

Climate Change and Scottish agriculture:
Impacts, mitigation, adaptation
(and economic rationality)

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Main questions



- Do we know what the impacts are going to be?
- Do we know how much we should mitigate?
- How much should we adapt?
- Should we do anything: a) in agriculture;
b) more generally?

Key issues (jargon)

Emissions scenarios, warming and related regional forecasts IPCC - UKCIP

Impacts: which sectors, how big and when? (costs of inaction)

Emissions scenario choice obviously dictates what the impact damages will be

Responses:

- Mitigation (abatement) of emissions: how?/how much? - costs/ benefits (costs - avoided damages)
- Adaptation costs and benefits of living with environmental change
- Vulnerability
- Uncertainty/ Risk....

What's the damage?

“Scotland could be (on average) 2.5°C to 4°C warmer than present by 2080, with winter precipitation increasing by up to 35% in the south, east and north east, and summer precipitation decreasing by up to 50% in the south, central and east of Scotland....”

Warmer and wetter = threats and opportunities

Downscaling and biophysical modeling gives a mixed picture: crops:
yields and disease exposures

Livestock: productivity, disease and welfare issues

But some benefits as well...

Is agriculture “vulnerable” ?



Vulnerability is a contested term in the social science of CC (combination of exposure and adaptive capacity)

Agriculture is exposed to climate change; adaptive capacity varies

But: economically small sector in conventional terms and arguably adaptation is a private responsibility: “crowding out”.

On the other hand : adaptation by many land owners may have unanticipated impacts on public goods. Thus adaptation moves from a private to a public goods issue

Conclusion: possible cause for concern.....

Mitigation

Mitigation: Recent estimate suggests that agriculture could account for >20% of Scottish emissions

National commitments determined by external treaty

Discretion as to how cuts allocated to sectors

Agriculture so far getting a free lunch

We know what to do, & we know that there are likely to be ancillary benefits (e.g. water pollution)

Greenhouse gas	GWP (t CO ₂ equiv / t gas)
Carbon dioxide (CO ₂)	1
Methane (CH ₄)	21
Nitrous oxide (N ₂ O)	310 (depletes ozone)

Mitigation: how much?



**If we think we are avoiding imminent catastrophe then mitigate a lot
now.....**

Otherwise,

**National decisions on mitigation can be determined by economic
efficiency - i.e. look for “low-hanging fruit” first**

**Put another way: if the “shadow price” of carbon = £25 per tonne CO2
equivalent in 2007, (rising over time to £59 in 2050); we should use
this notional damage cost to guide the cost of mitigation actions**

But we need to understand marginal abatement costs

Summary of costs of reducing GHG emissions from different sources in Scotland.

Source: Nick Hanley plus additional calculations



Sector	Costs per tonne CO ₂ eq.	Comments
Industry	£14	Current EU ETS price.
Housing	negative	Based on UK wide data
Transport	Not known	No Scottish research available
Renewables	£11 - £49	Depends on whether on- or off-shore wind and whether replaces coal or gas
Agriculture	£10	Can deliver up to 1 Mt/yr., but based on US/EU data
Biofuels*	£75 >	No current estimate of Scottish land area likely to convert
Forestry	£4-£12	Assumes additionality
Carbon capture and storage	Not known	

Mitigation: smarter solutions



Currently little incentive for farmers to mitigate

But this may change.....

Mitigation can be affected by direct regulation (command & control)
or market-based instruments (i.e. joint implementation/ trading)

Trading is the UK's preferable approach to affect mitigation at least
social cost

But issues of transactions costs in applying to agriculture

Adaptation



Adaptation strategy is a domestic choice

Should Scotland focus more on adaptation?

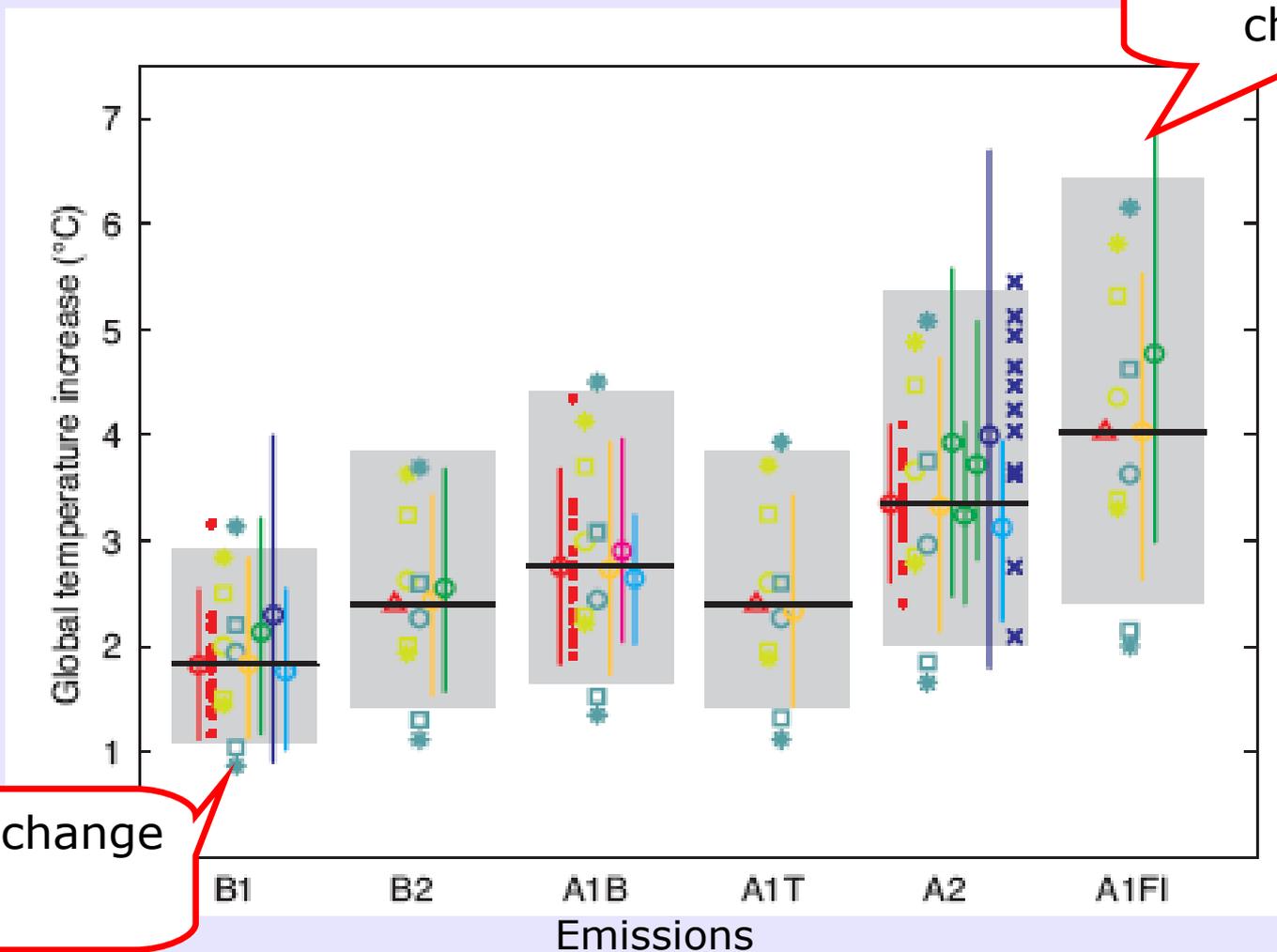
Private versus public roles – are public goods at stake?

How much adaptation? Depends on expected damages

Takes us back to the risk picture

What are we really adapting to?

This is fraught with uncertainty....



Huge planetary changes

Minor change

And this leads to other possible conclusions...



*“Governments should act not on the basis of the likeliest outcome from climate change but on the risk of something really catastrophic...Just as people spend a small slice of their incomes on buying insurance on the off-chance that their house might burn down, and nations use a slice of taxpayers’ money to pay for standing armies just in case a rival power might try to invade them, so the world should invest a small proportion of its resources in trying to avert the risk of boiling the planet.
The costs are not huge. The dangers are.”*

The Economist, November 4th-10th 2006

- Do we know what the impacts are going to be?

Not really....so what should policy assume?

- Do we know how much we should mitigate?

Depends on risk perspective & ethics

Rule of thumb: don't spend more than marginal damage cost

- How much should we adapt?

Again, depends on what risk we assume

- Should we do anything: a) in agriculture;

Probably mitigate and let adaptation happen

b) more generally?

Probably, how much and how soon?