CLIMATE CHANGE

Problem

It is now generally accepted that the increasing rate of greenhouse gas emissions during the twentieth century is forcing climate change. The most common greenhouse gases, carbon dioxide (CO_2), methane (CH_4) and nitrogen dioxide (NO_2), result from combustion of carbon fuels, agricultural practices and land use change. Scottish agriculture creates both carbon sources and carbon sinks. It is estimated that the Scottish agriculture and forestry sectors currently contribute about 5% of the UK total of greenhouse gas emissions. There is a significant opportunity for Scottish agriculture to play a key role in the Scottish Executive's contribution to the UK climate change mitigation strategies.

Impact

The current climate change scenario for Scotland to 2100 suggests:

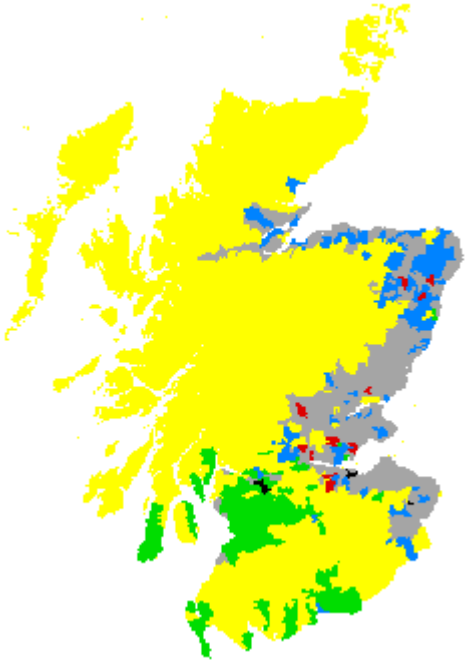
- annual average warming of 2°-3°C.
- annual precipitation increasing by around 20% with precipitation intensities increasing in all seasons.
- changes in seasonal precipitation will vary from west to east. Summer rainfall will increase by up to 20% in the west, with a slight decrease in the east.
- there are likely to be up to 20 more "hot" days (>20°C) for each degree of global warming, and a general decrease in mean seasonal wind speeds.

Expert opinion suggests that these changes will not be the major drivers of agricultural change over the next century. However, climate change may have indirect effects on Scottish agriculture through, for example, impacts on world commodity supplies and effects on prices, impacts of trading in emissions, and the opportunities for Scottish agriculture to play a positive role in climate change mitigation strategies.

Areas at Risk

There has been little research on the potential regional impacts of climate change on Scottish agriculture. Whilst the present change scenario is considered to be generally benign, evidence from studies on US agriculture indicate that there may be regional differences. Broadly:

- Lengthening of growing season, increased temperatures and CO2 levels will increase crop yields. These may reduce demands on crop land and reduce grazing pressure. This has a strong east/west component in Scotland.



Distribution of Main Farm Types

	Areas at RIsk		
Farm Type	Localised	Regional	Universal
General Cropping		Soil physical damage Loss of soluble phosphorus	Fugitive emissions Loss of nitrate
Mixed	Soil physical damage	Loss of soluble phosphorus	Faecal pathogens Fugitive emissions Loss of nitrate
Dairy		Soil physical damage	Faecal pathogens Fugitive emissions
Pigs and Poultry	Fugitive emissions		
Cattle and Sheep		Soil physical damage	Faecal pathogens Fugitive emissions

- Increased summer precipitation in the west will increase risks of soil damage through traffic and trampling effects. Reduced summer precipitation in the east may increase demands for irrigation water. Increased rainfall intensity will increase risk of soil erosion in vulnerable areas.
- Increasing crop yields could lead to increases in nitrate leaching from crops and pastures.
- The indeterminate effect of climate change on crop pests and diseases could mean increased use of pesticides and herbicides.

Practical Actions

Scottish agriculture can make a very positive contribution to the UK climate change mitigation strategy both directly and indirectly. Direct biological mitigation can be achieved by:

- conservation of existing carbon pools eg through adoption of low impact, minimum tillage systems.
- sequestration of carbon eg through diversification into biomass crops like short rotation coppice.
- substitution of sustainably produced biological products (ie crops which have high energy conversion efficiencies and/or require little fossil fuel subsidy - a benefit of localising food production). The "food miles" idea could be utilised to promote these crops.

Scottish agriculture can help mitigate the other impacts of climate change particularly in relation to flood risk and provision of wildlife corridors.

Linkages

Climate change will have systemic effects, impacting on all aspects of agriculture and the environment in Scotland.

Research Gaps

- Assessment of the potential impacts of extreme events (eg individual events or successive seasons of "poor" weather).
- Quantitative scenario analysis to assess potential regional effects (as per studies on US agriculture).
- Cost-benefit analysis of the potential roles for Scottish agriculture in biological mitigation of climate change either through conservation, sequestration or substitution strategies.
- Identification of the potential roles of agriculture in relation to mitigating other impacts (eg flooding and wildlife corridors) and examining how these can be factored into current land management strategies at farm or river catchment level.

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