

# Managing Conflicting Goals in the Uplands: Consequences for biodiversity?

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# Structure

- Ecosystem Services approach
- Trade-offs and conflicts
- Consequences for biodiversity
- Framework for managing conflicting goals



Energy



Forestry



Carbon storage



Recreation & tourism



Biodiversity



Drinking water



Landscapes of aesthetic & cultural importance

Game



Livestock



# ECOSYSTEM SERVICES

## Supporting

- NUTRIENT CYCLING
- SOIL FORMATION
- PRIMARY PRODUCTION
- ...

## Provisioning

- FOOD
- FRESHWATER
- WOOD AND FIBER
- FUEL
- ...

## Regulating

- CLIMATE REGULATION
- FLOOD REGULATION
- DISEASE REGULATION
- WATER PURIFICATION
- ...

## Cultural

- AESTHETIC
- SPIRITUAL
- EDUCATIONAL
- RECREATIONAL
- ...

# Multiple Objectives

The background of the slide is a photograph of a mountain valley. In the foreground, there are rocky, grey slopes. The middle ground shows a wide valley with green meadows and a winding path or stream. In the distance, there are more mountains under a hazy sky.

Ecosystem Services approach highlights the multiple objectives inherent in determining how to sustainably manage out uplands.

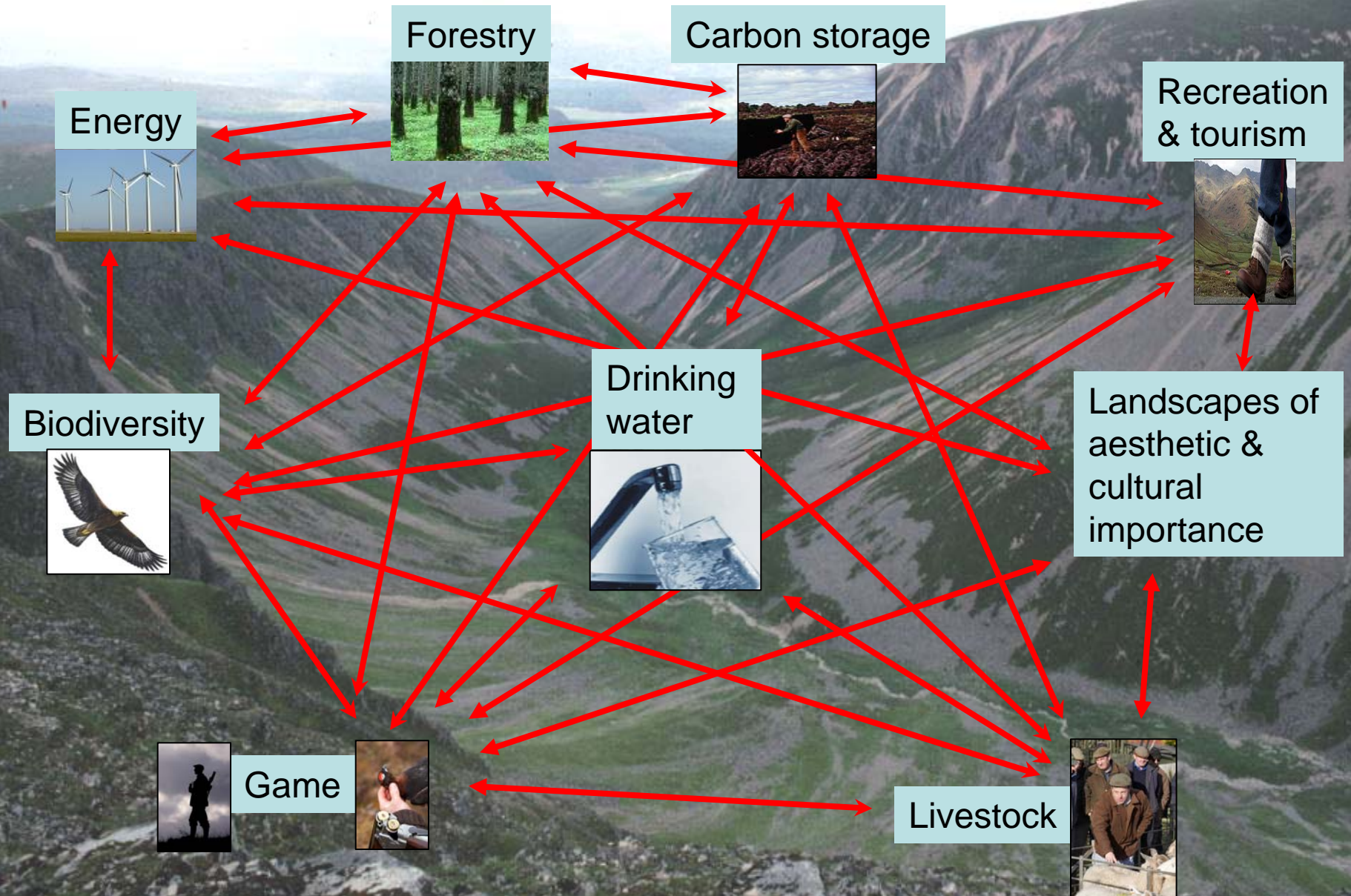
Sustainable upland management depends on:

- Identifying trade-offs between objectives
- Quantifying impact on Ecosystem Services (biodiversity)
- Developing adaptive management framework

# Scotland's Upland Biodiversity

<b>Taxonomic Group</b>	<b>Scottish Priority spp</b>	<b>Primarily Upland</b>	<b>Secondarily Upland</b>	<b>% combined</b>
<b><i>Algae</i></b>	<b>11</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b><i>Bryophytes</i></b>	<b>59</b>	<b>26</b>	<b>1</b>	<b>46</b>
<b><i>Fungi &amp; Lichens</i></b>	<b>127</b>	<b>14</b>	<b>7</b>	<b>17</b>
<b><i>Vascular plants</i></b>	<b>111</b>	<b>45</b>	<b>8</b>	<b>48</b>
<b><i>Invertebrates</i></b>	<b>164</b>	<b>30</b>	<b>19</b>	<b>30</b>
<b><i>Vertebrates</i></b>	<b>138</b>	<b>7</b>	<b>11</b>	<b>13</b>
<b><i>TOTAL</i></b>	<b>610</b>	<b>122</b>	<b>46</b>	<b>28</b>

# Conflicting goals



# Conflicting goals

- Upland ecosystems are generally managed for the delivery of market-valued goods.
- Upland ecosystems are highly valued for a variety of other (often un-priced) goods and services.



# Two examples from upland management



**Provisioning –  
Food: Sheep**



**Cultural –  
Recreation: Grouse shooting**

# Sheep grazing



# Grazing conflicts with other ES



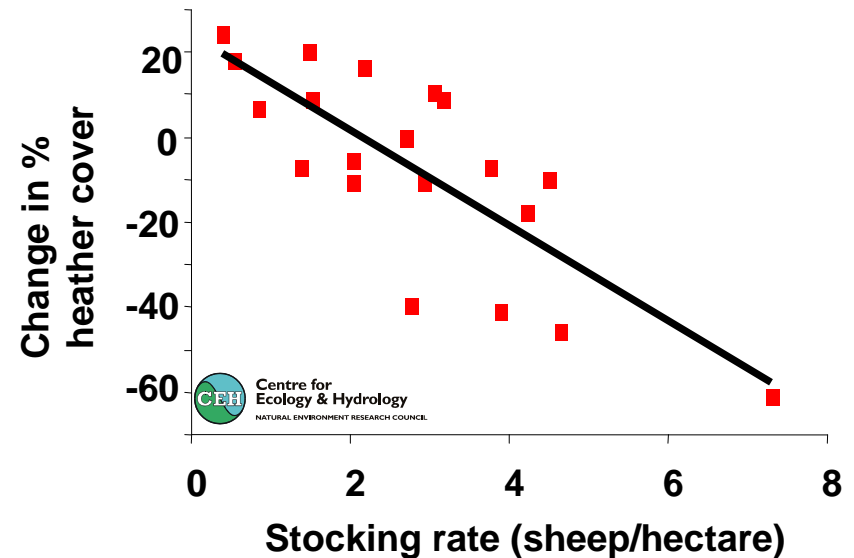
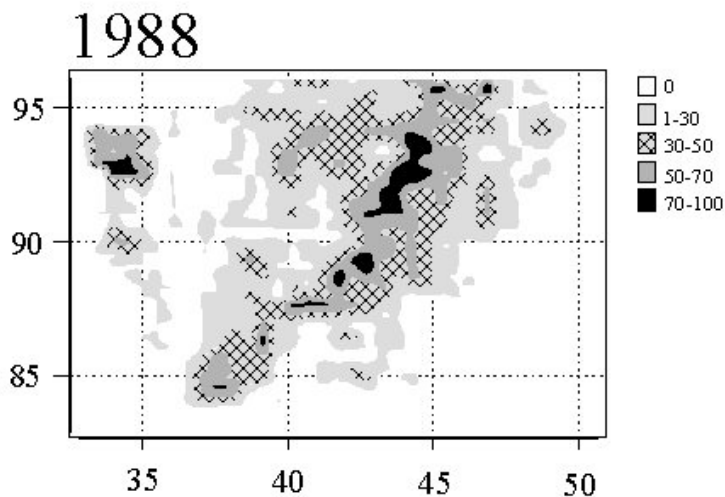
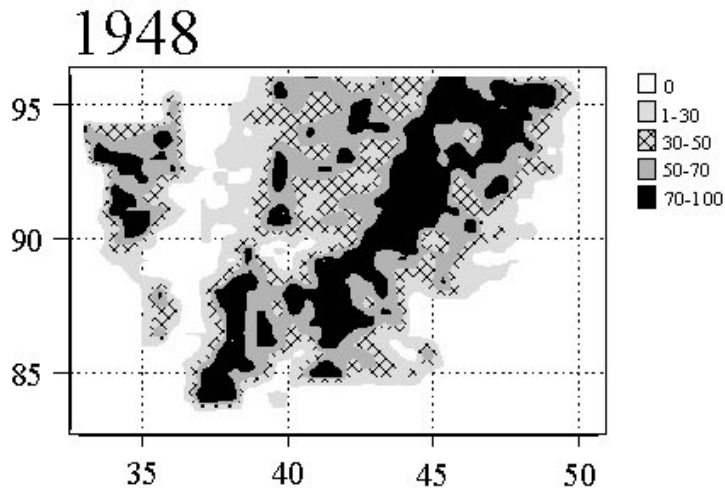
## Grazing can contribute to:

- Loss of heather and associated biodiversity / game
- altered river flow & enhanced flood peaks downstream (Holden 2009);
- soil erosion (Evans 1996)
- carbon losses (Worrall & Evans 2009)
- water borne disease – *Cryptosporidium*

However, evidence is often sparse and relationships poorly understood.

# Consequences of grazing for biodiversity

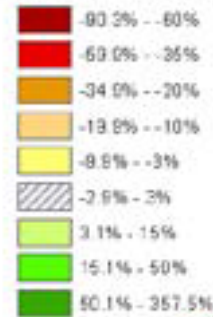
25% reduction in heather moor



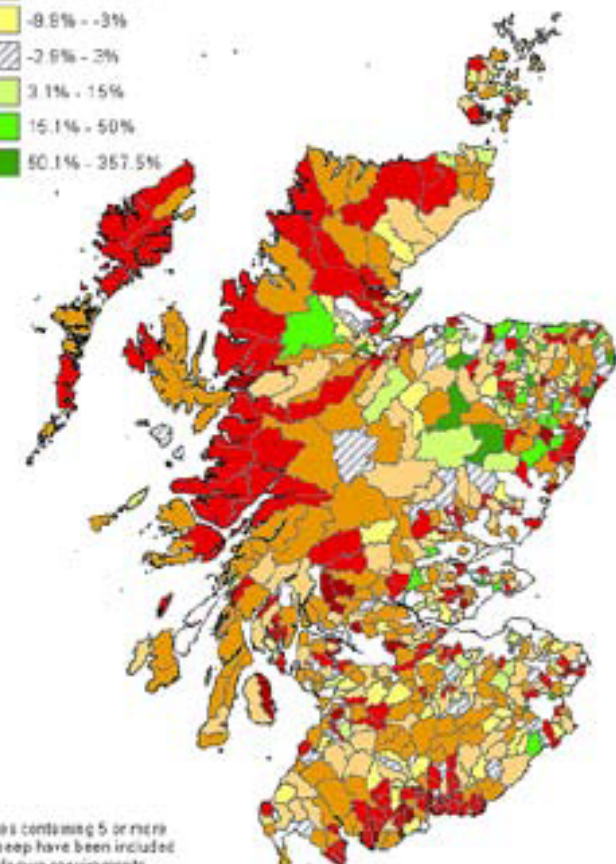
# Grazing management

Sheep grazing is sensitive to payment schemes and as such the conflicts that have arisen have the potential to be effectively managed through appropriate policies.

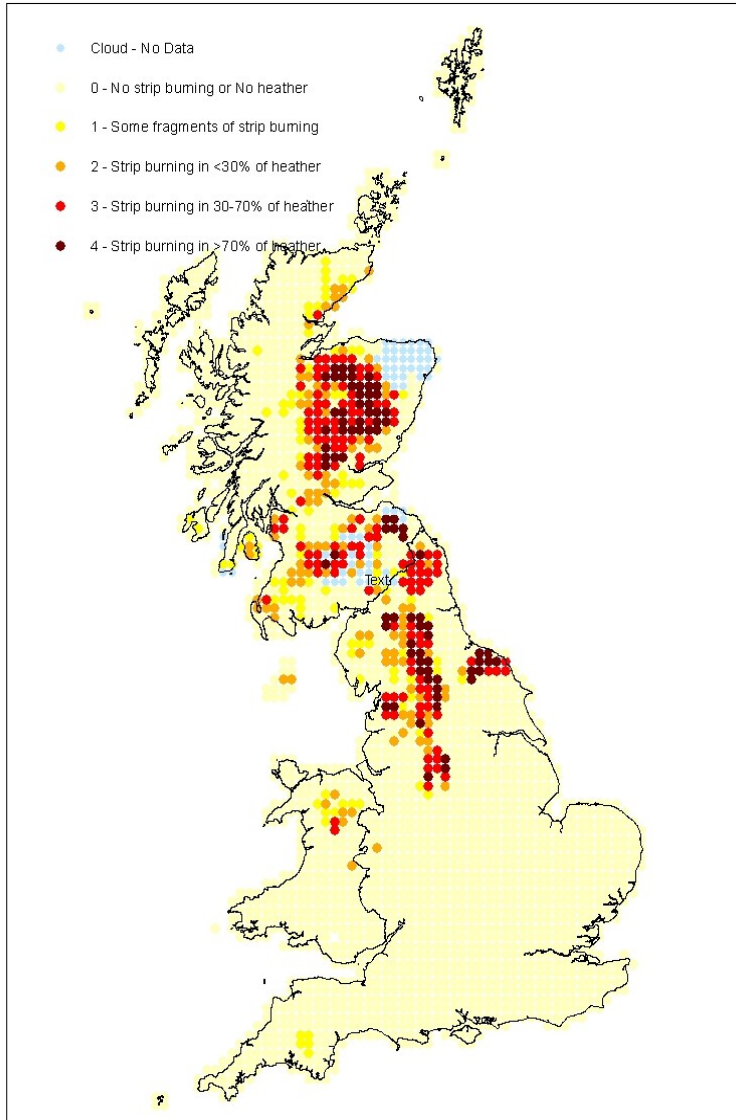
Change in Sheep No.



Only Pastures containing 5 or more  
units with sheep have been included  
to meet disclosure requirements.  
Source: RERAD, Joint Agriculture and  
Horticulture Council of Scotland



# Red grouse management: conflicting goals



Anderson et al. 2008.



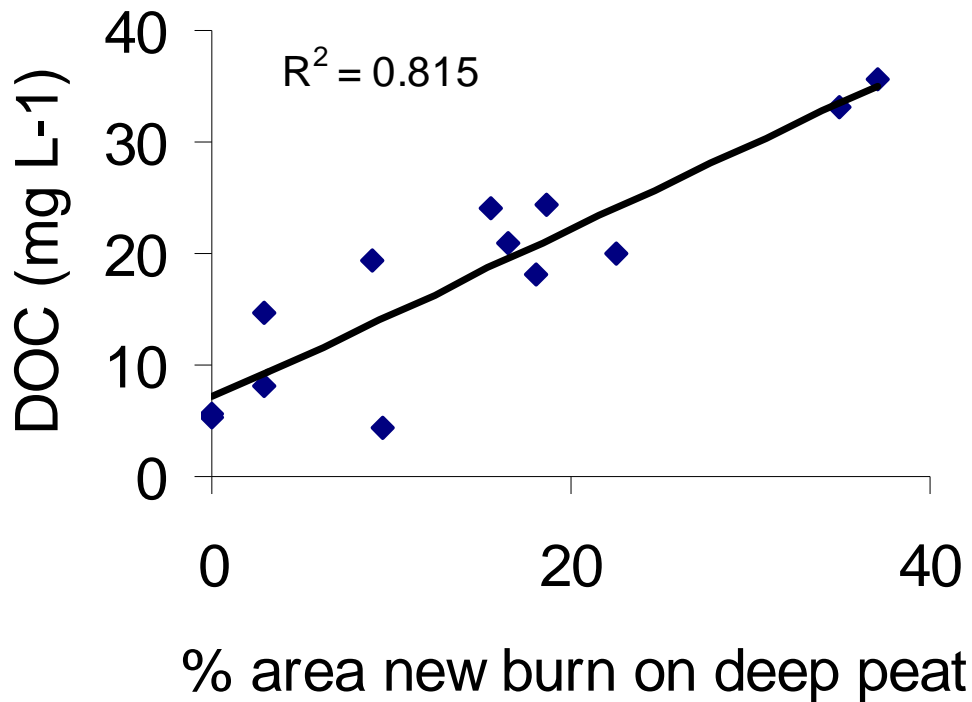
# Grouse management conflicts with other ES

**Management can contribute to:**

- loss of predators
- loss of carbon
- reduced pine regeneration
- reduced recreational access



# Does burning conflict with other ES? (e.g. Burning and carbon losses)



“There appears to be ample justification for suggesting that all deep-peat areas of the uplands....should not be burnt”  
Yallop et al. 2009.



# Burning: consequences for biodiversity



Does burning maintain vegetation diversity?

Short and long-term studies indicate burning old stands may **reduce** floristic diversity.



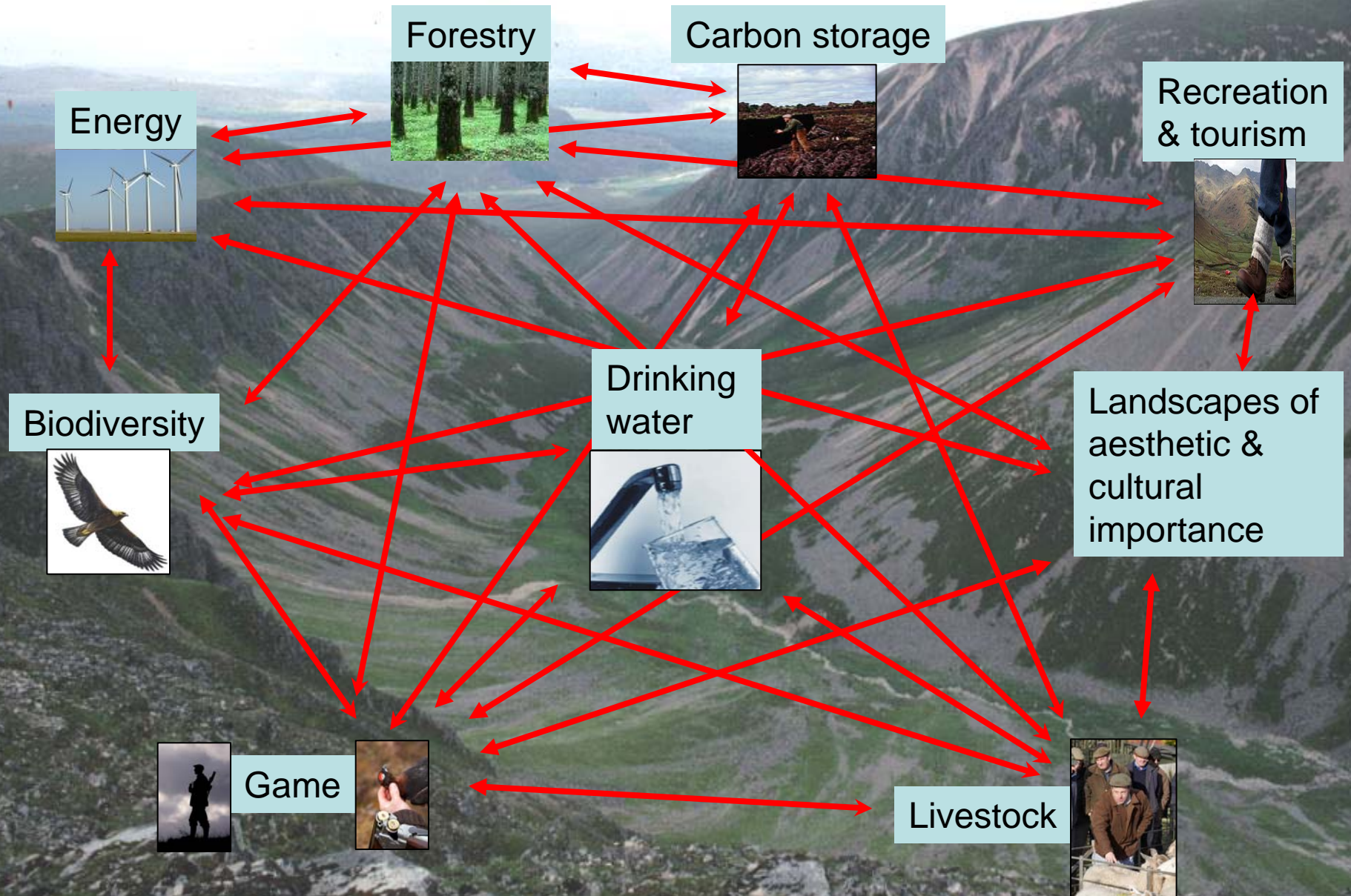
“More systematic research required to tease out interactions with grazing and site specific effects” – *Stewart, Coles and Pullin (2004)*.

# Grouse management



- Grouse managers do not receive government subsidy and rely on private income to support this “recreational” activity.
- Subsidies and incentives are less important levers and whilst legislation can be put in place – it may be ineffective if it is seen as competing with the goal of land management.

# Conflicting goals

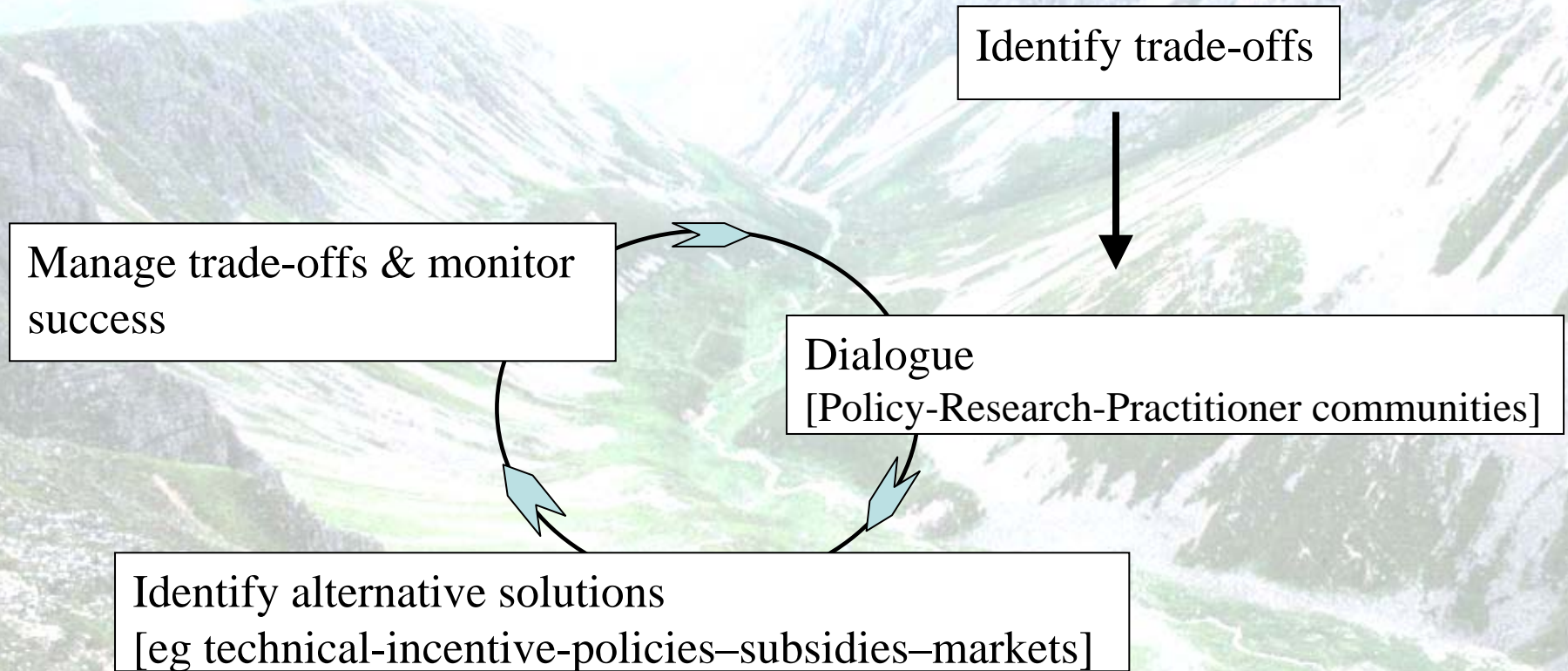


# Challenges: Managing conflicting goals

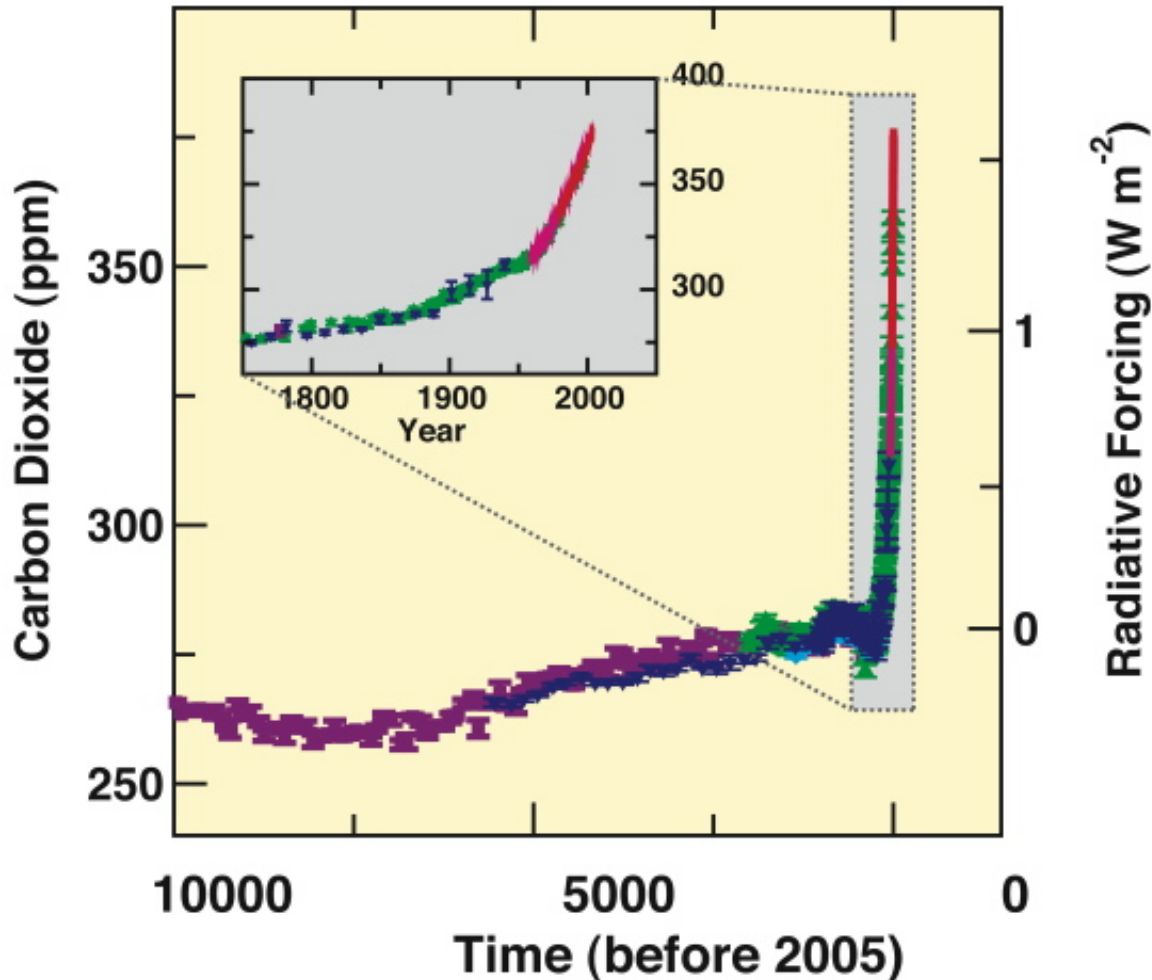
## Two broad approaches:

- **“Top-down”** approach aimed at delivering strong mechanisms to safeguard ecosystem services – eg biodiversity
- **“Bottom-up”**, participatory approach aimed at integrating management with the livelihoods of those dependent on the ecosystem

# Way Forward: Adaptive Management



# The Future



## IMPACT on:

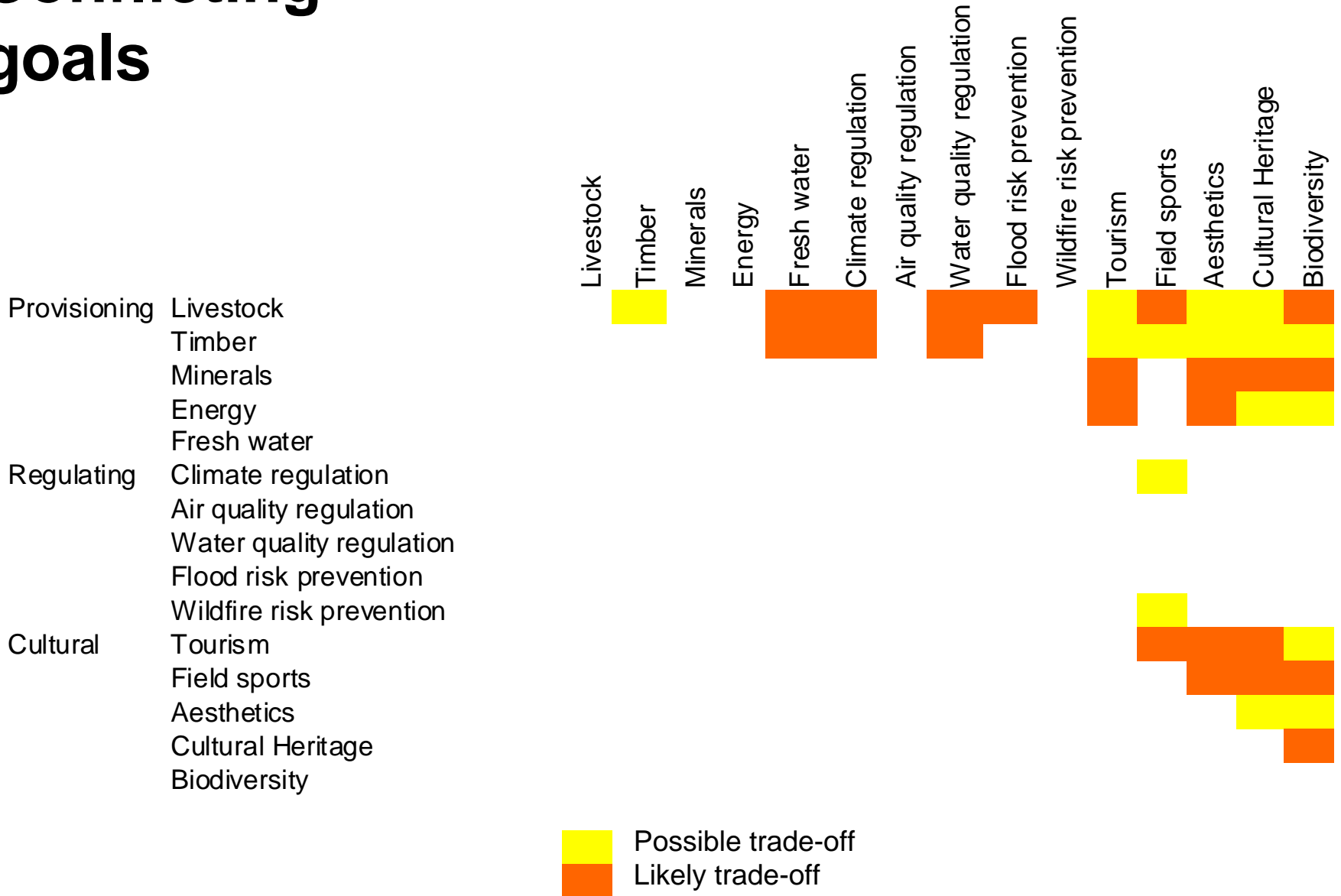
- Climate
- Carbon sequestration
- Upland productivity
- Ecological processes
- Societal pressures –
  - water
  - energy
  - food

# Summary

- There are numerous trade-offs among Ecosystem Services (ES)
- Lack of knowledge about trade-offs & consequences for biodiversity
- Upland management requires holistic rather than sectoral approach
- Need inclusive approaches for setting priorities and optima
- Dynamic system – challenges will vary over time in response to climate, land-use and governance.
- Adaptive management framework can accommodate this but needs resources (time and money)



# Conflicting goals



# Consequences of land management for habitat condition.

