate Adaptation and Regional Planning. He is author of "Adaptation to Climate Change: a Spatial Challenge" (Springer, 2009).

Rob's presentation focussed on flood risk in the Netherlands. 50% of the country has a risk of flooding. There are two government programs that work on this risk:

1. A climate change spatial planning program. Now near final phase. 80m euros. Big communication sector. Research & hotspots include 'climate proof Groningen'.

2. Knowledge for climate. Adaptation is the central focus, in hotspots of vulnerability. 100m euros allocated. To develop adaptation strategies & support for hotspots, which include Schiphol Airport, The Hague Area, Rotterdam Harbour, Zeeland Delta, and the Wadden Sea. Finance for research comes from governments and the commercial sector.

Rob focussed on how, in the Netherlands with its serious climate risks due to low lying territory, political decision making becomes extremely difficult and courage is needed to accept the uncertainty posed by future sea level rise and associated impacts. Politicians tend to look 4yrs ahead, whereas the planning system focuses perhaps 10yrs ahead. Nonetheless, climate and energy issues need a longer focus again. The lack of the long term perspective leads to a gap between long term necessities & short term practice. So, short term solutions are adopted, along with inappropriate blueprint planning generated by fixed mindsets. Conventional spatial planning is not equipped to include climate adaptation, and it does not facilitate a climate proof future.
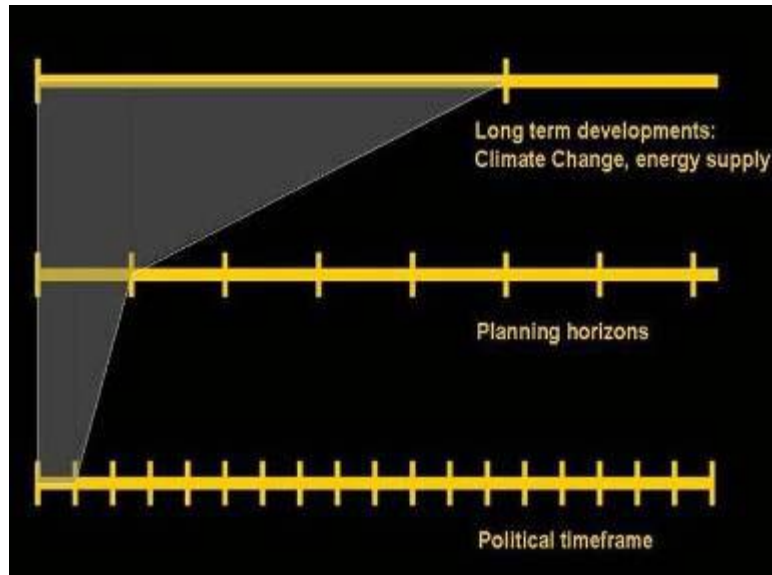
Spatial planning, therefore, needs to be longer term and anticipatory - a 'wicked' planning approach to address wicked problems. One approach is **swarm planning** – to give incentive at a location to start a process of change that evolves and spreads – in other words, create tipping points for change through focussed planning workshops.

In an example, Rob describes a process of collaborative involvement in thematic & integrative expert meetings on how to adapt to rising sea level and associated risks, which involved brainstorming with policy makers, students, specialists & generalists. People had to come up with their own visual solutions for sea level rise. Several of these sessions have now been completed. The result has been a map of climate adaptation possibilities, alongside other outputs (water maps shown here).
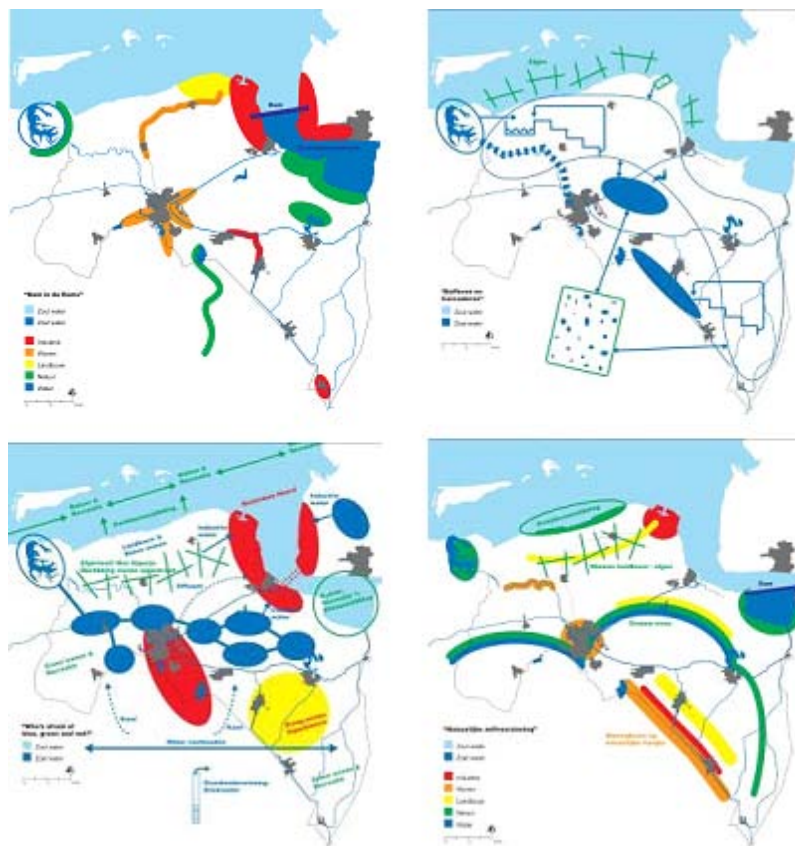
Participants in workshops reshuffled the city of Groningen and its land uses on paper. They 'redesigned' coastal defences and some areas would be allowed to flood, in which case higher ground becomes separated from the mainland in future and redesigning around that scenario would include floating housing/facilities (which are already used in the Netherlands). Water supply measures would involve capturing more rainfall in winter. Energy would come locally sourced and more based on renewables through solar, wind, biomass, and hydro which could provide 50% of current demand and which would reduce CO_2 emissions by 80% (see map).
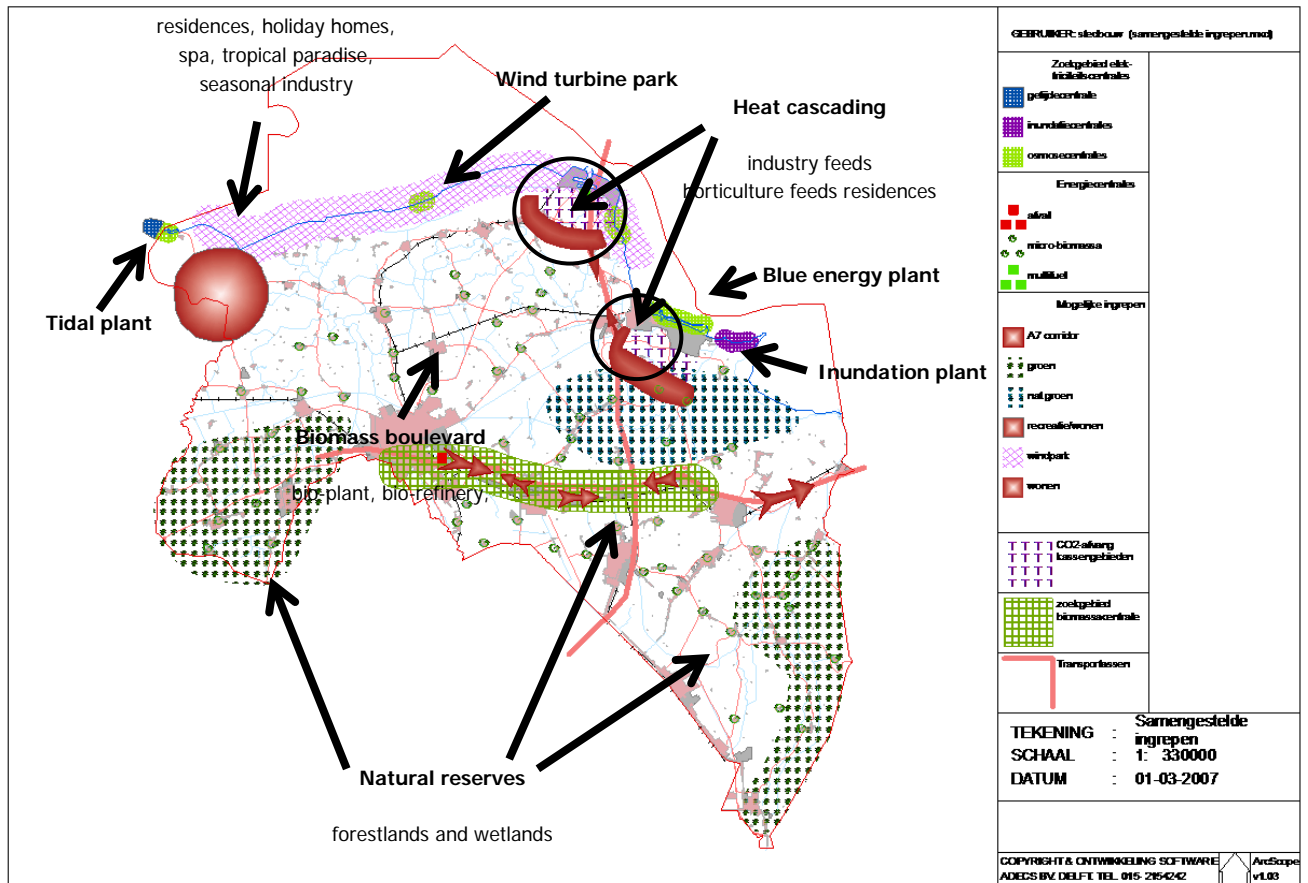
[Naar een energiegestuurd Omgevingsplan Groningen: Dobbelsteen et al., 2007]

By combining all the maps produced, a new climate adaptation map emerges (below).
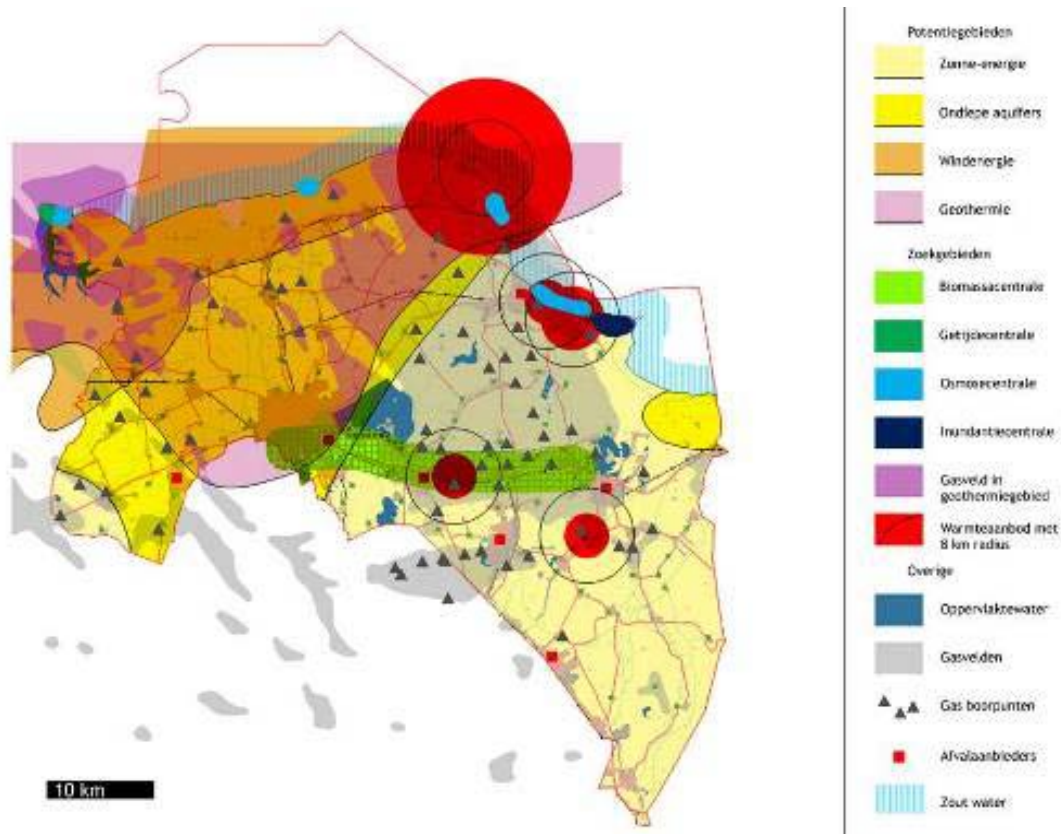
Integrated, multilayer maps of this type may then be checked against future climate scenarios. Some elements were not found to be viable. Nonetheless, this type of swarm planning, it is hoped, provides fresh ideas and also 'takes off' across space as more participants join. The spatial order will thus evolve by itself; it needs a long term horizon.

Questions. How would you go looking at multiple stressors, not just sea level rise & increased precipitation? Rob: Choose your main factors first then next factor will present itself. How to compensate or retrofit existing housing? In reality, most housing will protect against flooding where possible, but some will choose to relocate or choose a waterborne lifestyle. Government's role is strategic; to lay out options and to provide high quality advice. How to communicate such bad news about future environments to communities? At first this can be difficult, but you need to stress that that it's a slow process & that new alternative is of higher quality. Encourage people to adjust over time. The scenario of relocation sis most hard for farmers – many will be forced to move.

Speaker 4 Dr Suraje Dessai, University of Exeter: Planning and decision making without scenarios

Dr Suraje Dessai (PhD, UEA) is a lecturer at the University of Exeter, UK. His expertise is in climate science and decision-making, including climate impacts and adaptation in the context of heat stress, and water resources management, decision-analysis, and perception and communication of climatic hazards.

Suraje posed the adaptation challenge – the legacy of past emissions and the prospect of climate change; evidence that societies are not "well" adapted to current climate variability; and thus, how can we ensure that adaptation measures realise societal benefits now, and over coming decades, despite uncertainty about climate variability and change? He prefers to use planning for future vulnerability and variability. For example the UK water sector needs to plan for "Headroom": the minimum buffer that a prudent water company should allow between supply and demand to cater for specified uncertainties in supply and demand. In the UK water sector,

it was estimated that 30% of headroom is due to future climate change. The elements comprising this decision-making process for the sector are:

	Factor	Characteristic
Supply related	Vulnerable surface-water licences	Expected loss
	Vulnerable groundwater licences	Expected loss
	Time-limited licences	Expected loss
	Bulk transfers	Expected loss
	Gradual pollution causing a reduction in abstraction	Expected loss, increases with time
	Accuracy of supply-side data	Random variability
	Single-source dominance and critical periods	Random variability, possible demand increase
	Uncertainty of climate change on yield	Unexpected changes, increases with time
Demand related	Accuracy of sub-component data	Random variability
	Demand forecast variation	Unexpected changes, increases with time
	Uncertainty of climate change on demand	Uncertainty of climate change

The UK since 1998 has been building adaptive capacity against climatic change, but some actions have not been followed though. Such is the nature of risk management. The approach they need to take is **uncertainty management, rather than trying to predict with certainty what will happen.** This breaks down according to the degrees of certainly about outcomes and the knowledge of likelihoods:

Source: Dessai and Hulme (2003)
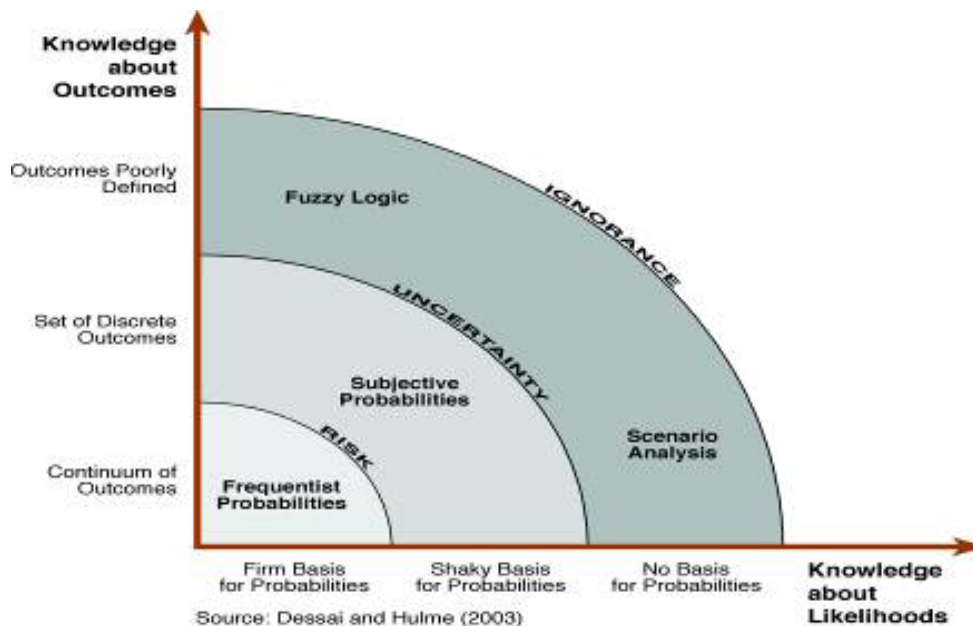
Assessing risk of a certain event occurring involves

- Set out the structure of the problem

- Proposing one or more strategies

- Assessing each strategy over a wide range of plausible futures

- Summarising key tradeoffs amongst promising strategies

- Suggesting robust alternatives

Robust decision making does not require accurate and precise predictions of the future state of the climate. It can be 'scenario neutral'. Instead it focuses on exploring how well strategies perform across wide ranges of assumptions and uncertainties. One example of the steps involved:

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┌─────────────────┐        ┌─────────────────┐        ┌─────────────────┐
│    Observed      │  ───▶  │  Vulnerability   │  ◀───  │ Observed climate │
│  non-climatic    │        │      (now)       │        │  variability and │
│    pressures     │        │                  │        │      change      │
└─────────────────┘        └─────────────────┘        └─────────────────┘
                                    │
                                    ▼
                           ┌─────────────────┐
                           │   Adaptation     │
                           │    options       │
                           │   A, B, C....    │
 Social acceptability      └─────────────────┘    Economic appraisal
 ·········································································
 Technical feasibility     ┌─────────────────┐    Regulatory context
                           │    Preferred     │
                           │    measures      │
                           │   B, H,  S,  W   │
                           └─────────────────┘
┌─────────────────┐                 │                 ┌─────────────────┐
│  Narratives of   │  ───▶  ┌─────────────────┐ ◀───  │  Climate change  │
│  non-climatic    │        │  Vulnerability   │        │    narratives    │
│    pressures     │        │     (future)     │        │                  │
└─────────────────┘        └─────────────────┘        └─────────────────┘
 ·········································································
 Adaptation principles     ┌─────────────────┐    Sensitivity analysis
                           │     Robust       │
                           │    measures      │
                           │      B, W        │
                           └─────────────────┘
 ·········································································
 Performance appraisal     ┌─────────────────┐    New evidence
                           │   Adaptation     │
                           │    pathways      │
                           │    W then B      │
                           └─────────────────┘
```

(Monitoring — vertical label on right)

His conclusions were that

- Uncertainty dominates regional/local climate and impact projections

- Adaptation efforts should not be limited by the lack of reliable foresight about future climate conditions. We can make decisions on other ways – by testing different strategies.

- Where uncertainty dominates robust decision-making methods are likely to be more useful to decision-makers than traditional "predict and provide" methods.

Questions don't be too quick to discard 'predict & provide' decision making methods. Because this is what decision makers are doing all the time, assessing uncertainty.

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