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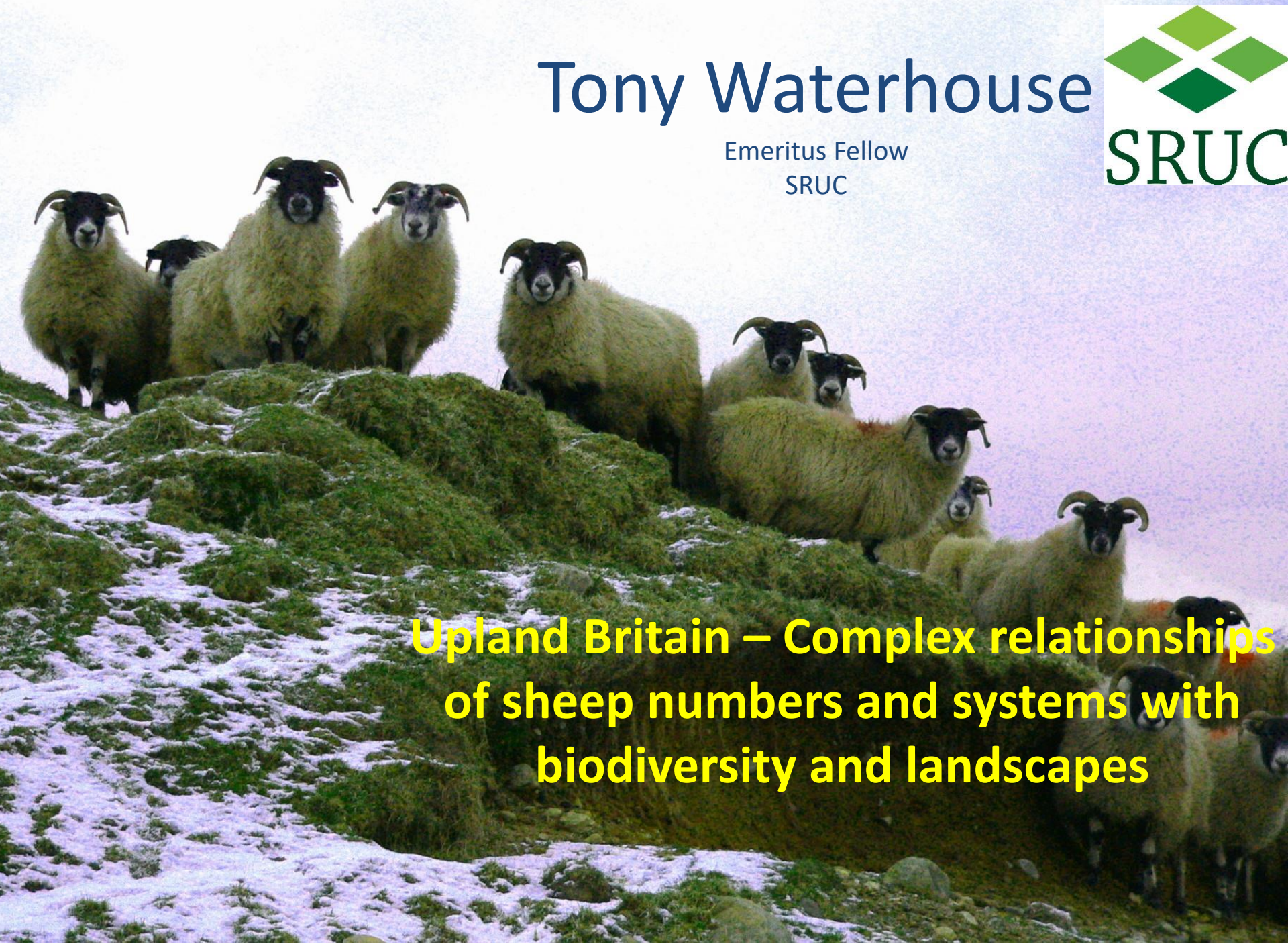
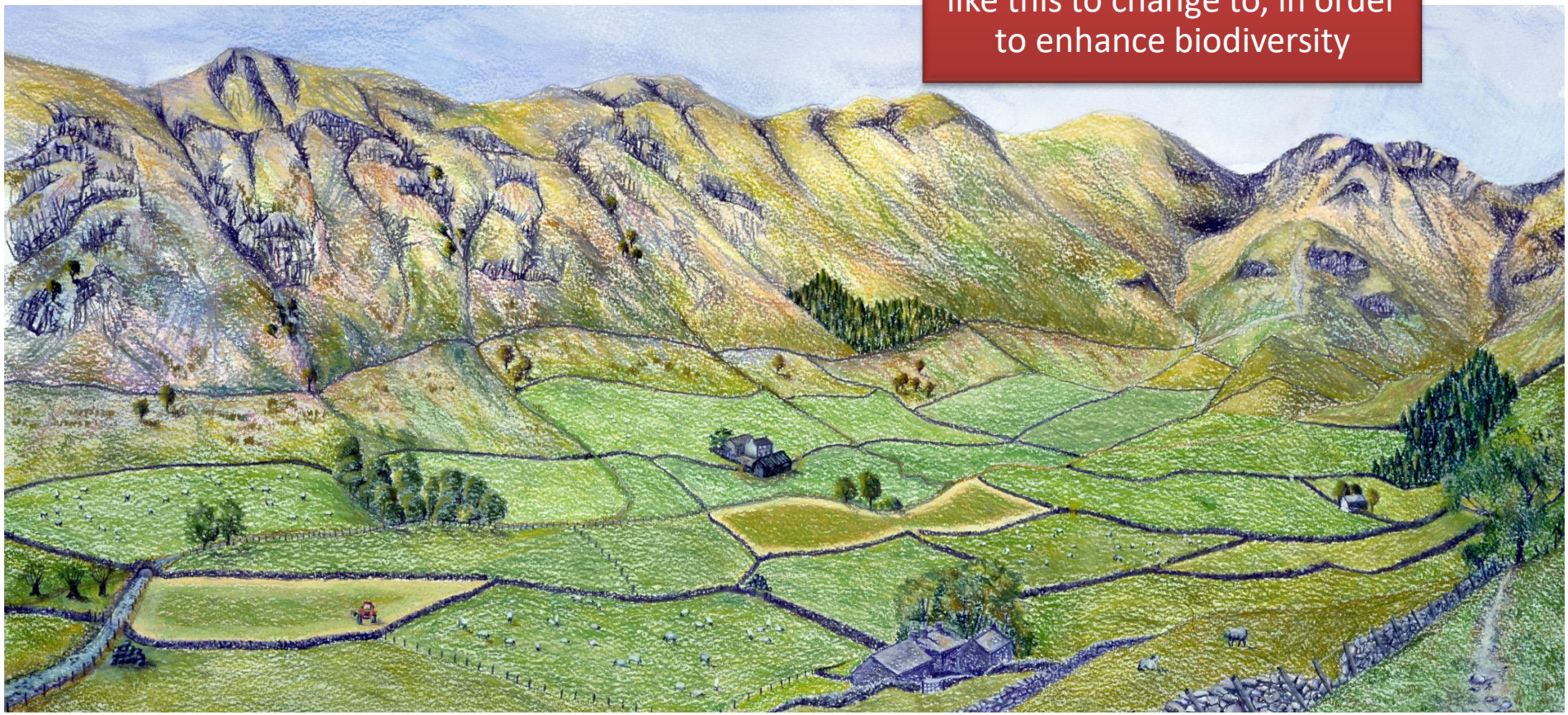


Upland Britain – Complex relationships of sheep numbers and systems with biodiversity and landscapes

UK upland systems, based around sheep, use sophisticated landscapes very much designed for, and by, livestock farming

This view is of Great Langdale in the Lake District National Park.
This valley and its surrounding hills, called Fells here, contains an estimate of 200 or so cattle, in the valley, maybe 2-4,000 sheep using both hill native pasture and improved pastures. There are no fences on the upper fells. On a typical day, over 1,000 tourists will visit and walk the fells in this area

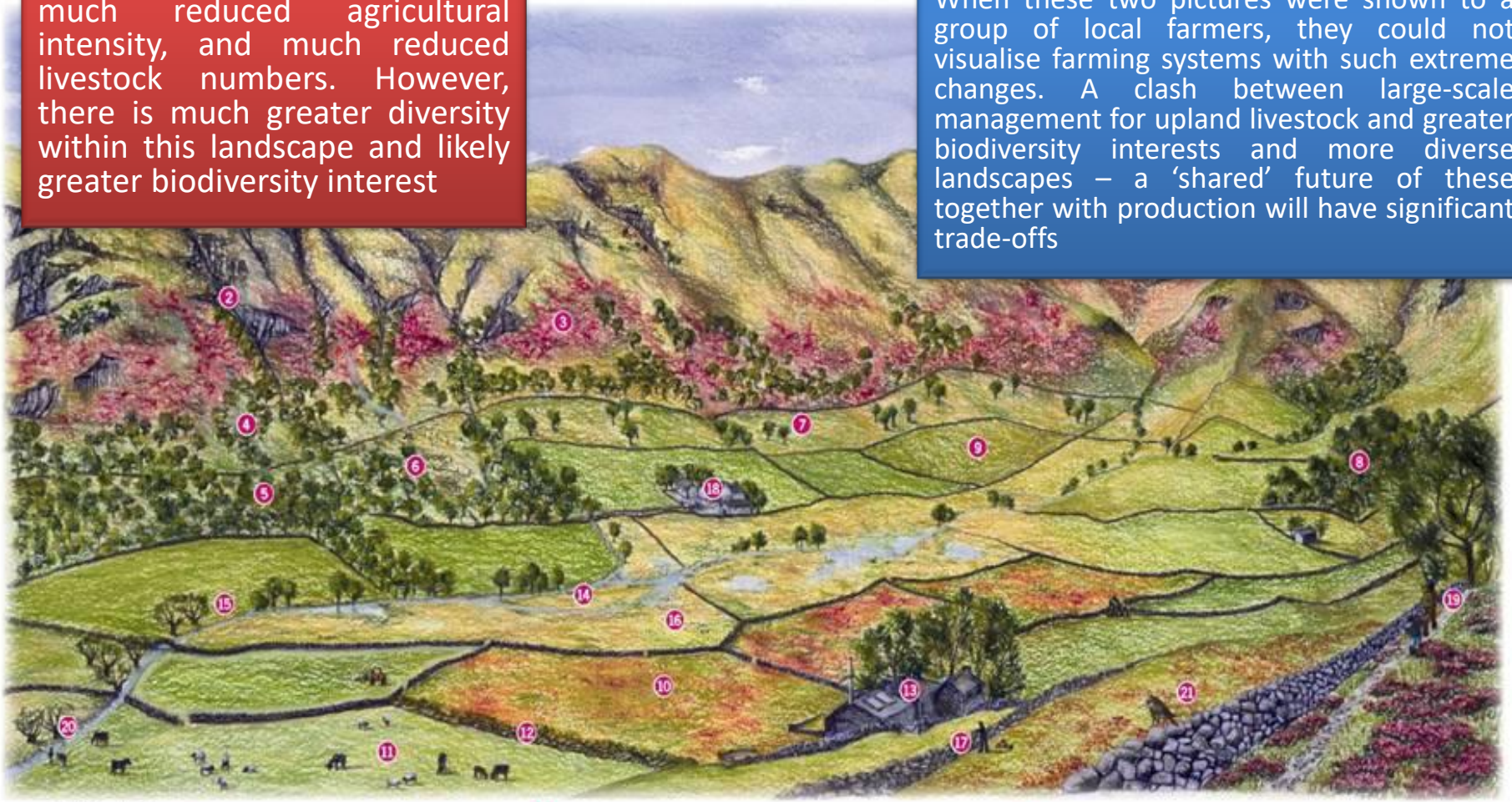
This stylised drawing shows a typical lakeland landscape. This was used by authors (below) to discuss what non-farming interest groups would like this to change to, in order to enhance biodiversity



Flora of the Fells Project; Martin Varley and Paul Arkle

The resulting landscape has much reduced agricultural intensity, and much reduced livestock numbers. However, there is much greater diversity within this landscape and likely greater biodiversity interest

When these two pictures were shown to a group of local farmers, they could not visualise farming systems with such extreme changes. A clash between large-scale management for upland livestock and greater biodiversity interests and more diverse landscapes – a 'shared' future of these together with production will have significant trade-offs



OPEN FELL

Whole fell management with grazing levels of both sheep and cattle which encourage natural regeneration of:

1. ledge and crag vegetation
2. woodland in gills and gullies
3. heather
4. wood pasture

INTAKE

5. woodland re-creation where appropriate
6. commercial use of woodland - coppicing, charcoal, biomass
7. wood pasture
8. restoration of conifer woodland to native woodland

IN-BYE AND FARM BUILDINGS

9. intensive grassland
10. restoration of upland hay meadows
11. mixed grazing of sheep and cattle
12. repair of field boundaries/planting of new hedges
13. use of small-scale renewable energy/sustainable building materials on farms, e.g. wind power and solar panels

RIVERS AND WATERCOURSES

14. more natural watercourses
15. enhanced riverside vegetation
16. restoration of wet meadows

RECREATION AND EMPLOYMENT

17. increased opportunities for land-based emplyment
18. potential for farm diversification into wildlife/nature conservation based activities/education or housing for workers
19. added colour/texture to landscape enhances recreation experience
20. improved opportunities for fishing and water based recreation where appropriate
21. more opportunities for wildlife

Biodiversity – a badly used term

As commonly used, '**more biodiversity**' makes as much sense as '**more genetics**'

Usually, it makes more sense to talk about 'richness in habitats' and 'richness of biodiversity' etc

But often for land use choices, the opening question should be

'what sort of biodiversity do you want?'

Different suites of wildlife/plantlife for;

- Open grazed landscapes
- mozaics of fields surrounded by hedges and small woodland/copses (bocage landscape)
- and woodlands (of either native or exotic forestry species)

Who wants which type of biodiversity?

Complex series of trade-offs between different land use objectives and different outcomes at different scales from patch to landscape

Grazing

- Biomass removal – grazing
- Trampling
- Defaecation/urination

- Within species/breed differences
- Between species

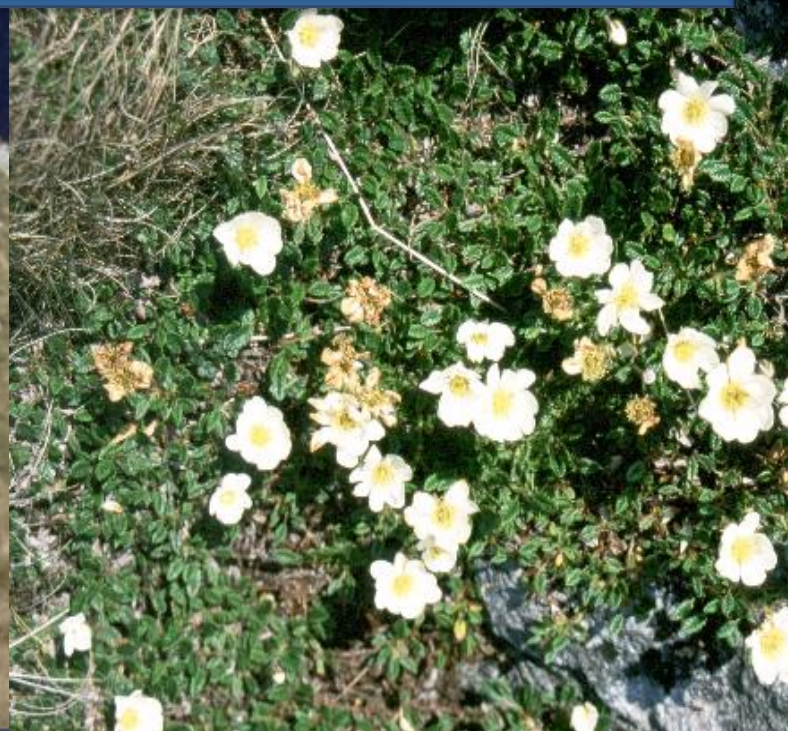
- Other roles within ecosystem, e.g. providing carrion ?

Grazing – different scales

- Tussock
- Patch
- ‘Field’
- Landscape
- Human intervention

Some complex relationships between grazing and wildlife – here a butterfly, the high-altitude Mountain Ringlet highly dependent upon grazing through its use of Nardus stricta, a grass often considered very poor for biodiversity interest. Now at risk from extinction in UK from climate change

And some plants are little affected by grazing because live in inaccessible locations of cliffs OR conversely other species are found in short-grazed habitats



Grazing exclosures

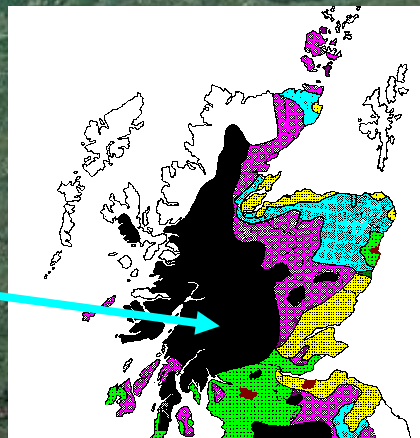
Large scale sheep off-wintering project

Grazing systems - 3 plots

Some large scale, full system grazing studies. Here sheep are long term residents in the system, not short term grazing plots

Site = Kirkton and Auchtertyre, west Highlands

350-1033 m.a.s.l.

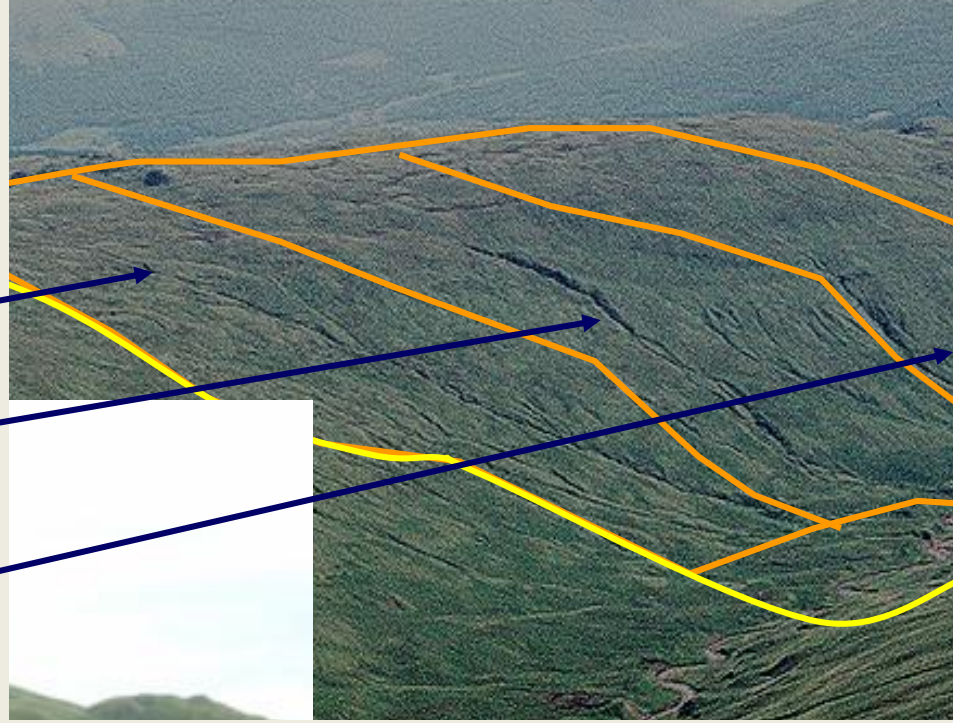


Full sheep systems;

Phase 1 - baseline - all 1 ewe/ha

Phase 2 - three systems -

- 1 ewe /ha
- reduced to 0.5 ewes/ha
- 0.5 ewes plus summer cattle



For 5 years

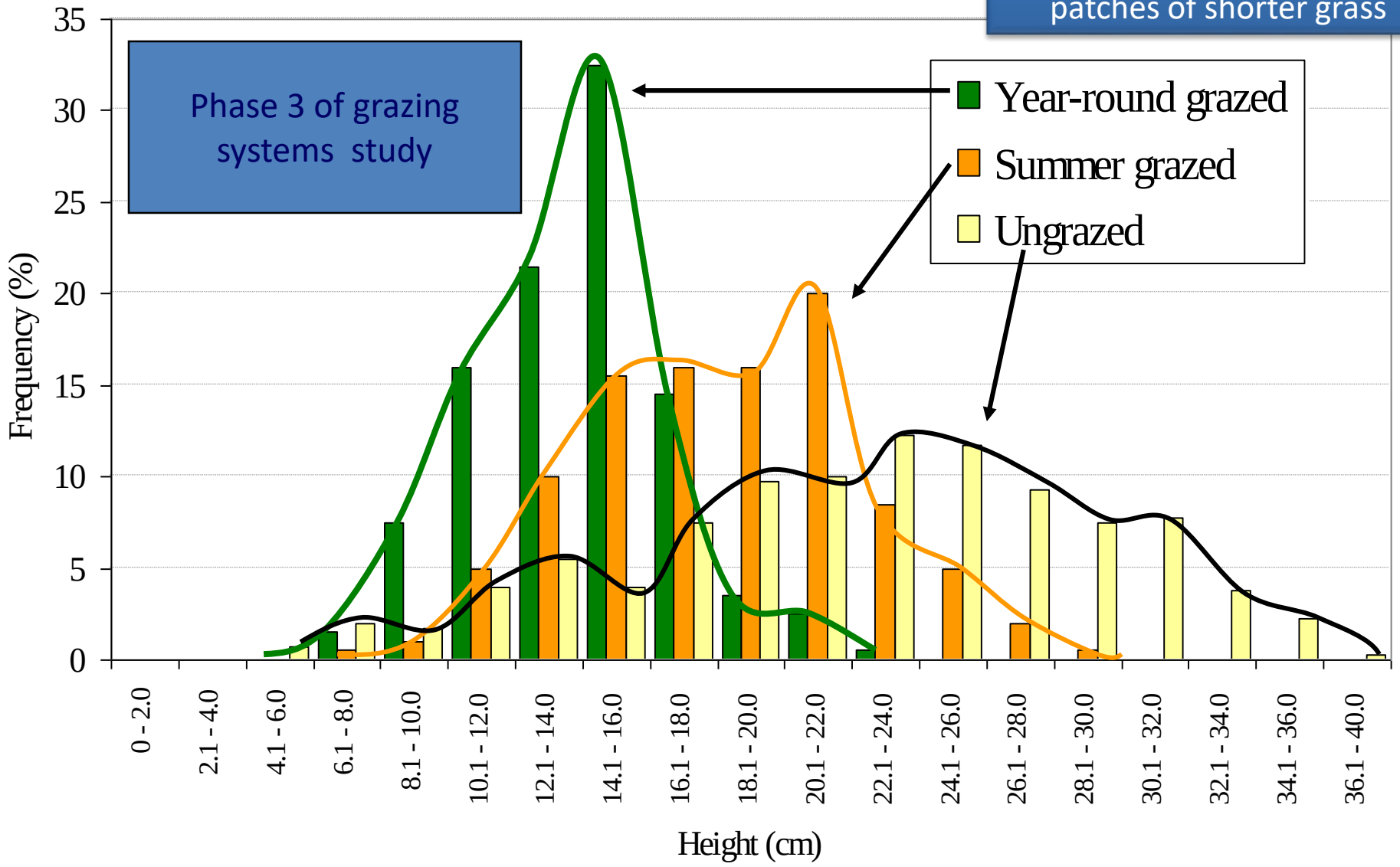
- No major changes in species composition or cover
- 'added' cattle system - small increases in ruderal species and in bare ground
- low levels of utilisation of plant communities - 6 to 26%
- but differences in sward structure begin to emerge
- no major impacts on animal performance

One conclusion: stocking rate is not very effective to achieve landscape changes, so system robust.

Impact of grazing system on swar

The next change was to shift to bigger seasonal grazing changes – and to grazing removals

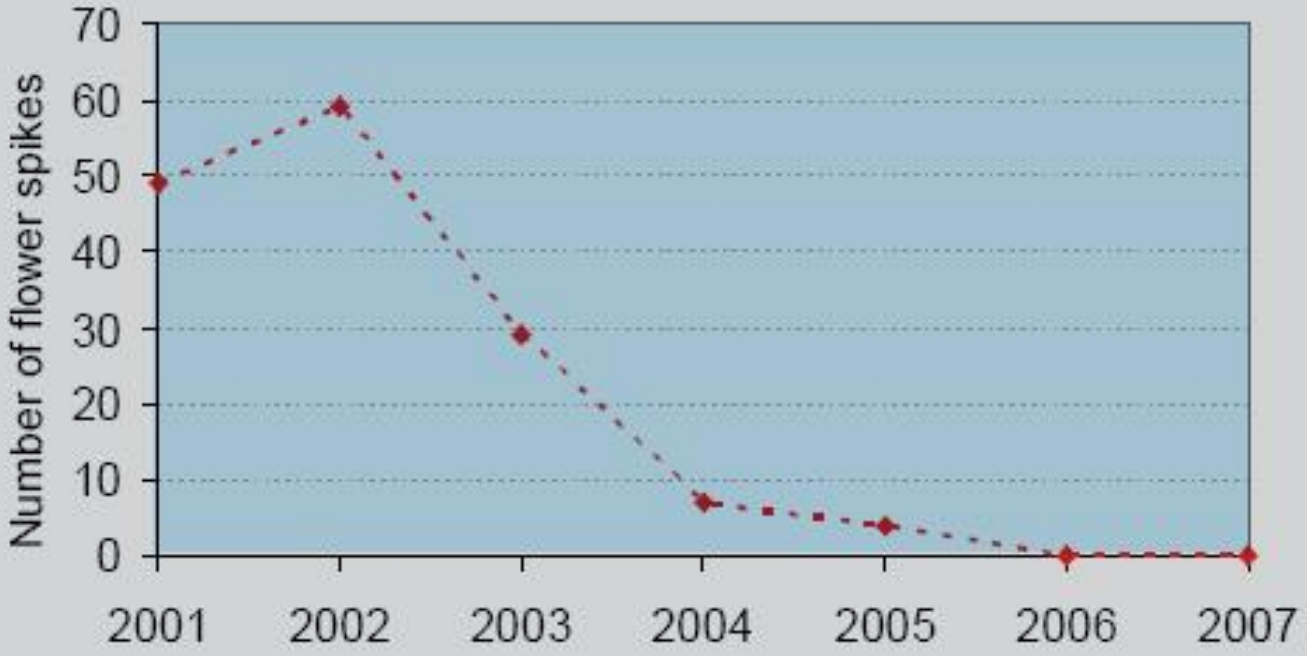
Quite quick impacts on loss of patches of shorter grass

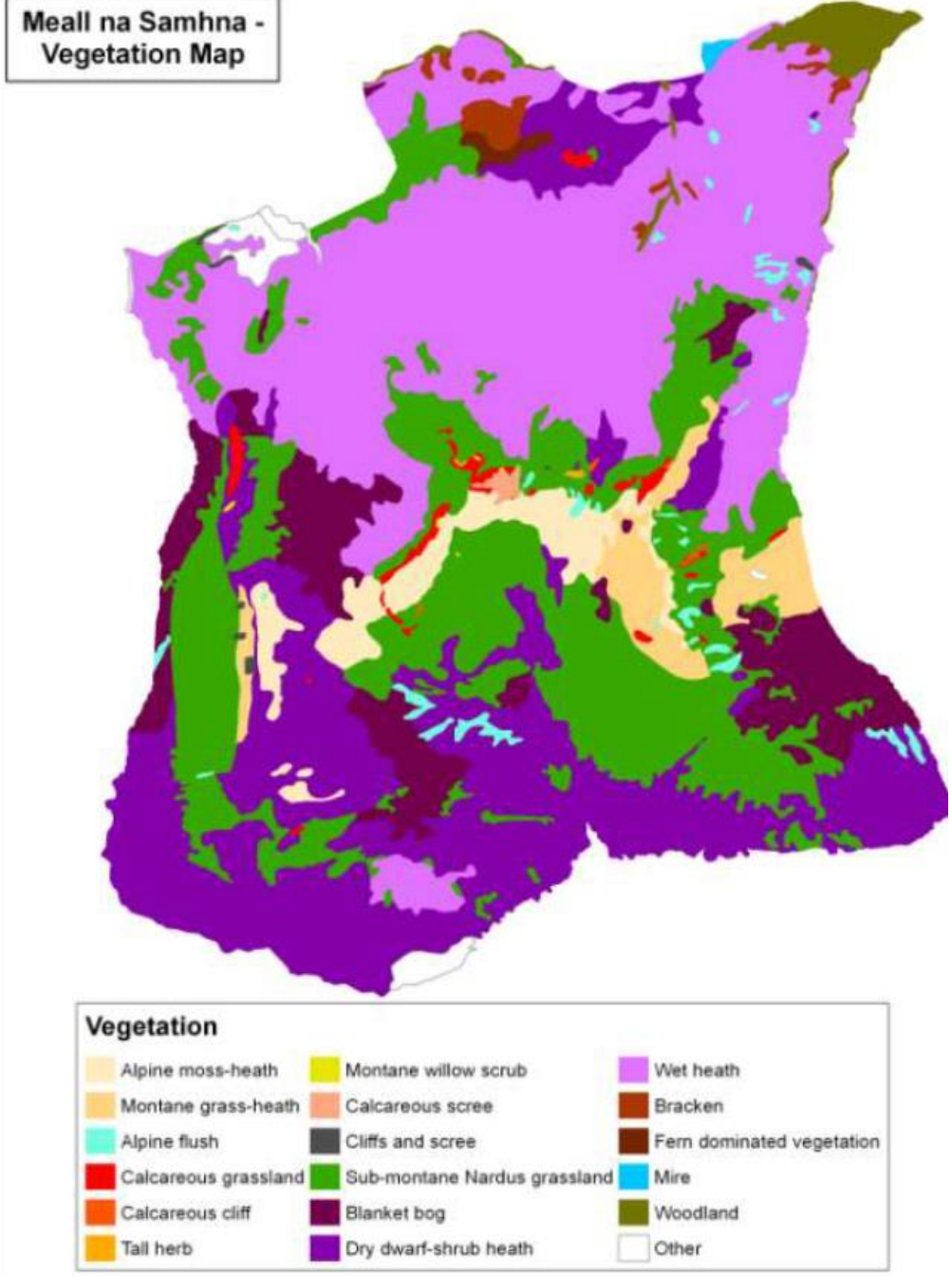


Impact of exclusion of large herbivores

	Number of species	Mean number of cells that species present	
		1999	2004
Major Reduction	10	52.5	6.5
Moderate Reduction	5	333	162
Minor Reduction	3	325	201
Increase	7	72	130
Large Increase	1	8	71

Example of grazing reduction leading to local extinction at landscape scale





In upland UK, many of the landscapes include large numbers of graziers with no, or few, fences. There are large variations in plant communities and habitats due to diversity of geology and topography.

Here, a very large upland landscape has my different habitats next to each other.

We asked a large number of upland biologists and conservatiom managers what tne range in grazing intensity these differign habitats might cope with.

Next slide shows the consensus views and how neighbouring habitats have very different grazing tolerances. So reducing grazing would be good for some, and arguably poor for others. So simple, prescription of grazing prsssure through stocking density would lead to mixed resutls.

Table 3.2 - Postulated 'desirable impact ranges' for the different feature types.

	Grazing Impact						
	Low (L)	Low to Moderate (LM)	Moderate (M)	Moderate to High (MH)	High (H)	High to Very High (HVH)	Very High (VH)
Smooth Grassland	X	✓	✓	✓	X	X	X
Flush	✓*	✓	✓	X	X	X	X
Tall Herb	✓**	✓	X	X	X	X	X
Scrub	✓**	✓	X	X	X	X	X
Blanket Bog	✓	✓	X	X	X	X	X
Dry Heath	✓**	✓	✓	X	X	X	X
Wind-clipped Heath	✓	✓	X	X	X	X	X
Species-rich *Nardus* grassland	X	✓	✓	✓	X	X	X
Alpine moss-heath	✓	✓	X	X	X	X	X
Montane grass-heath	✓	✓	X	X	X	X	X

*Flushes with a low impact are generally stable at high altitude and where they are very wet, but at lower altitudes there is likely to be a loss of structural diversity and the possible succession to scrub.

**At lower altitudes likely to be invaded by trees if a seed source is available (over two to three decades).

Next Slides show a series of generalised relationships between moorland birds (all of conservation interest) and different habitats and areas with varying degrees of grass, rush and heather-based pastures.

Removal of autumn/winter grazing, long term reductions in grazing can influence both sward structure and most dominant plant species type. Some are favoured by grazing, others not

Different bird species are heavily influenced by nesting and fledgling habitat type and structure.

Different habitat types and structures give different bird communities.

Variety is a good thing!

Species	Preferences
R grouse	heather; heather/grass variation
Snipe	cotton-grass; wetland (sedge)
Curlew	deer grass; wetland (rush/sedge)
G plover	cotton-grass; deer grass
M pipit	wetland (sedge); heather/grass variation
Skylark	grass; wetland (sedge)
Wheatear	bracken; heather/grass variation
Whinchat	bracken; heather/grass variation
Stonechat	heather; bracken; heather/grass variation

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