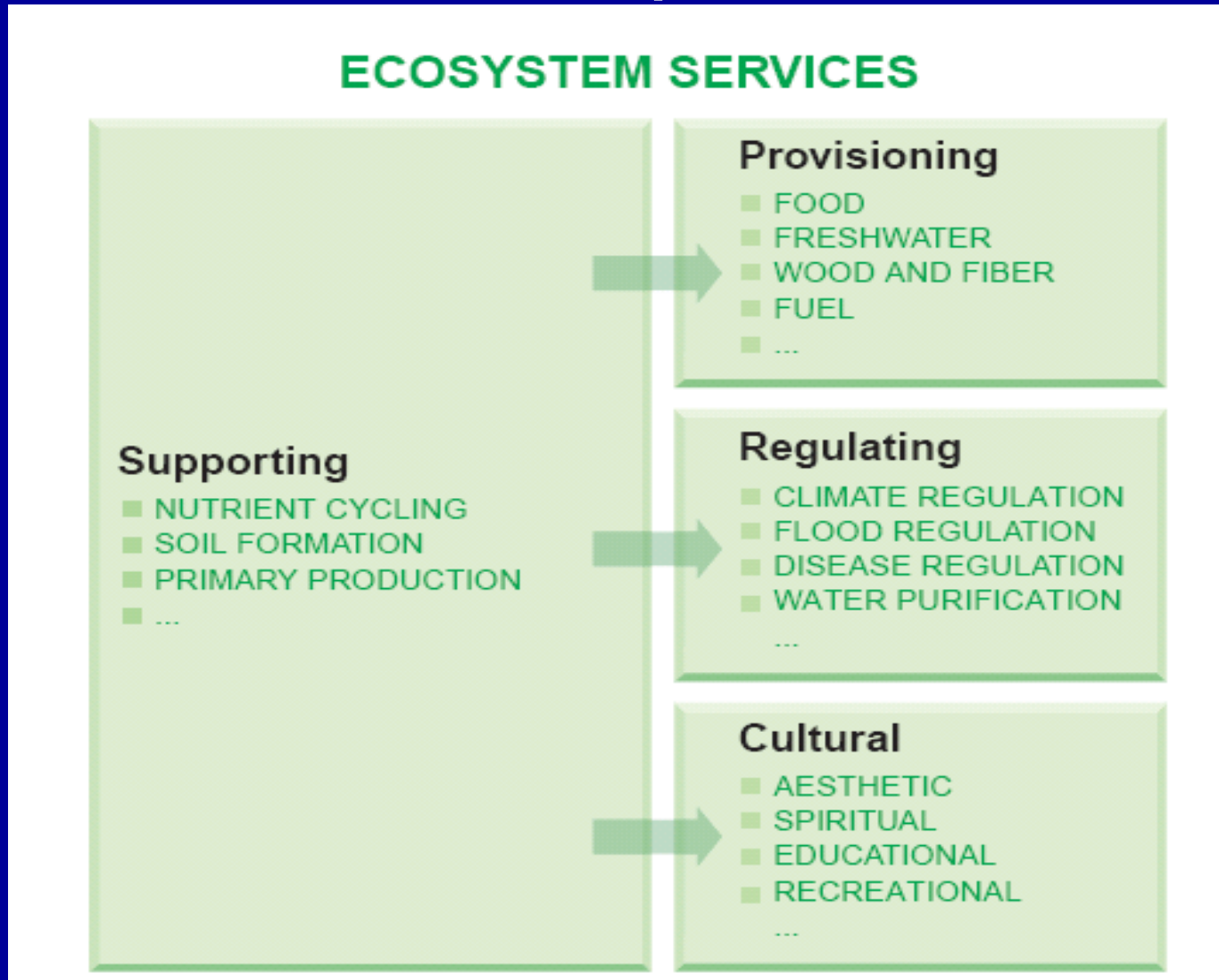




The significance of Scotland's wild landscapes for mitigating climate change

Graham Russell

Benefits people obtain from wild landscapes



What are wild landscapes?

- Perceived naturalness
 - depends on knowledge
- Few human artefacts
 - depends on observation
- Remoteness
 - depends on means of travel



What do we mean by climate change?

- Change in the statistical properties of weather parameters
 - annual cycle of temperature
 - rainfall pattern
 - storminess
 - snow fall



Some key questions

- Can wild landscapes be justified in terms of climate change mitigation?
- Considering climate change mitigation alone, would it be a good idea to convert wild landscapes to intensive forestry?
- Are all wild landscapes of equal significance for climate change mitigation?

Climate Change (Scotland) Act 2009

- Sets targets
- Duty to produce a land use strategy

Climate Change (Scotland) Act 2009 (asp 12)



Climate Change (Scotland) Act 2009 2009 asp 12

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Mechanisms of climate change

- Reflection of solar radiation
 - albedo of surfaces, snow cover, cloudiness, atmospheric aerosols, volcanic ash
- Retention of thermal radiation
 - greenhouse gases: carbon dioxide, methane, nitrous oxide, (water vapour, ozone, chlorofluorocarbons,)



Wild landscapes and climate change

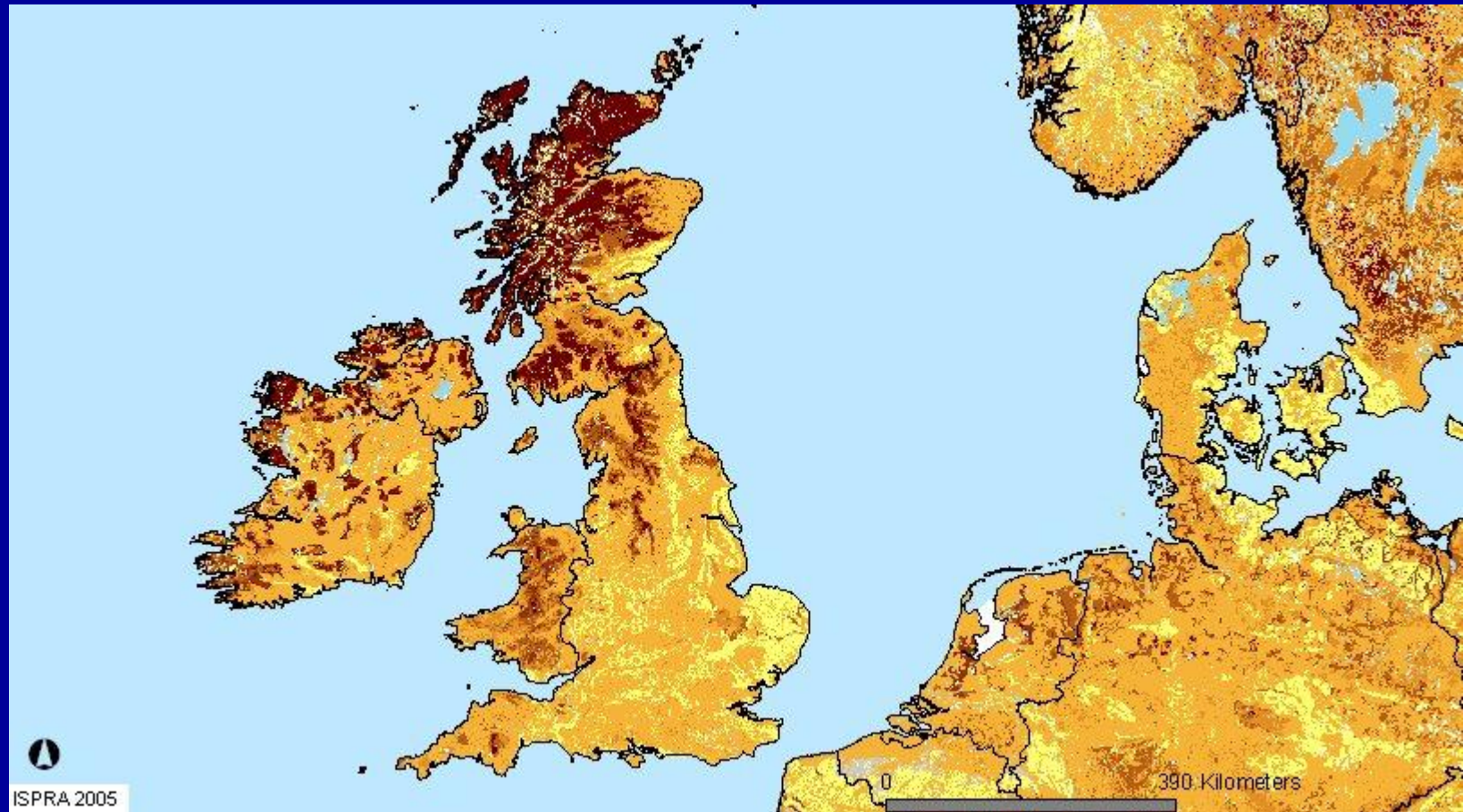
- Albedo
 - probably not a significant effect
- Carbon dioxide
 - taken up by plants, and storage in biomass and soil organic matter
 - released by land cultivation and fire
- Methane
 - released from wetlands
- Nitrous oxide
 - naturally released in damp conditions but probably not significant in wild landscapes

Some Scottish wild landscape soils



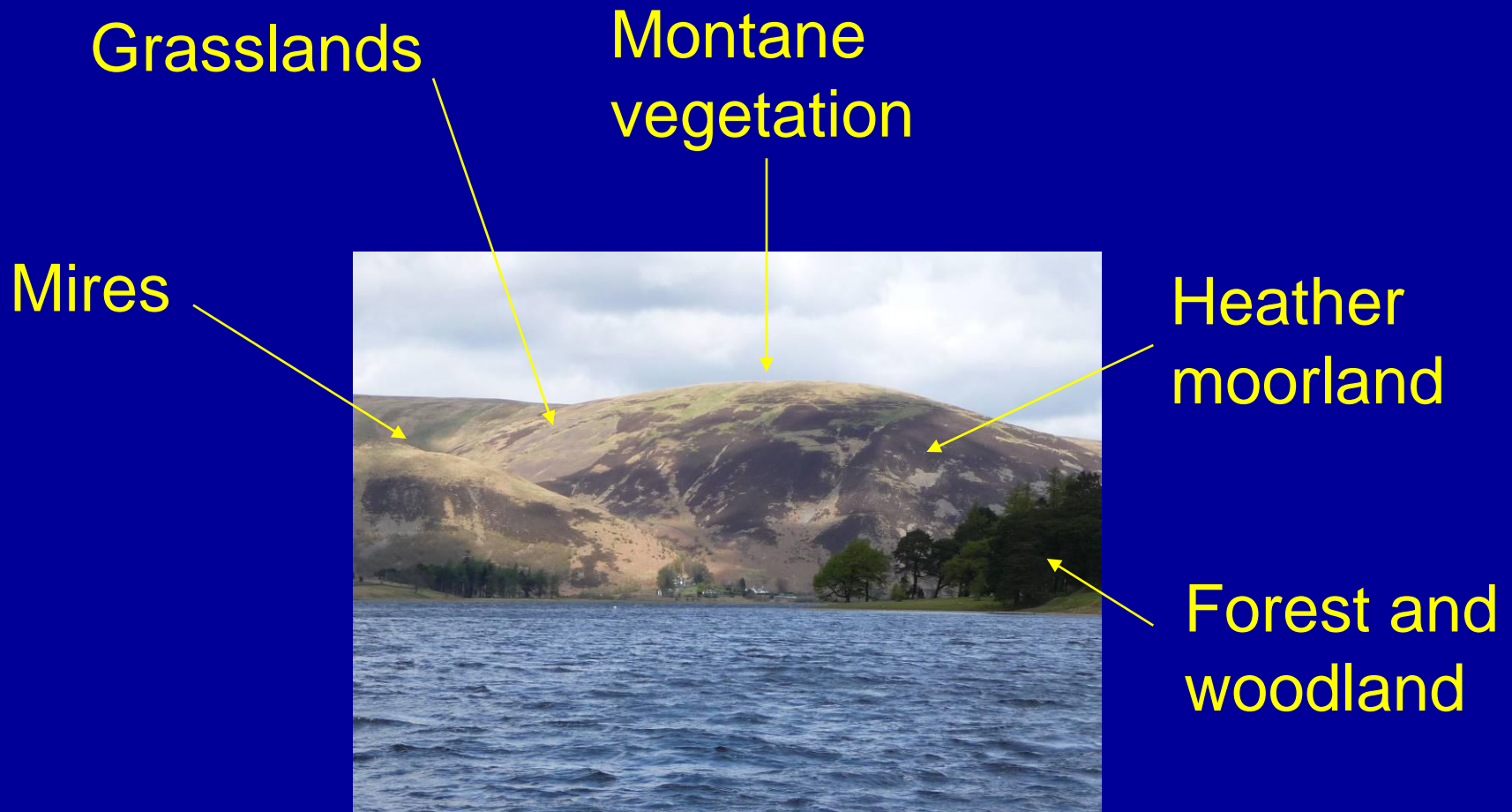
Scottish soils contain more than half of the UK soil carbon, mainly as peat. It has taken 7000 years to sequester the equivalent of about 180 years of our current CO₂ emissions as growth is very slow.

Soil organic carbon



High carbon soils are found where it is wet and cool

Land covers of wild landscapes



Mires



- Mainly blanket bog
- Healthy, actively-growing bogs are a sink of carbon
- They are a lesser source of methane
 - Emissions temporarily increased when drains are blocked to restore a bog
- Contain very important stocks of carbon that could be released as carbon dioxide
 - drainage, drier climate, tree planting

Forest and woodland

- Sink for carbon but reach a steady state
 - trees die and the carbon is released
- Longevity: 100 years for birch to 300 years for oak
- ‘Natural’ forests in Scotland tend to be gappy and grow slowly
- Risk of carbon loss through fire



Managed forests

- Managed forests sequester much more carbon (higher growth rates and more stems per hectare)
 - felled timber can be used to substitute for oil-based fuel and high carbon building materials like steel and concrete



Heather moorland

- An important part of Scotland's wild landscapes....
- ... but the result of management
- Kept at an early stage of succession by fire
- Carbon lost by appropriate burning is probably balanced by a rejuvenation of the heather
 - inappropriate burning can set peat on fire

Grasslands

- Most grasslands are a product of management by grazing
- Methane production from ruminants is small compared with other sources
- Neutral effect on carbon balance?
- Some grasslands may have high carbon soils
- Potential risk of fire



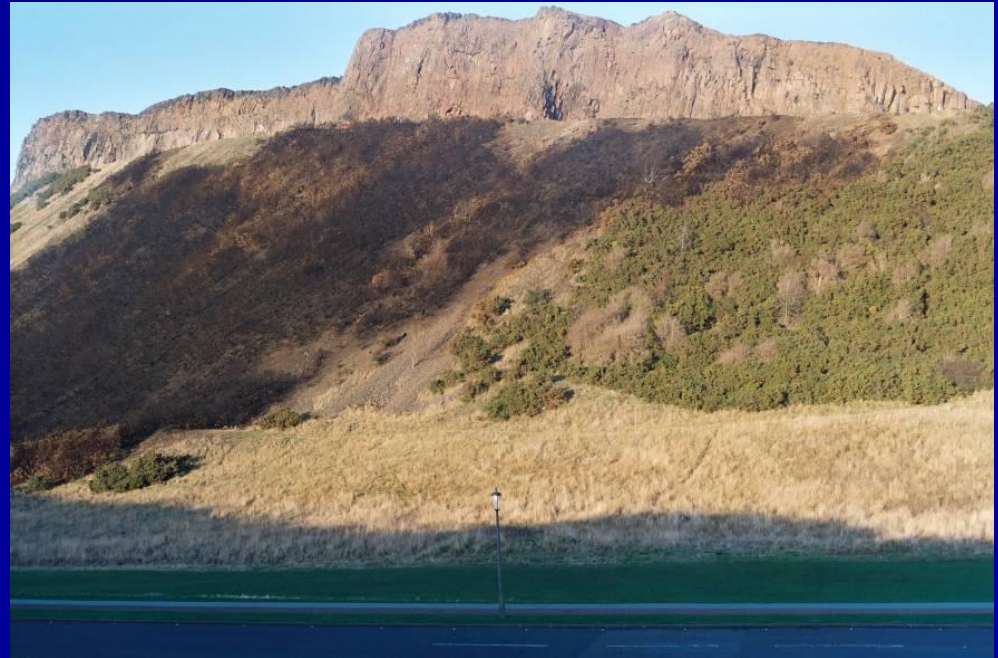
Montane vegetation

- Above the tree-line
- Thin, low-carbon soils
- Relatively small area
- Vulnerable to climate change



Transitions

- Mire to woodland
- Heather moorland and grassland to woodland
- Effect of policy
 - CAP/ SRDP
- Effect of climate change
 - wetness on mires
 - temperature on tree-line
 - risk of fire



Other regulating and provisioning services

- Flood control
 - but not for the largest floods
- Water purification
- Hydro power generation
 - reduces greenhouse gas emissions elsewhere



Does retaining unmanaged land enhance resilience and facilitate adaptation?

Conclusions

- Important to preserve carbon stocks
 - e.g. peatlands
- Woodland is a net fixer of carbon
 - but high rates of fixation and long-term storage require managed forests
- Better to reduce emissions elsewhere than rely on mitigation from wild landscapes
- Expect the unexpected!



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All errors and misinterpretations are my responsibility.