

Living With Environmental Change

What are the key policy questions and research needs?

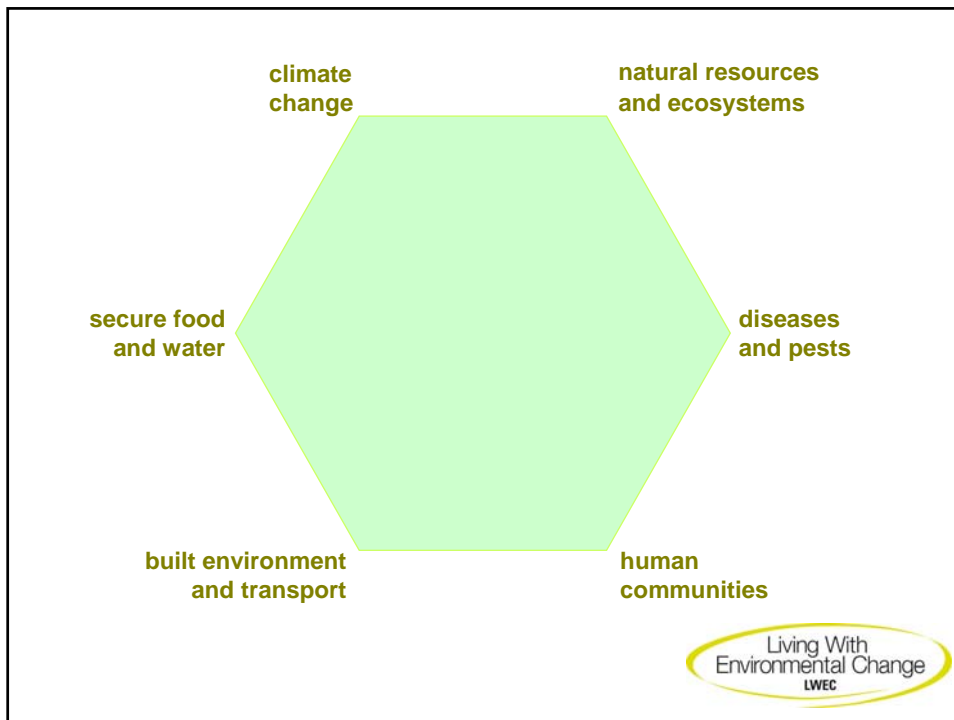
Bob Watson
Chief Scientific Advisor
Defra



LWEC's Six Strategic Objectives

- A. To build effective **mitigation, adaptation and resilience to climate change**, including preparedness for changes to the intensity and frequency of extreme events, so that human health, well-being, and a healthy natural environment are ensured through use of sustainable and socially acceptable environmental management approaches and technologies.
- B. To assess the links and feedbacks between the natural environment, **ecosystem services and human well-being**; how these might continue to develop within environmental limits in the face of major environmental change; and how decision-making and local and national planning can take account of these links and feedbacks to help in the development of new social, environmental and economic opportunities.
- C. To promote human well-being, **alleviate poverty** and minimise waste **by developing sustainable ecosystem management approaches for safe and secure food production and water supply**.
- D. To **protect human, plant and animal health** by predicting how diseases, pests, hazards and other environmental factors will alter under forthcoming environmental change scenarios, assessing which sectors of society are most at risk and determining what management actions need to be taken.
- E. To **make infrastructure, the built environment and transport systems resilient to environmental change** and develop **more sustainable**, less energy-intensive systems and approaches that are socially acceptable, economically advantageous and more environmentally harmonious.
- F. To work with the diverse communities of the UK to understand how, on the basis of our various cultural backgrounds and belief systems, we live with our environment at present, how this is likely to alter as the environment changes, and how we might use this knowledge to **develop thriving, cohesive and informed communities**.



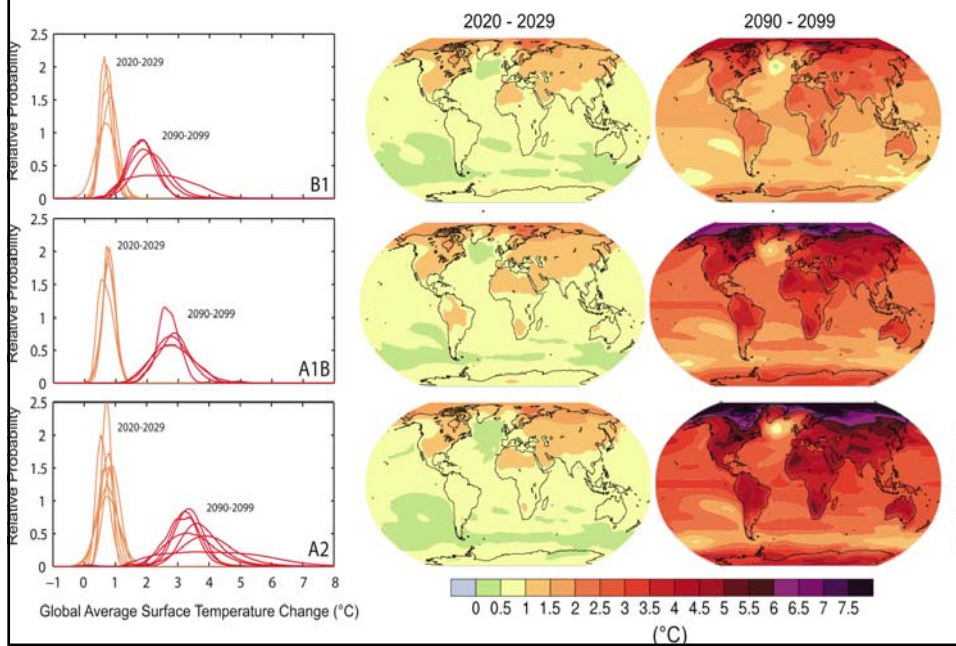


Climate Change: Examples of Key Policy Questions

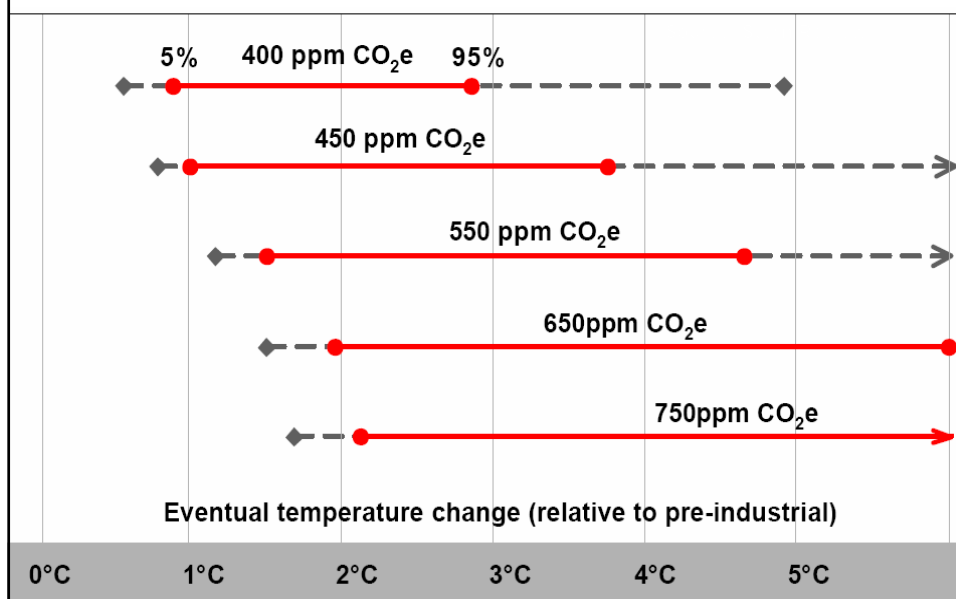
- What are the implications of different GHG stabilization levels and pathways for changes in the Earth's climate, regionally and globally, and how well can these changes be predicted at the regional scale?
- What is the scope and scale of regional and sectoral adaptation strategies to build resilience to the impacts associated with different stabilisation levels and pathways. What synergies and conflicts are there between such strategies and potential mitigation options?
- What is the scope and scale of technological options across the full range of sectors (e.g., energy, transport, industry, agriculture and avoided deforestation) for contributing to different stabilization levels and pathways? What are the institutional, behavioural and economic opportunities and barriers to such technological trajectories?
- How can different tiers of policy and governance foster the co-evolution of mitigation and adaptation strategies? Does the appropriateness of different suites of strategies change significantly with the different pathways and stabilisation levels?
- How can individual and collective action be mobilised to achieve mitigation and adaptation strategies. How should such strategies be adjusted to engage with and benefit from individual and collective action, and how would such **action change** over time and with the 'severity' of mitigation and adaptation strategies?



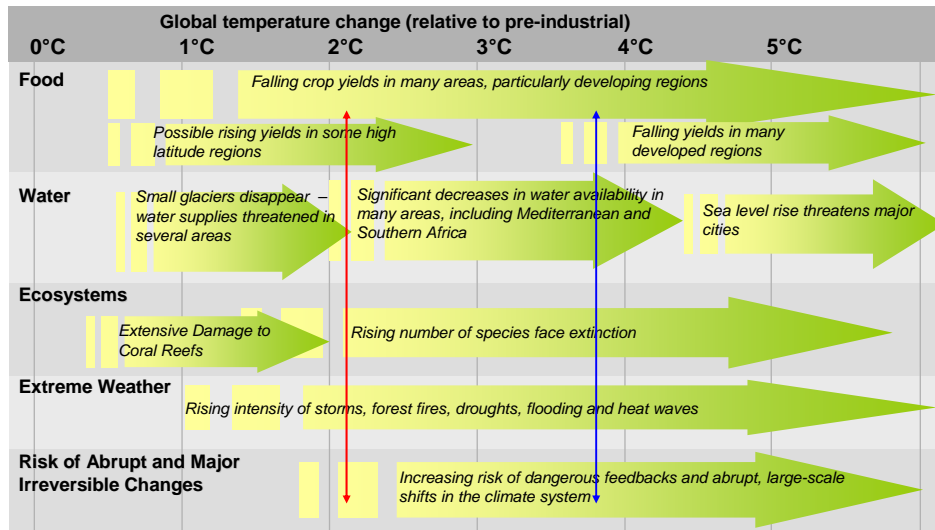
How do different GHG Scenarios Effect Temperature?



What is the Relationship between different GHG stabilization levels and Changes in Temperature?



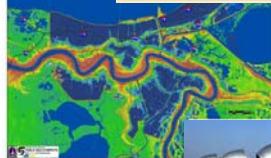
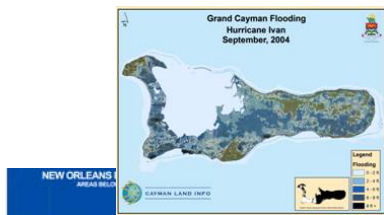
What are the Impacts of Temperature Changes?



The risk of serious irreversible impacts increases strongly as temperatures increase



Are there limits to how much we can adapt? ...physical, behavioural and technological limits



- **Physical limits:** there are physical limits to potential adaptation on small low lying islands e.g. Cayman Islands

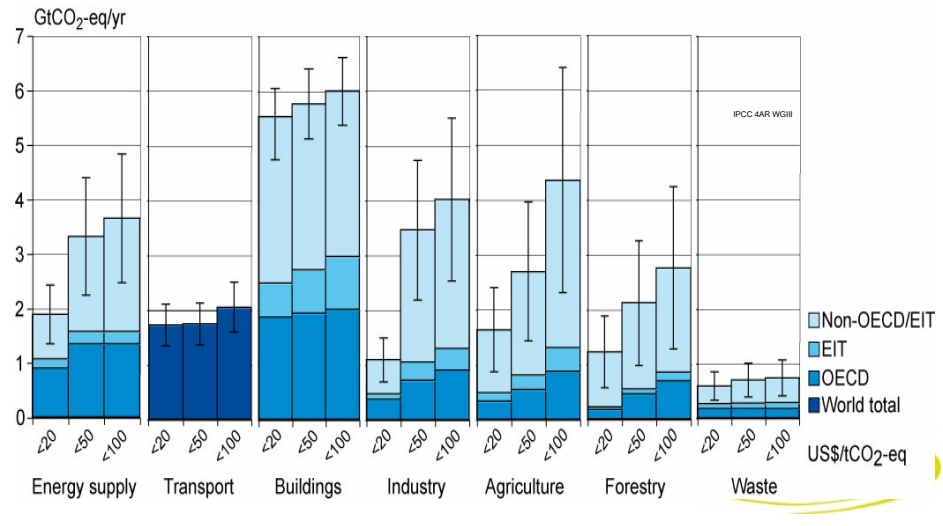
- **Behavioural limits:** there are behavioural constraints that influence where we live and why, e.g. New Orleans

- **Technological limits:** there are technological limits to the flood defences that can be constructed, e.g. Thames Barrier, London



Mitigation Potential by Sectors & Regions

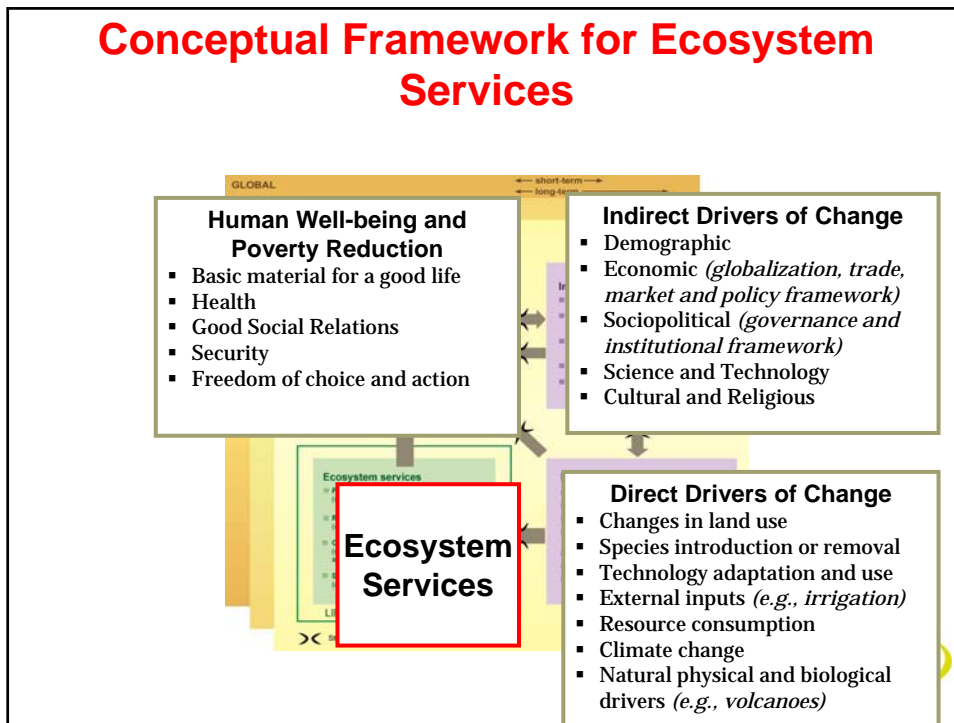
- *At least a 50% reduction global greenhouse gas emissions by 2050 is needed for a chance of meeting the EU 2°C target*



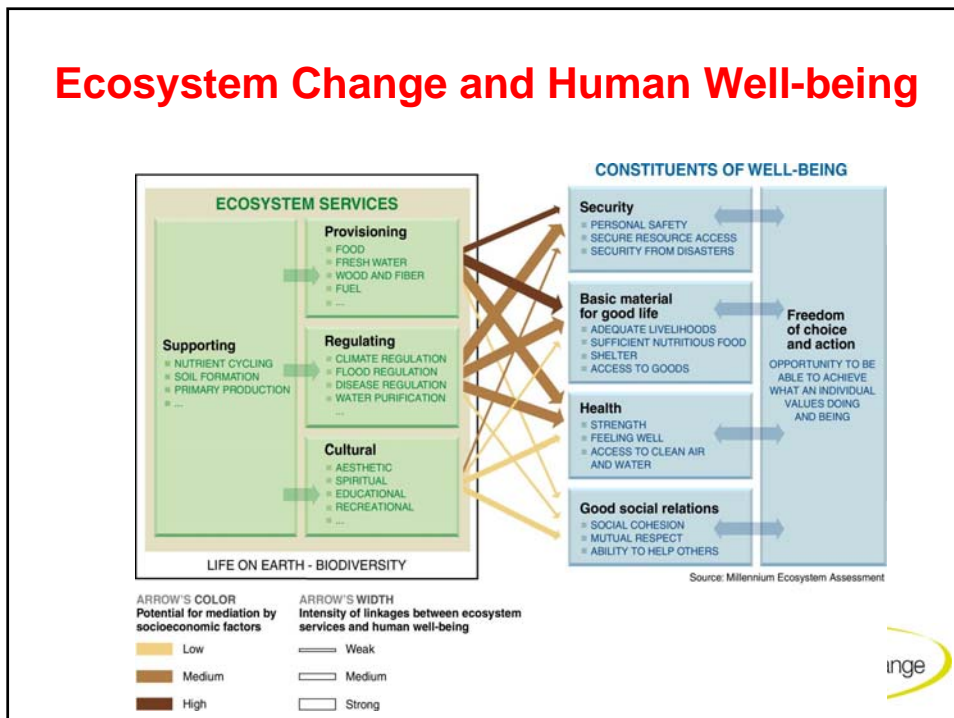
Ecosystems and Human well-Being: Examples of Key Policy Questions

- *What are the main drivers of ecosystem change?*
- *What are the benefits of taking an ecosystems approach?*
- *What are the economic and non-economic values of ecosystem services?*
- *What is the scope for adapting existing policy and project appraisal tools to incorporate principles of an ecosystems approach?*

Conceptual Framework for Ecosystem Services



Ecosystem Change and Human Well-being



Converting an ecosystem means losing some services and gaining others – e.g., a mangrove ecosystem – we need to understand the trade-offs



**Provides nursery and adult habitat ,
Seafood, fuelwood, & timber;
traps sediment; detoxifies pollutants;
protects coastline from erosion & disaster**



housing



shrimp



crops

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Alleviate poverty by developing safe and secure food production and water supply: Examples of Key Policy Questions

- *How can food and water security be achieved in a world with a changing climate and other multiple stresses?*
- *How can agricultural productivity be increased in an environmentally and socially sustainable manner?*
- *What are the human security implications of climate change impacting on food and water security and human health?*

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Food Security

Drivers of the recent increase in food prices

- Increased demand from rapidly developing countries, e.g., China
- Poor harvests due to variable weather - possibly related to human-induced climate change
- Increased use of biofuels, especially maize in the US
- High energy prices, hence fertilizer prices
- Export bans from some large exporting countries
- Speculation on the commodity markets

Key question is whether this is a blip or a harbinger of the future



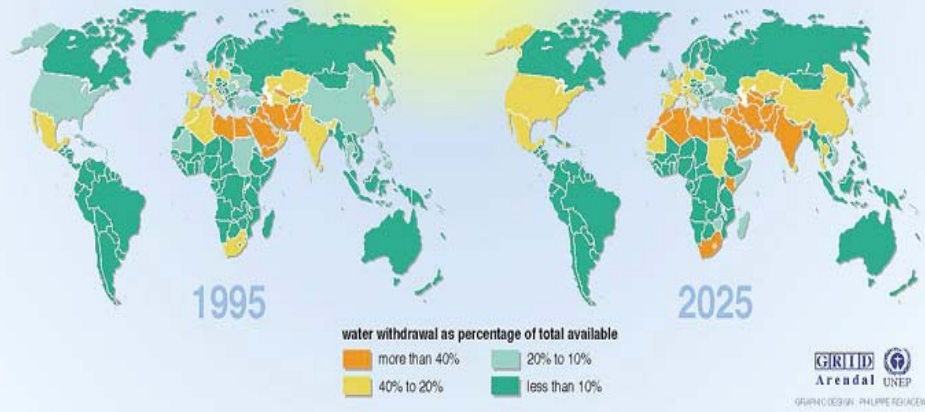
Can Biofuels be Economically, Environmentally and Socially Sustainable?

- Two major sources of biofuels
 - Bioethanol from sugar and maize
 - Biodiesel from palm oil, soy and rapeseed
- Rarely economic - normally heavily subsidized
- Serious questions regarding environmental sustainability
 - Greenhouse gas emissions - direct and indirect emissions
 - Loss of biodiversity, soil and water degradation
- Serious Questions regarding social sustainability
 - Food price increases
 - Involuntary displacement of small-scale farmers by large-scale plantations



How will Climate Change Increase Water Stress

Freshwater stress

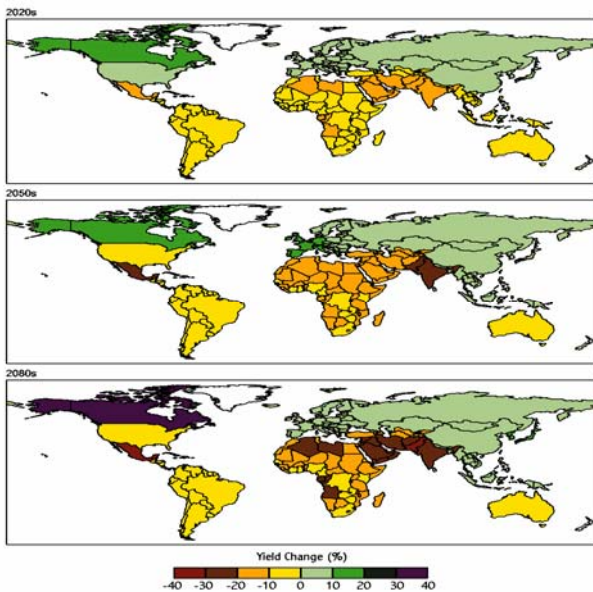


Source: Global environment outlook 2000 (GEO), UNEP, Earthscan, London, 1999.

This figure illustrates projected changes in water stress in the absence of climate change

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To what degree will crop yields decrease in the tropics and sub-tropics, but increase at high latitudes?



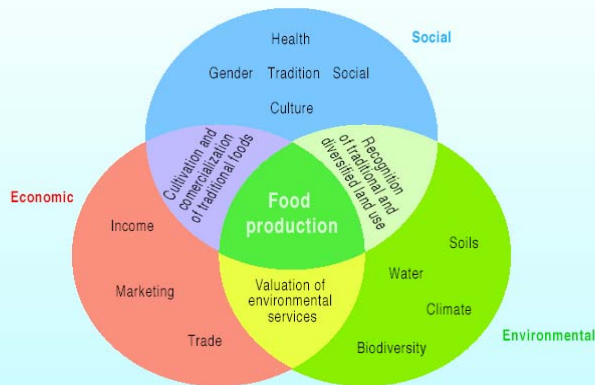
Percentage change in average crop yields for a mid-range climate change scenario

Even as soon as 2020 crop yields in SSA and parts of Asia are projected to decrease by up to 20%

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The Multifunctionality of Agriculture

The inescapable interconnectedness of agriculture's different roles and functions

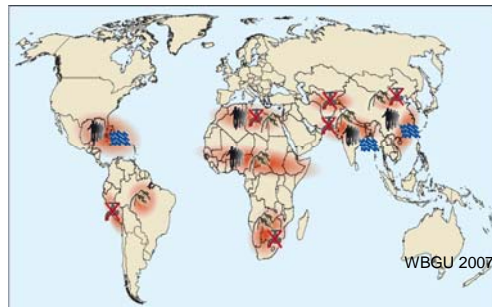


What Information and Policies are Needed to Implement a Multifunctional Approach to Agriculture?

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Climate Change and Conflict

- Tens of millions of people displaced
 - Low lying deltaic areas
 - Small Island States
- Food shortages where with hunger and famine today
- Water shortages in areas already with water shortages
- Natural resources depleted with loss of ecological goods and services
- Increased incidence of disease
- Increased incidence of severe weather events



Conflict constellations in selected hotspots

Climate-induced degradation of freshwater resources

Climate-induced decline in food production

Hotspot

Climate-induced increase in storm and food disasters

Environmentally-induced migration

To what degree can climate Change, coupled with other stresses, lead to local and regional conflict and migration and how does this depend on the social, economic and political circumstances?

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Human, Plant and Animal health : Examples of Key Policy Questions

- How will changes in the environment effect human, plant and animal health?
- What actions can to be taken to decrease the vulnerability of human, plant and animal health to environmental changes?



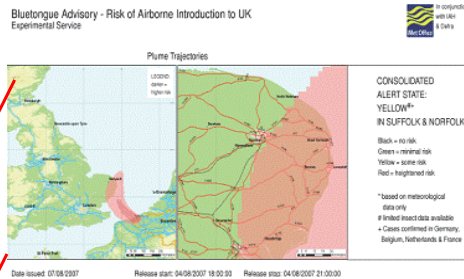
Climate Change and Human Health

	Negative impact	Positive impact
Very high confidence Malaria: contraction and expansion, changes in transmission season	←	→
High confidence Increase in malnutrition	←	
Increase in the number of people suffering from deaths, disease and injuries from extreme weather events	←	
Increase in the frequency of cardio-respiratory diseases from changes in air quality	←	
Change in the range of infectious disease vectors	←	→
Reduction of cold-related deaths		→
Medium confidence Increase in the burden of diarrhoeal diseases	←	

How does climate change quantitatively impact human health regionally?



Bluetongue outbreak



Questions on the role of "climate change"

- Potential for establishment in high latitudes
- incursion of other vector-borne disease



Conclusion

LWEC provides an outstanding opportunity to address policy relevant issues through world-class scientific research

LWEC can provide the scientific knowledge needed to increase the resilience and decrease the vulnerability of ecological systems, socio-economic sectors and human health to projected local, regional and global scale environmental changes in context of other drivers of change

