



Management of grassland areas

Habitat Science



Lecture plan:

- Types of grassland
- Types of grassland management – grazing regimes & non-intervention
- Upland peat restoration projects

Grasslands

- Prevention of succession
- Restricted location historically
- From Neolithic times – clearance woodland for farming
- Grazing, cutting and burning



Grasslands

- Enclosure Acts -18th & 19th century
- Agricultural development
- Old grasslands ploughed – converted to arable
- Fertiliser
- Drainage and liming
- Vigorous early growth



Range of grasslands

- Soil :
 - Acidic
 - Mesotrophic
 - Calcareous
- Drainage status:
 - Wet
 - Dry
- Intensity of improvement:
 - Improved
 - Semi-improved
 - Unimproved
- Level of grazing
 - Meadow
 - Pasture



Classroom Task

Individually, research the following grasslands habitats for discussion among the group:

- Lowland dry acid grassland (Fraser)
- Lowland calcareous grassland (Chan)
- Purple moorgrass and rush pasture (Naim)
- Coastal and flood plain grazing marsh (Paige)
- Lowland meadow and pasture land (Ysobella)
- Upland calcareous grassland (Robert)
- Upland acidic grassland (Jonathan)
- Calminarian grassland (Simon)

UK distribution; status; what conservation value do they have; identifiable species and how should they be managed?

Acid Grasslands

- Nutrient poor
- Low pH
- Low biodiversity
- Widespread over siliceous rock and peat – Upland Britain
- “rough grazing land”
- Pasture



Acid Grasslands



- Burning unpalatable species: *Molinia caerulea* purple Moor-grass
- Species-rich acid grasslands – Breckland, Norfolk

Acid grassland birds



Mesotrophic grasslands

- “habitats comprising plant species with a preference for soils that are neither too acidic nor too basic” (Ausden and Treweek, 2009:198)
- Lowland clays and loams



Mesotrophic grasslands

- Traditionally managed as meadow or pasture
- Arable conversion
- Agriculturally improved
- Hay meadows
- Nutrient compensation
- Prime siting
- Continuous management



Mesotrophic grasslands

- Common rights
- Lammas lands – consistent management since Medieval times
- Unimproved hay meadows – species rich



Mesotrophic grasslands

- Dominated by perennial rye grass and clover
- Uniform and poor
- Little conservation value
- Most wet grasslands are grazed



Calcareous grasslands

- Chalk or limestone areas
- Shallow soils
- pH – 7.0-8.4
- Free draining and well aerated
- Species rich
- Traditionally managed as sheepwalks



Calcareous grasslands

- Some cattle grazing
- Rabbits *Oryctolagus cuniculus*
- Short springy closed turf
- Low growing herbs
- Large number of rare plants and orchids



Calcareous grasslands

- More than 300 species plant
- 25+ species butterflies (Wells, 1969)
- Loss following Enclosure Acts
- Steep slopes; Ancient monuments; Military land; Protected areas
- Cessation grazing & myxomatosis – rapid decline in plant diversity
- Rank grass dominates – False oat-grass; Tor grass – leaf litter



Calcareous grasslands

- Lapwings, wheatears and stone curlews
- Breeding density birds positively correlated with scrub encroachment ↑



Grassland Management

- Grazing
- Cutting
- Burning
- Plus soil disturbance and hydrological management
- Boundary maintenance
- Environmental features



Management - general

- Distinguish between sites unmanaged, previously managed using different techniques and those continually managed using the same method
- Restorative management
- Maintenance



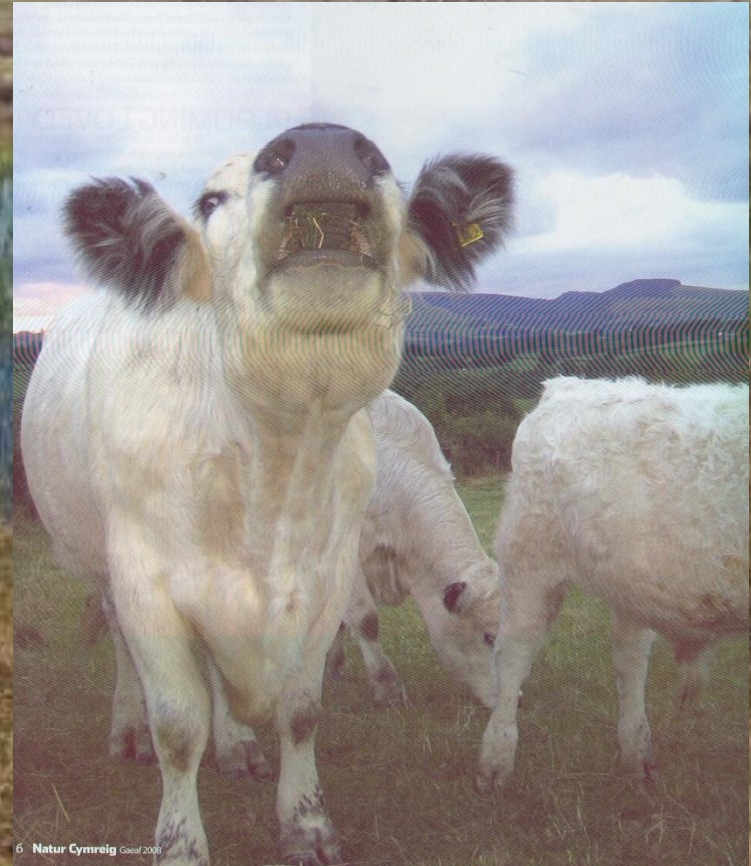
Management - Grazing

- Gradual form of removal
- Less impact than burning or cutting
- Selective feeding
- Removal more palatable species tall herbs
- Removal of aerial stems – can affect invertebrate fauna

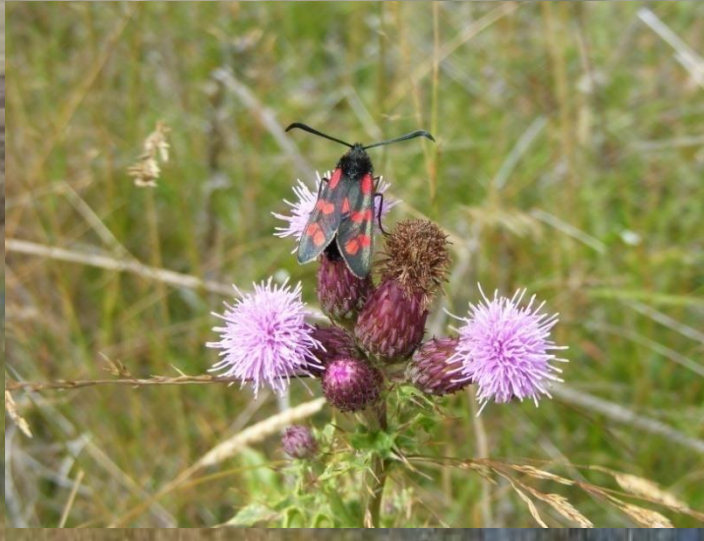


Management - Grazing

- Physical disturbance to vegetation and soil – germinating seedlings
- Stone curlews and woodlarks
- Too much trampling – erosion, destroys nests, changes in species composition



Management - Grazing



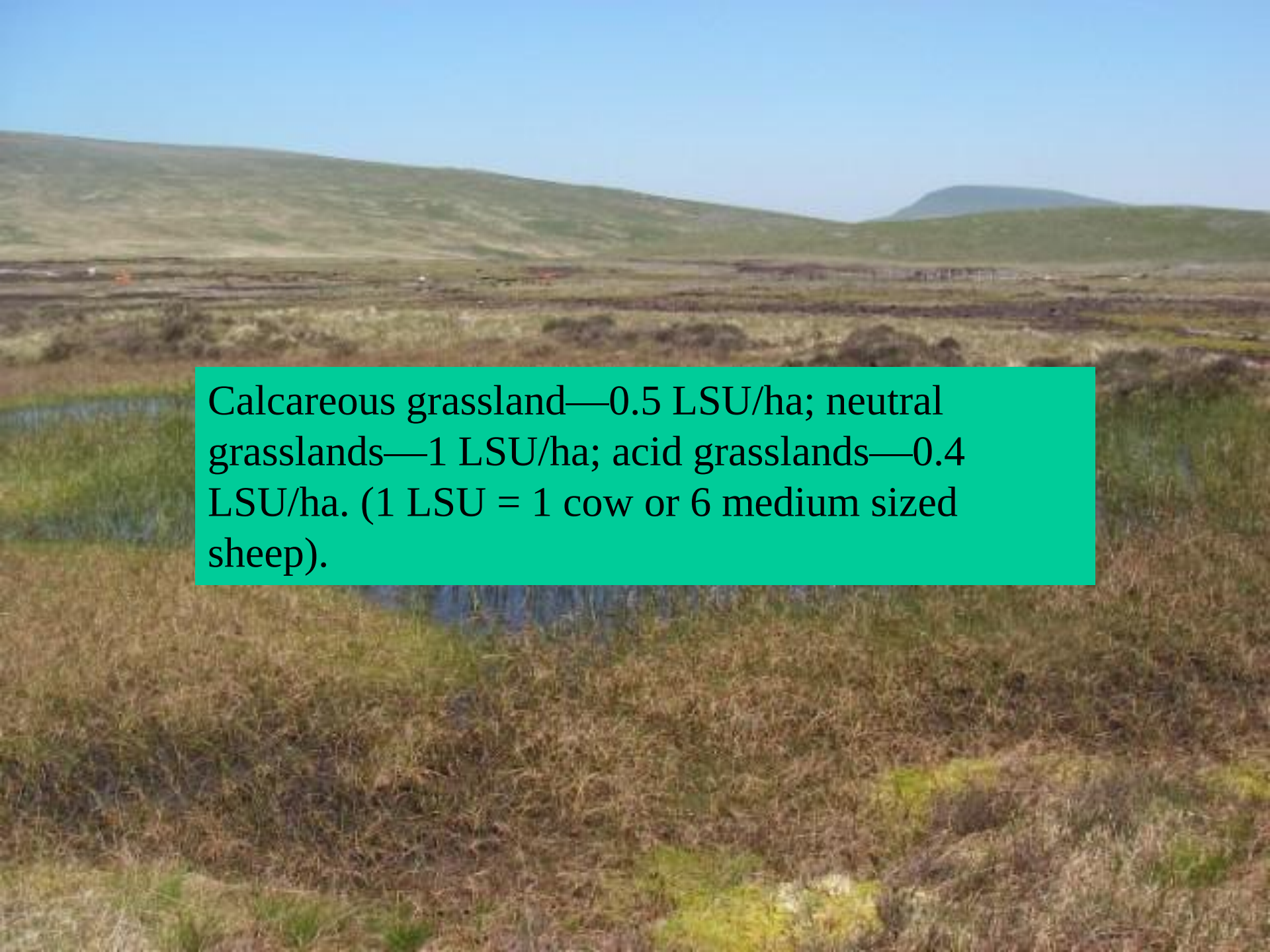
- Nutrient distribution – variation in grazing intensity
- Invertebrates – beetles, flies
- Birds – Chough, Yellow and Pied Wagtails
- Effects depend upon method of grazing, intensity and type of grazing animal



Grazing Animals & Intensity

- Variable behaviour and selectivity
- Varies with age and breed also
- Influences species composition and sward structure
- Differ in their dung and trampling intensity
- Stocking density critical



A landscape photograph showing a wide, open grassy field in the foreground and middle ground. The grass is a mix of green and brown, suggesting some dryness. In the background, there are rolling green hills under a clear, pale blue sky. A small, rounded hill is visible on the right side of the horizon. A small body of water is visible on the left side of the image, partially obscured by the text box.

Calcareous grassland—0.5 LSU/ha; neutral grasslands—1 LSU/ha; acid grasslands—0.4 LSU/ha. (1 LSU = 1 cow or 6 medium sized sheep).

Sheep



- Ruminants
- Bite with lower incisors
- food preference variation
- Graze close to ground , producing tight sward
- Prefer flowers and herbs
- Upland and old breeds hard mouthed and can tackle scrub

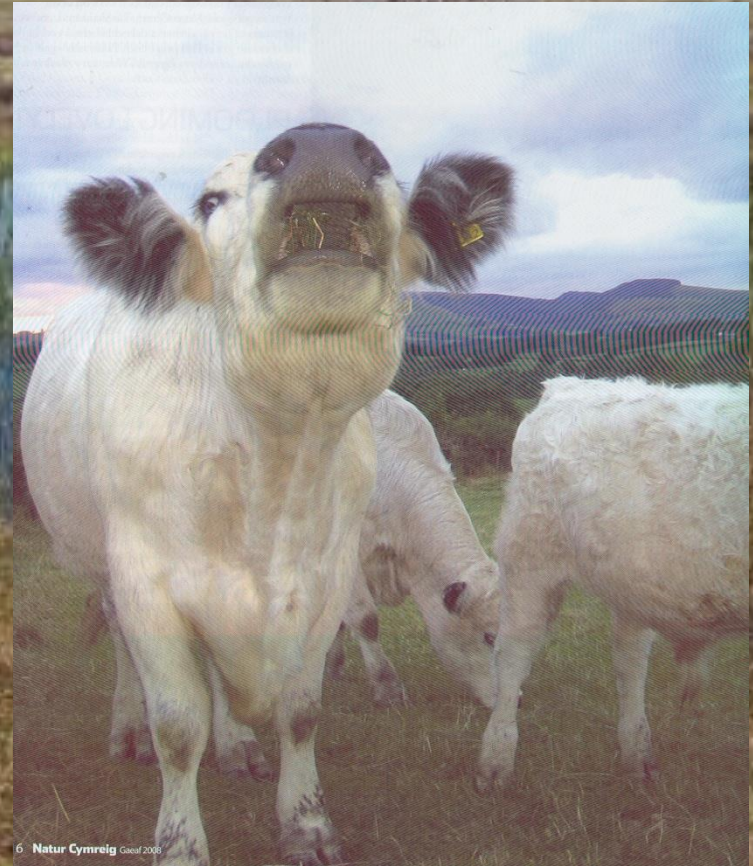
Sheep



- Light trampling
- Unsuitable for restorative management
- Can encourage bracken *Pteridium aquilinum*
- Less suitable for wet grasslands – susceptible to disease
- Easier to handle and manage than cattle

Cattle

- Large rasping tongue
- Feed on taller vegetation
- Ideal for neglected sites
- Selective feeding and heavy trampling – uneven sward
- Better for invertebrates than sheep grazing
- Avoid areas around pats – distinctive areas of ungrazed land



Cattle

- Waders – tussocky sward
- Fewer required – reducing trampling risk
- Age – variable behaviour
- Small groups preferred
- Fattening beef animals and sucklers most suitable for most sites.



Horses and Ponies

- Love grass and will eat sedges and rushes esp. when not much grass
- Graze patchily
- Don't prefer flowers unlike sheep; good for flower meadows
- Produce patchy mosaic of tall and short swards.
- At moderate stocking levels, beneficial for invertebrates

(Allen, 2009)



Rabbits

- Most selective grazers
- Concentrate on short sward
- Patchy mosaic at moderate densities
- Scrapes and burrows – bare and disturbed land
- Annual abundance varies – difficult to manage



Mixed Grazing

- Danger that resultant habitat is uniformly poor
- Supplementary feeding
- Ivermectin concerns



Cutting

- Sudden, unselective form of vegetation removal
- Creates uniformity, soil compaction, damage to topographical features (anthills) and nutrient enrichment
- Detrimental to invertebrates



Cutting

- Useful in restorative management
- Successful – growing season
- Flailing
- Rotational
- Frequency site dependent
- Preferred sward height is species dependent



Preferred Sward Heights of grassland butterflies (Fry and Lonsdale, 1991)

Species	Sward Height (cm)
Small Skipper <i>Thymelicus sylvestris</i> 	15
Common Blue <i>Polymmatas icarus</i> 	4-10
Ringlet <i>Aphantopus hypercantus</i> 	15-30
Gatekeeper <i>Pyronia tithonus</i> 	2-6 (prefers sparse turf)

Burning

- Sudden process – greater floristic uniformity than grazing
- Favours those plants with perennating structures
- Detrimental to invertebrates



Burning

- Quick shallow burns create less damage
- Variable topography
- Removal unpalatable plants – restorative management
- Nutrient can encourage growth of undesirable plants – grazed
- Rotation and never over the entire site
- Lowlands – 31st Mar and 1st Nov
- Uplands – 15th Apr – 1st Oct



Soil Disturbance and Non-Intervention

- Scraping, rotovating or ploughing
- Avoided on permanent grassland sites
- Non intervention – allows aggressive species to dominate
- Eventually scrub and woodland



PEATLANDS

Peatlands cover 12% of the UK and their restoration has never been a more pressing issue - unfortunately, 80% are in a poor condition because they've been drained of water or damaged by extraction.

The IUCN UK Peatland Programme has issued a call for one million hectares, a third of UK peatlands, to be in good condition or under restoration management by 2020.

Peatlands

- What do you know about peat restoration projects in the UK?



Peak District National Park – reintroduction of sphagnum mosses

- >1700 hectares of the Peak District National Park and South Pennines with around 1.7 million plug plants and clumps of this peat-forming.
- The £1.25 million investment from various Natural England and the EU LIFE programme through the partnership's MoorLIFE 2020 project.

“Sphagnum mosses are amazing plants that are able to hold between 10 and 20 times their weight in water.....play a major role in keeping water on the hills for longer, reducing the risk of wildfires and of flooding downstream”. (Buckler, 2016)

MoorLIFE 2020 Project

- 
- A wide-angle photograph of a peat bog landscape. In the foreground, there is a dense field of purple heather. A yellow excavator is visible in the middle ground, working on the peat. The background shows rolling hills under a blue sky with white clouds.
- Stabilising and revegetating 95km² of bare peat
 - Installing 15,000 mini-dams in drainage channels to help rewet the blanket bog
 - Tackling areas of over-dominant plant species, like heather,
 - Planting approximately 1.7 million plug plants of sphagnum moss
 - Controlling invasive species, like rhododendron and sitka spruce
 - Working with land managers to share best practice

FLOOD PREVENTION

- Water running over Sphagnum on blanket peatlands moves much more slowly (iCASP, 2008; IUCN, 2019) Yorkshire Integrated Catchment Solutions Programme
- Water movement dominated by flow close to the surface
- Sediment release from bare peat strongly influences peatland stream ecosystems - biodiversity and functioning.



Making Space for Water Project

- Defra funded
- Project to monitor local flood risk on the Kinder Scout plateau
- Project 2012-2015
- Monitored:
 - Rainfall volumes in mini catchments
 - Volume flowing out of catchments
 - Height of water table below surface
 - Quantity of peat and carbon washed away
 - Colour of water



Kinder Catchment Monitoring Project, 2015

- Peat accumulation or water pooling associated with 95% of gully blocks
- Upstream vegetation establishment associated with 94% of gully blocks
- ‘nurse’ grasses dominating vegetation cover
- Mosses and Lichens cover increased significantly
- 39 new locations of either single plants or carpets of sphagnum
- Bare peat was reduced by 75% where work was carried out
- Gradual rise in the water table, and reduced water flow after heavy rain

(MoorLIFE Project; 2015; IUCN, 2019)



Research on the effect of Peat Pipes (current PhD)

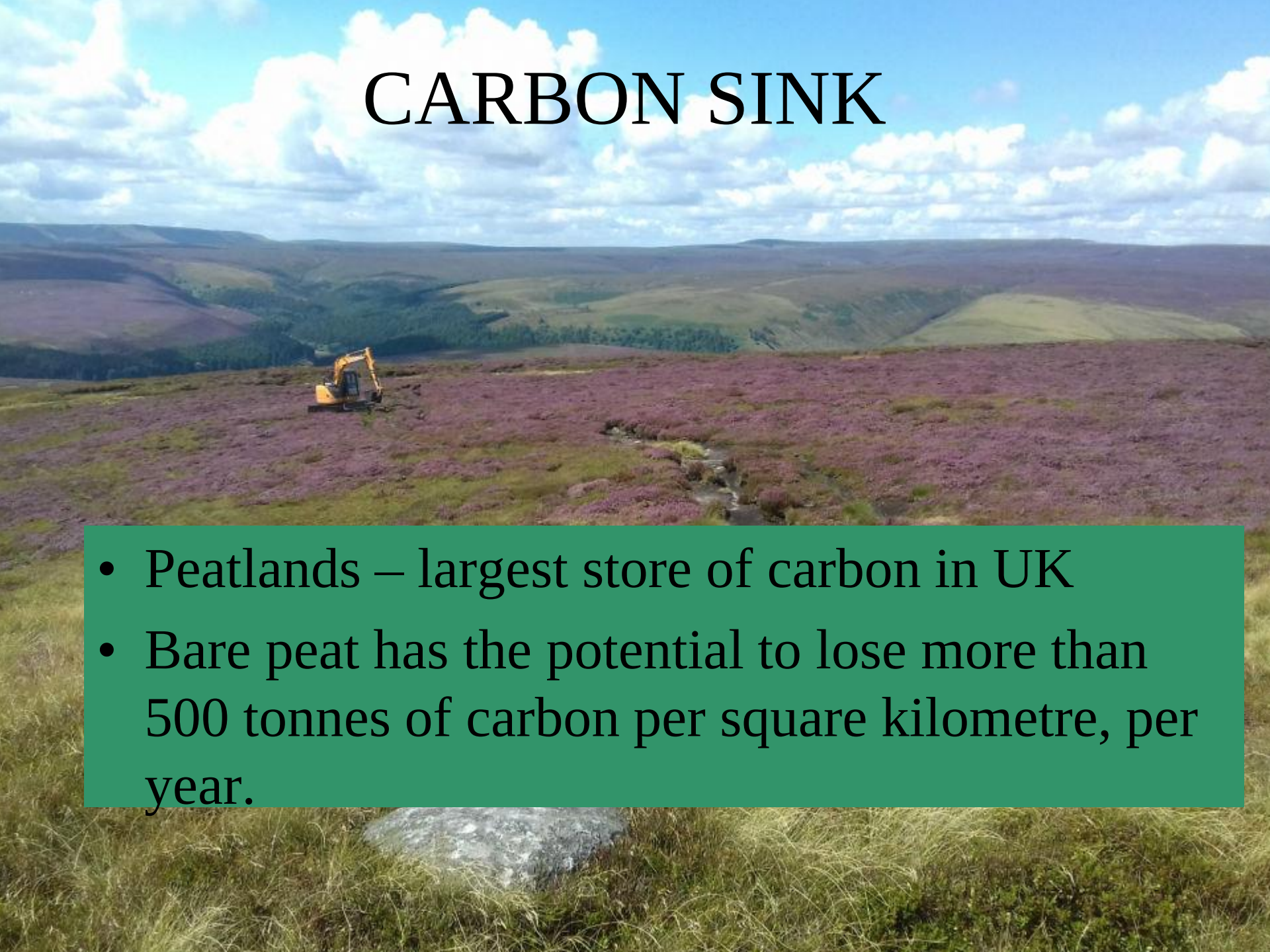


Peat Pipes.... tbc

- Underground channel – a conduit for water beneath the peat
- How?
- Why?
- What effect on the peatlands
- Finding them is a challenge



CARBON SINK

- 
- Peatlands – largest store of carbon in UK
 - Bare peat has the potential to lose more than 500 tonnes of carbon per square kilometre, per year.

What of the risk of wildfires?



MoorLIFE 2020 Wildfire Database

- Causes of wildfires - how to prevent and tackle them
- Identify spatial distribution of wildfires
- Provides data on wildfires that partners and academic institutions can access
- Scale, risk and impact of wildfires



The Yorkshire Peat Partnership aims to substantially increase the amount of peatland restoration activity by meeting the following objectives:

- To restore 35,000 ha of damaged peat by 2017, that's 50% of the damaged peat in Yorkshire!
- To revegetate areas of exposed bare peat, sphagnum carpets being the ultimate goal.
- To establish long-term research monitoring to assess the benefit of peatland restoration to a range of ecosystem services.



7. Conclusions & Next steps

7.1 How did we do?

The following table sets out our original objectives against the outcomes we actually achieved. It is clear that the Yorkshire Peat Partnership has been a hugely successful project getting very close to its original very challenging targets during a period of global austerity.

Original Objectives	Outcome
To restore 50% (35,000ha) of Yorkshire's blanket bog by March 2017, including:	
Restore 21,262ha of degraded peatland using existing HLS.	✓ 27,223ha worked on (39%). No capital works needed on 3,797ha (5%). This is a total of 31,020 (44%) so we got pretty close!
Secure funding and implement a works programme to restore at least an additional 13,738ha to bring the total restored to 50%.	✗ Could not secure landowner support for works on a further 4,653ha (7%)
Complete a programme of desk based surveys of 45 individual peatland sites to provide restoration plans	✓✓ Surveyed and produced restoration plans for 62 peatland sites.
Establish long-term research & monitoring at a minimum of 2 sites	✓ Working with the Stockholm Environment Institute supported a 5 year study into the relative merits of burning versus cutting.
Complete a research programme to model the benefits of grip blocking in reducing the flood hydrograph	✗ but other organisations (e.g. Water@Leeds) have done this
Produce an estimate of the carbon storage and sequestration potential of the Yorkshire region's upland peat.	✓ Estimated that our peatlands currently store 38,101,767 tonnes of carbon but we have not yet worked out the sequestration potential.
Develop and secure funding for a communications and raising awareness programme to promote the importance of Yorkshire peatlands.	✗ but supported the IUCN-UK Peat Programme to do awareness-raising on behalf of all of the restoration partnerships.
Seek and secure funding to enable the continuation of the Yorkshire Peat Partnership core team beyond March 2013	✓✓ We kept going and have funds to continue. We also developed innovative approaches to unlock substantial funds.
Develop a plan for restoring a significant proportion of the remaining 50% of degraded blanket bog and other peatlands	✗ This will form the basis of the next business plan.

Waun Fignen Felen: Upland bog

- Wet cool conditions of uplands prevents dead vegetation from rotting
- Peat – blanket bog
- Water-logged, acidic and nutrient poor
- Specialist plants – Sphagnum mosses *Sphagnum spp*; cotton grass *Eriophorum, spp*; heathers *Ericaceae spp*
- Nutrient replenishment from rainfall
- Fauna – Golden ringed *Cordulegaster boltonii* and black darter dragonflies *Sympetrum danae*

Waun Fignen Felen

- **Valley Mire**
- **Southern valley end – exposed area of peat – vegetation removed through erosion**
- **Causes?:**
 - **Catastrophic wild fire**
 - **Changes in groundwater and surface drainage patterns**
 - **Changes to rates of subterranean cave formation in underlying limestone**
 - **Climate change**
 - **Acid rain**
 - **Livestock grazing pressures**

Historical accounts

- Likely fire started process
- Combination events especially wind and rain erosion
- Aerial photographs- erosion present 1940s
- Current rate of change is slow enough to warrant intervention

Areas of Concern

- Inappropriate management of sheep
- Uncontrolled & frequent burning
- Heather beetle infestation
- Conifer plantations
- Achieving harmony on Common Land
- Interaction between two or more of the above





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Plas y Ffynnon, Cambrian Way
Brecon, Powys, LD3 7HP
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Plas y Ffynnon, Ffordd Cambrian
Aberhonddu, Powys, LD3 7HP

Waun Fignen Felen in 2000
Paul Sinnadurai

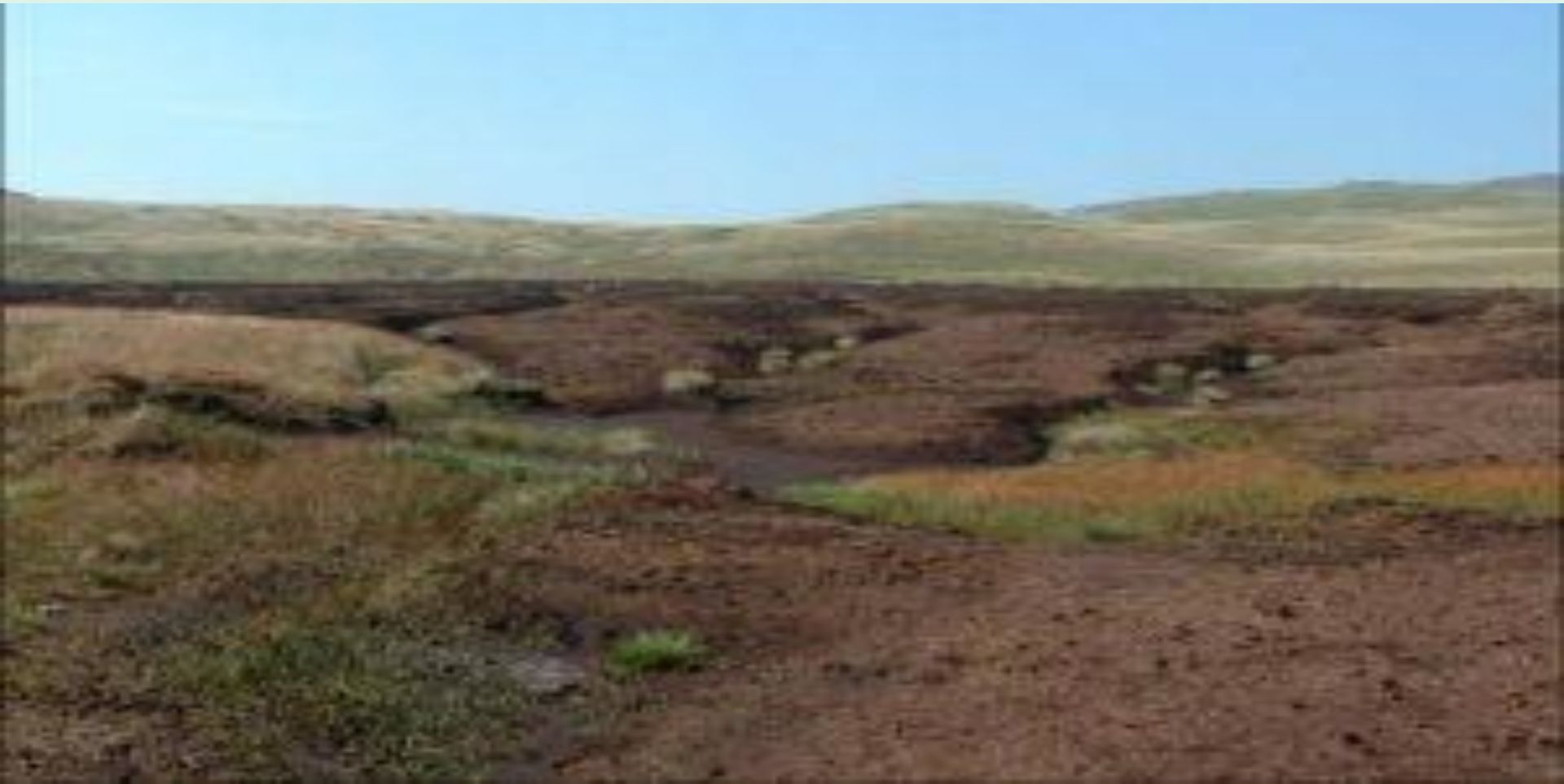
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BEFORE RESTORATION WORK



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- Solutions?
 - Change grazing pressures
 - Re-establish diminishing peat reserves
 - Encourage growth moorland grasses and shrubs
 - $\Rightarrow$ restore carbon sequestration & flooding risk improvements

First prevent exposed
peat being washed
away













Gorse spreading





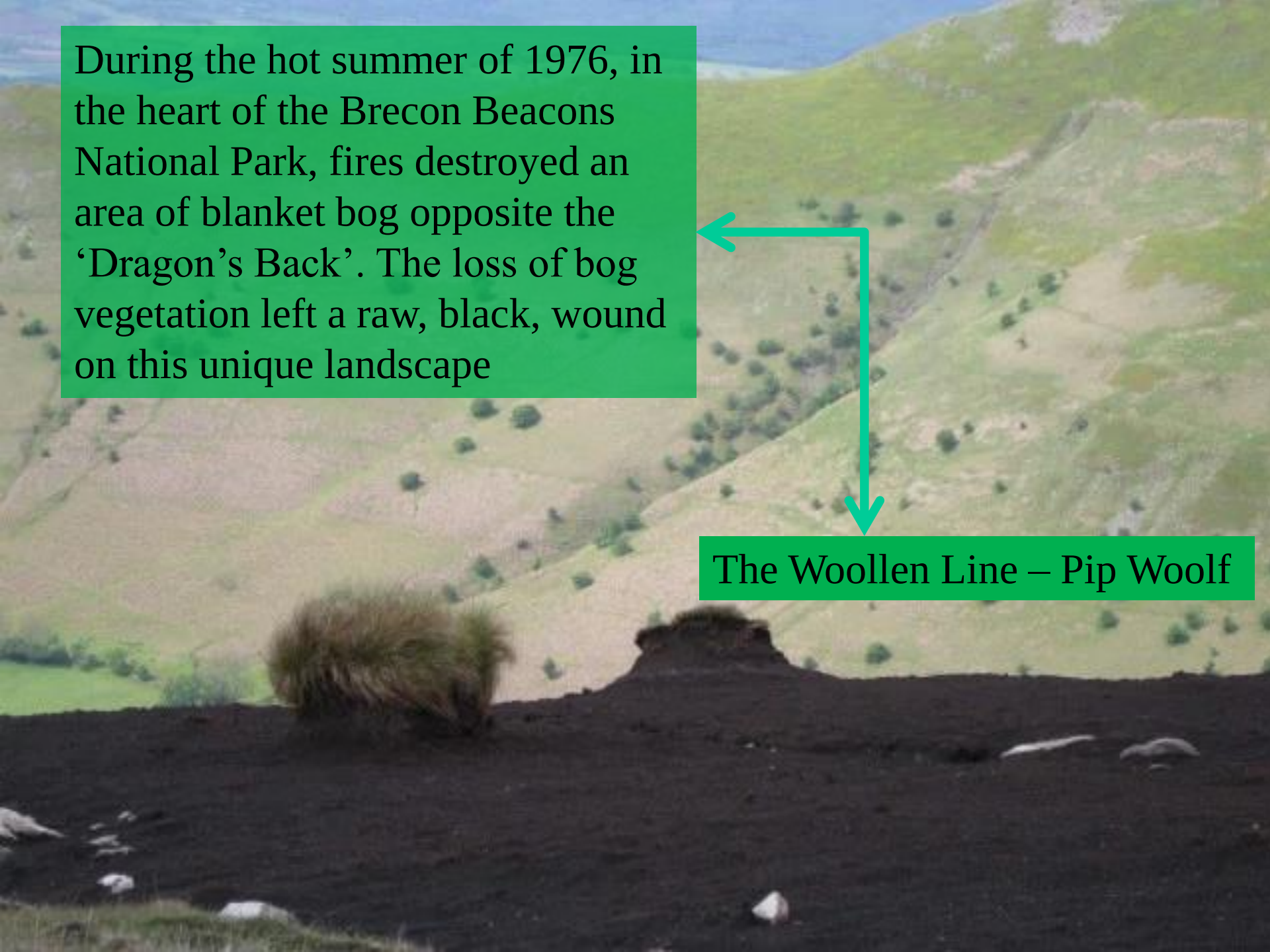


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AFTER RESTORATION



During the hot summer of 1976, in the heart of the Brecon Beacons National Park, fires destroyed an area of blanket bog opposite the 'Dragon's Back'. The loss of bog vegetation left a raw, black, wound on this unique landscape



The Woollen Line – Pip Woolf







The challenge is huge – some 70,000 m²



Someone said " it looks like stitches, as if we are mending the landscape" (Pip Woolf)





Revision/Further Reading:

Review the current peat restoration projects, determining how successful they've been and whether we will meet the UK targets by 2020.