

A landscape photograph showing a dry, hilly area with sparse vegetation. In the foreground, there is a stone wall and some dry grass. The background shows rolling hills under a clear sky.

How can we build resilience to
help combat climate change?

GIS and Habitat Management



Lecture plan:

- Building resilience:
 - Coastal environments
 - Woodlands
 - Hedgerows
 - Peatlands

Building Resilience

“we will build, build, build: build back better, build back greener, build back faster. (Boris Johnson, June 2020)

- Hope or ignorance?
- Urgency born from pandemic but just emphasises the need to tackle growing problems that have been around for some time.
- EA2025 – to protect and enhance the environment and contribute to SDGs:
 - a nation resilient to climate change
 - healthy air, land and water
 - green growth and a sustainable future

Climate change in UK

Current status:

- More intensive rainfall over short periods of time
- Coastal changes
- Longer droughts
- More frequent heatwaves
- Increase in plant disease prevalence
- Population growth and increasing demands for energy, land and water will compound the impacts on wildlife and the environment.

Air, Land and Water

“Many of our water bodies are in a fragile state. Intensive agriculture and urban land-use often pollutes waterways and threatens valuable wetlands, peatland and biodiversity. Climate change will exacerbate these pressures”.

“Over half of the UK’s food is grown domestically, but intensive agriculture is depleting the health of many of our soils. In the long term this could be catastrophic for food production and release large carbon stores held in the ground”.

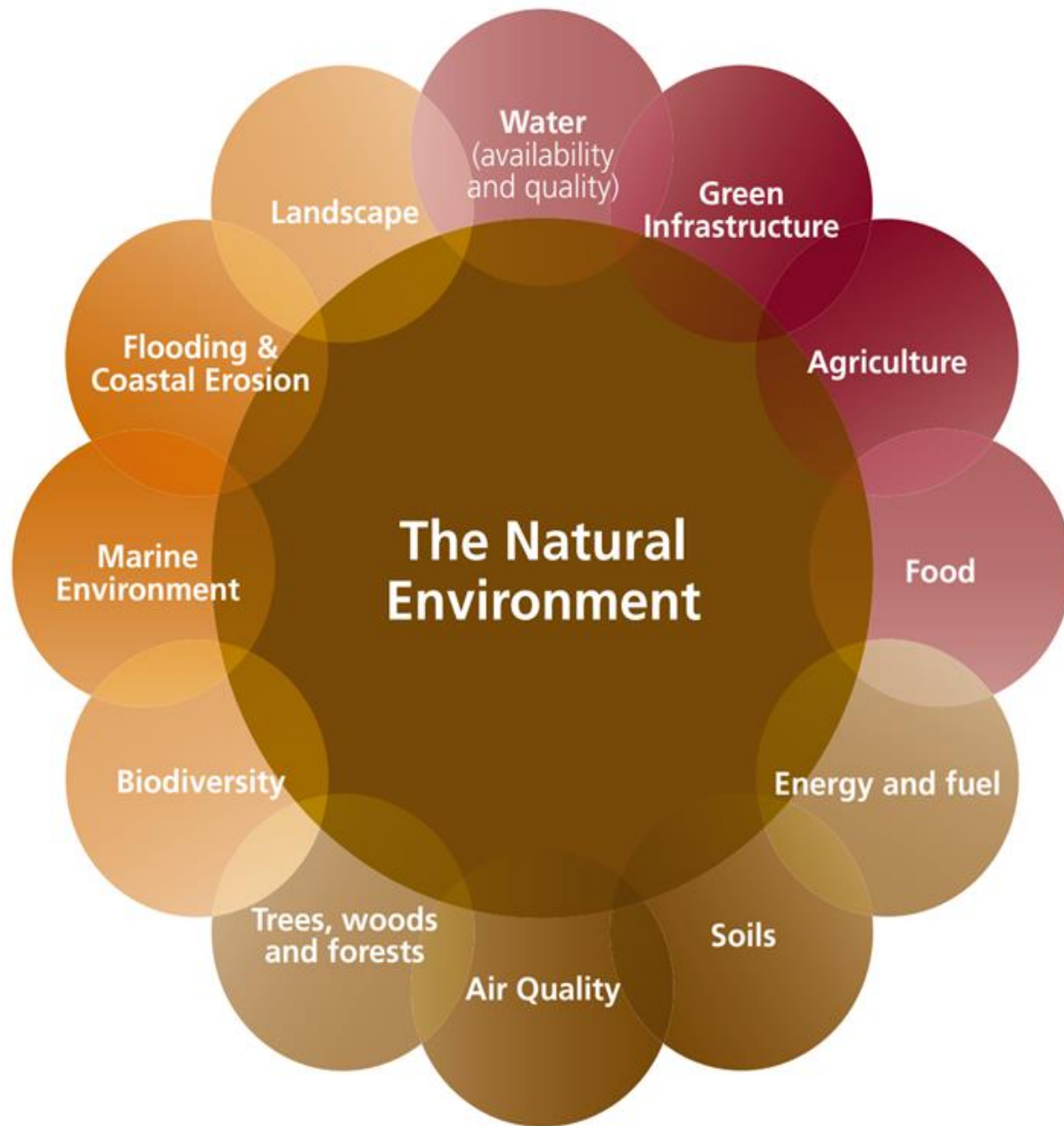
Air, Land and Water

“By 2050, we may experience significant water shortages unless action is taken to reduce demand and increase supply”.

“UK soils currently lock up around 10 billion tonnes of carbon, roughly equal to 80 years of the UK’s current annual greenhouse gas emissions”.

“New risks may be emerging from micro-plastics and chemicals introduced into the air we breathe, the water we drink and the food we eat. There is also strong evidence that our health and wellbeing can be enhanced with access to green space and nature”

<https://www.gov.uk/government/organisations/environment-agency>



Tropical Corals

- **Globally – between 1 and 9 million species**
- **Economic, and habitat relevance**
- **Bleaching – 1°C large scale & regular mortality**
- **Acidification**
- **Distributional change**

Ocean Acidification

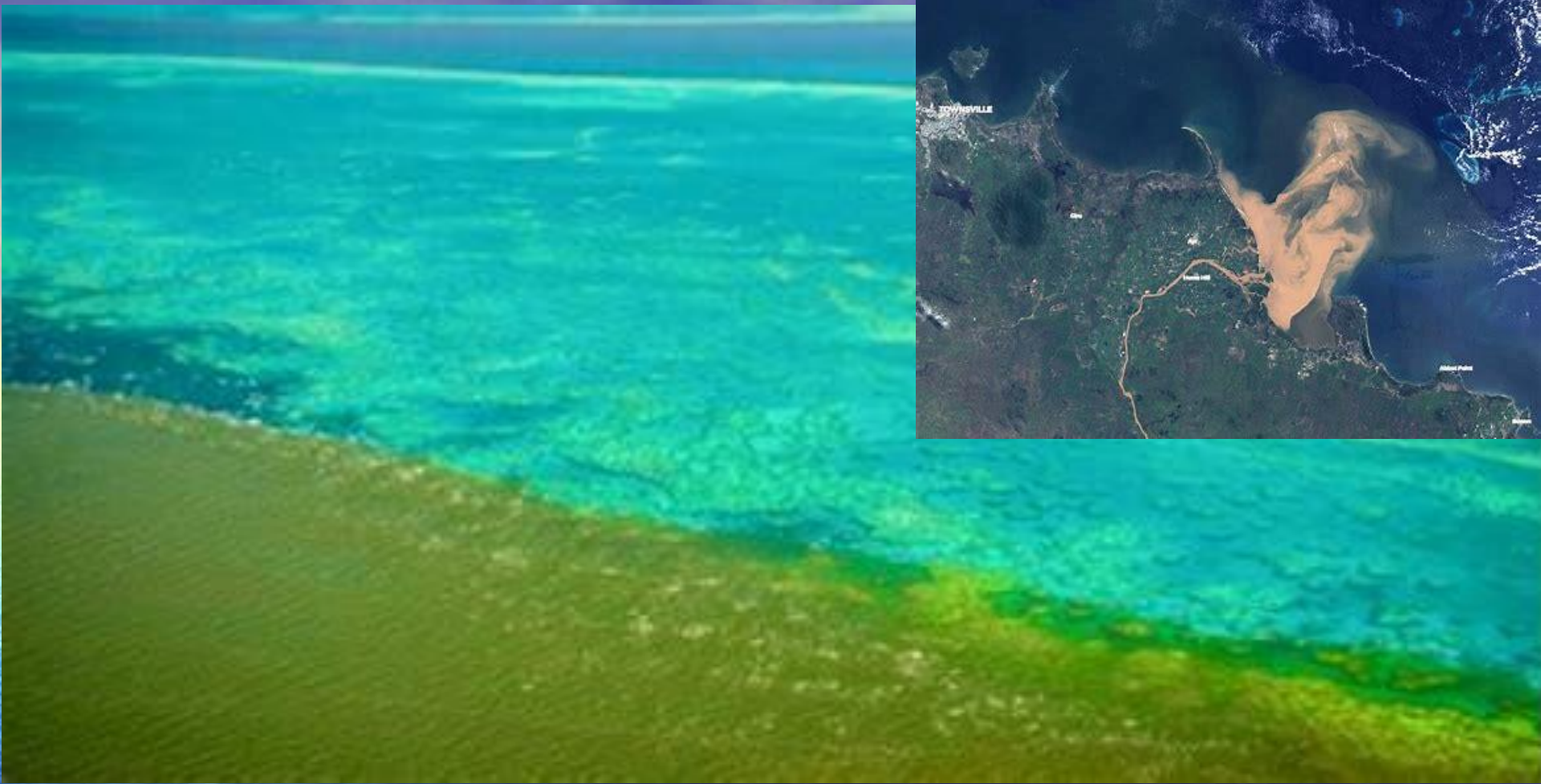


- Under saturated with calcium carbonate
- Coccolithospores – basis marine food chain
- 2100, 75% cold water corals
- Changes could develop in decades not centuries (Orr *et al.*, 2005)
- 0.5 change in average pH by 2100 (IPCC, 2019)





“For the second year in a row, the Great Barrier Reef is experiencing a mass bleaching event” (Raphael, 2017:1)



January 2019 – massive pollution in North Queensland
caused by unusually high rainfall and flooding (The Guardian,
2019)

Coral Bleaching in 2020

- Severity of bleaching second only to 2016
- “No one event will kill the Barrier Reef but successive bleaching events creates significant damage. Its resilience is not limitless” (Hughes, 2020:1)
- A recent study – corals have more than halved in the past 25 years (Visontay, 2020)





In some places
coral transplants
are having to be
introduced to
save this valuable
ecosystem.





Constance Moorfushi, Maldives

- No waste water discharges
- Coral Planting
- Weekly water and beach litter cleans





- Biobank – a Noah’s Ark for coral
- Project to house 800 hard corals in a purpose-built facility in Port Douglas (Vistonay, 2020)
- Conserve and bolster degraded reefs
- Public and home aquarium collectors to hold and maintain backup fragments all over the world, creating the largest collaborative preservation network of corals.

Research, teaching & open to the public



Cold water corals

- Seamounts and continental rise
- Hotspots of biodiversity
- Slow growing
- Depth of aragonite saturation horizon
- 70% affected by 2100



Seagrasses

- **Vital role in carbon and nutrient cycling**
- **Buffer**
- **Biodiversity – crustaceans, fish**



- **Increase in productivity**
- **Temperature & UV radiation**
- **Storm regimes**
- **Flowering timing**

Seagrasses

- Seagrass meadows provide important ecosystem services
- \$1.9 trillion per year in the form of nutrient cycling
- a habitat for thousands of fish, bird, and invertebrate species; and a major food source for endangered dugong, manatee, and green turtle

- Global assessment of 215 studies found that seagrasses have been disappearing at a rate of $110 \text{ km}^2 \text{ yr}^{-1}$ since 1980
- Seagrass loss rates are comparable to those reported for mangroves, coral reefs, and tropical rainforests and place seagrass meadows among the most threatened ecosystems on earth.

Project Seagrass

The background of the slide is a photograph of seagrass underwater. The seagrass is green and appears to be growing on a sandy seabed. The water is a clear, light blue color.

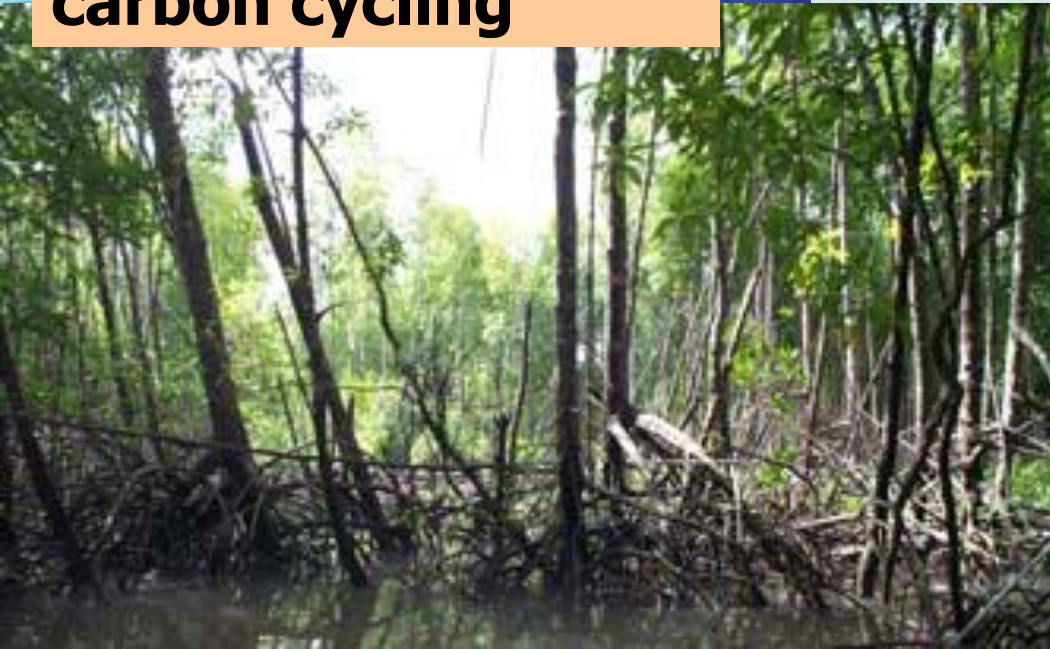
- 92% seagrasses have died in the UK over the last century (Kings College, London)
- *If we want to provide our fisheries and our coastlines with the potential to adapt to a rapidly changing climate we need to restore the habitats and biodiversity that support their productivity.* (Dr Richard Unsworth, Swansea University, 2020)

Seagrasses

- Carbon storage vital against climate change
- Ability to capture carbon from the atmosphere (up to 35 times faster than tropical rainforests)
- 92% loss in UK waters – coastal devt, pollution, boat propellers
- Project Seagrass, Sky Ocean Rescue and WWF - >750,000 seeds Dale, Pembrokeshire
- Restore 20,000m²
- Mature meadow supports 160,000 fish and 200 mill invertebrates
- Absorbs C and releases O₂

Mangroves

- **Buffer**
- **Sediment**
- **Filtering**
- **Habitat –fish, crabs, prawns, birds**
- **Nutrient and carbon cycling**



- **Increase productivity**
- **Threat of sea level rise**
- **Shift in distribution**
- **Growth rate changes**

Kelp Forests

- **75% decline in some areas**
- **Storminess**
- **Changes in rainfall**
- **Species compositional change – herbivore**



- **For resilience, maintain the sea otter populatuon**



Salt marshes/mangroves

- Coral reefs, mangroves and salt marshes vulnerable
- In England, 40-100 hectares saltmarsh lost annually (Eccleston, 2008)
- Space for horizontal migration
- Ecosystem resilience reduced where there are also human influences

Research in 2018 paints a grim outlook for saltmarshes

Marshlands in south-east England could start to vanish in about 20 years due to rising sea levels; rest of UK by 2100

Salt marshes protect coastal areas from erosion by acting as a buffer against waves and reducing flooding by slowing and absorbing rainwater.



Building resilient saltmarshes

- Prevent further drainage for grazing/agriculture
- Managed realignment – removal of coastal defences or moving them inland
- Habitat Creation
- Create value – demand for seaherbs/halophytic plants in agriculture

1 hectare of saltmarsh capture 2 tonnes of carbon each year and locks it into the sediment

Plans to realign 10% of England's coastal zone by 2030 would create 6,200 ha of habitat and increase carbon storage, as well as reduce risks of flooding and coastal erosion.

Self Study

- Consider case studies that demonstrate best practice for building resilience into coastal areas.
- For discussion at the start of next week's session

Woodland Threats

- Legal Loopholes – 80% Ancient woodland has no legal protection
- Land management – agricultural practices, fragmentation & overgrazing
- Climate change – increased temperature, changes to precipitation & storms
- Diseases – fungal, viral & bacterial

- 60 million trees have been taken by Dutch Elm disease
- 126 million trees in British woods at risk of ash dieback
- 19 pests and diseases are attacking our native trees, six have reached epidemic levels. And at least 11 more diseases are nearing our border



Bacterial and Viral Infections

- Lack of light, water, CO₂ and nutrients can lead to reduced growth – stress
- Stressed trees more vulnerable to disease
- Oak decline – complex – bacteria, insect infestation & weathering

Acute – mature trees. Bacterial agents - symptoms such as stem bleeding

- Pedunculate & Sessile affected

Chronic – more prolonged (yrs)

- Early signs - foliage deterioration, twig death, sparse foliage over crown
- Typically Pedunculate



Acute Oak Decline

Acute oak decline (AOD) is a condition affecting several thousand oak trees, mostly across East Anglia, the Midlands and Southern England as far west as Somerset.

Insect attack, particularly by the buprestid beetle, *Agrilus biguttatus*. 'D'-shaped exit holes of *Agrilus* might occur in close proximity to some stem bleeds. *Agrilus* beetles not a cause of acute oak decline, but they are thought to be 'opportunistic' on the weakened trees

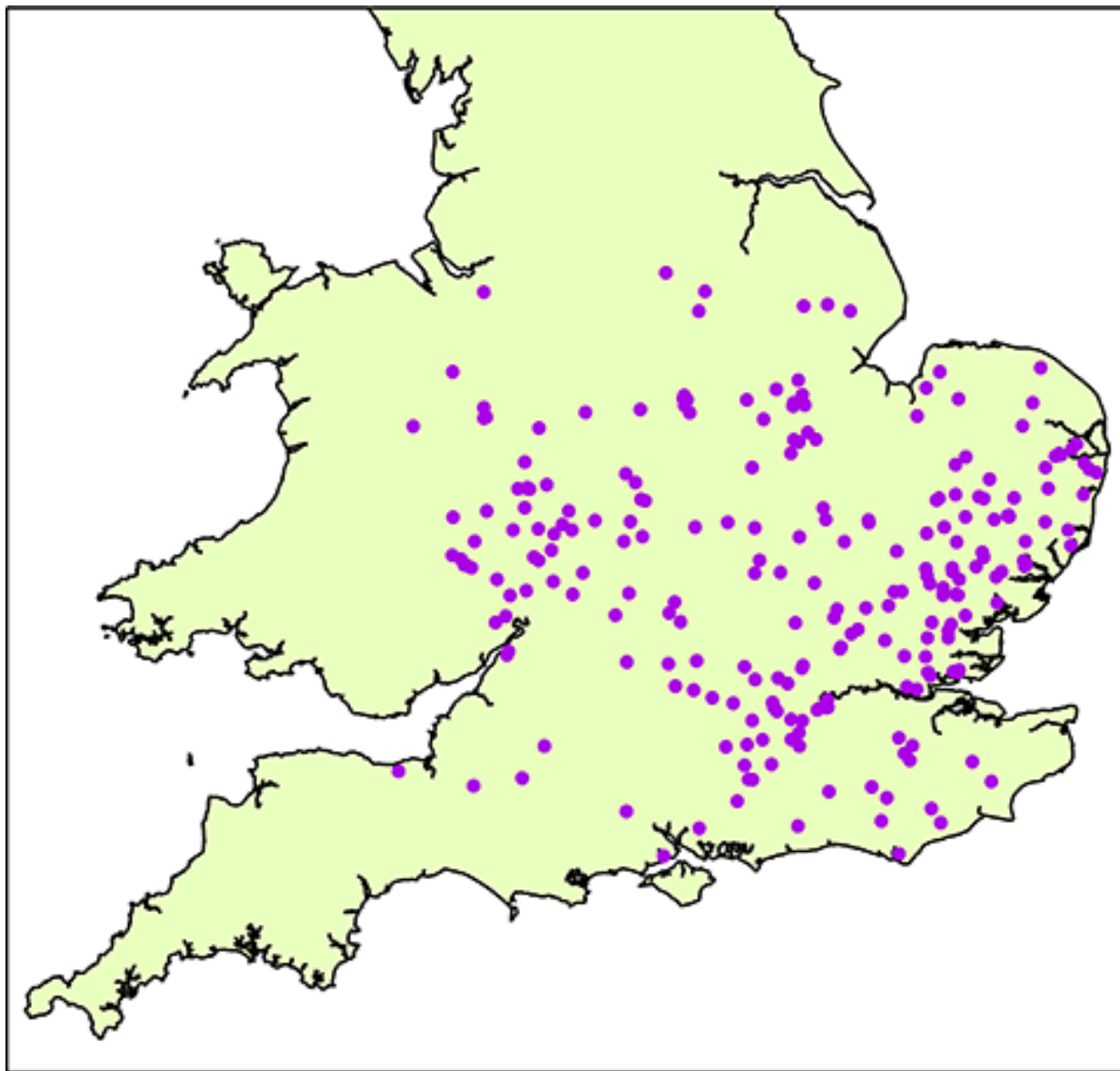


(a) - bleeding

(b) Lesion below the bark



Confirmed cases Acute Oak Decline in 2018



- Some trees are recovering
- Those severely affected die within 4-5 yrs
- Project called “Purpose” launched in 2016 – consider best treatment approaches: University of Reading, Oxford, York, the Centre for Ecology and Hydrology, Forest Research, and the James Hutton Institute

Brown and White Rot

- Brown rot – attacks cellulose
- Leaves a brittle, cracked brick effect – timber value lost
- White rot attacks all the wood – spongy mass
- Often only discovered when fruiting parts are visible
- Honey fungus
- Not all fungus problematic!



Notifiable Diseases - fungi

- Forestry Commission and Animal and Plant Health Agency

1. Sudden Oak Death - *Phytophthora ramorum*

- Native oaks not as susceptible as American oaks
- Rhododendron – host
- Since 2009 – Japanese Larch



Symptoms:

- Wilted, withered shoot tips with blackened needles
- Infected shoots shedding their needles
- Prematurely bleeding cankers exuding resin on the upper trunk and branches

Causes:

- spreads easily in moisture and water such as moist air currents, mists, fog and watercourses
- Contaminating spores can also be spread by animals and on footwear, vehicle wheels, machinery and equipment

Outlook:

Globally it has more than 150 host species.

Ability to switch species a concern

Species affected: Oak spp; Larch; Sweet chestnut, Horse chestnut; Beech



Management:

- Basic housekeeping – cleaning boots/vehicles/restricting site access
- Fungicides to suppress spread. None kill the pathogen
- Tree removal - Licence from Forestry Commission to remove off site
- Plant Health Notices

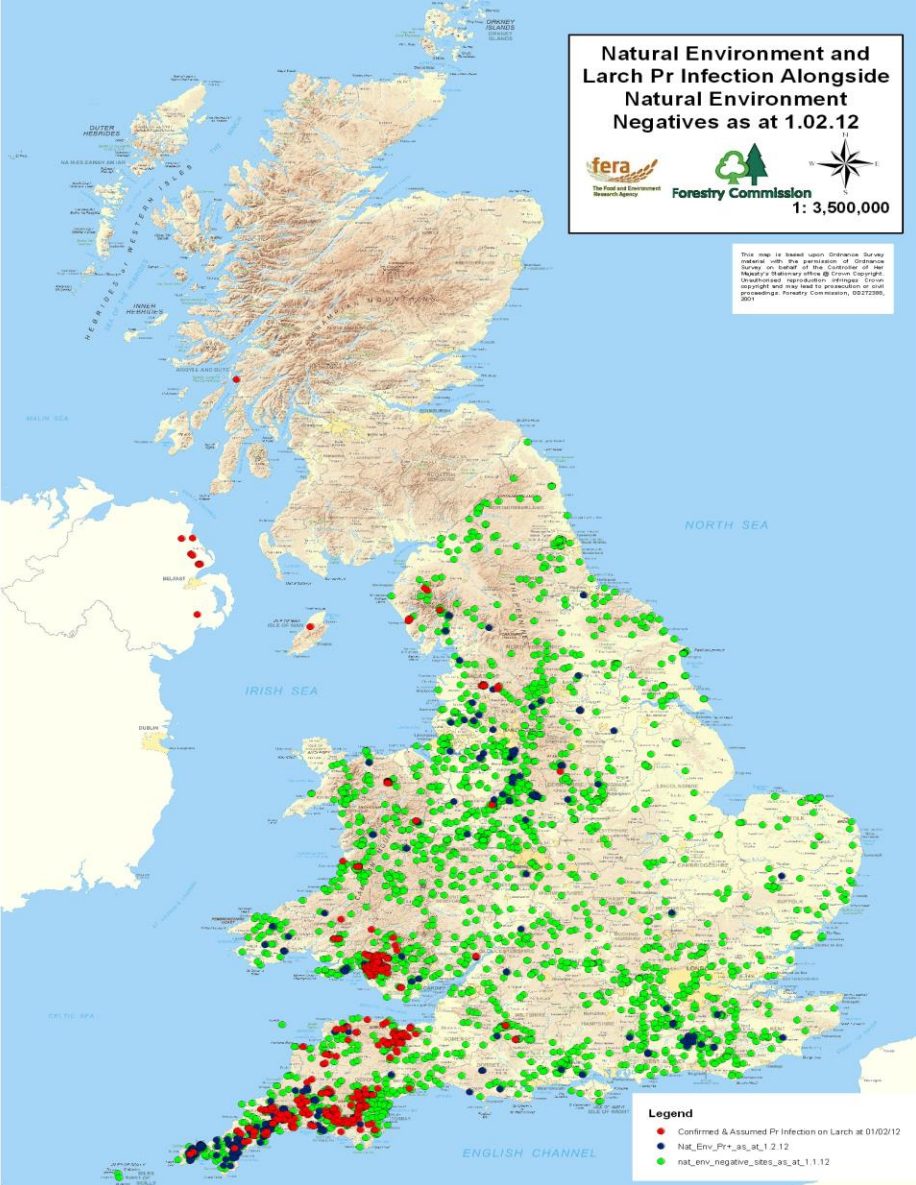


Symptoms:

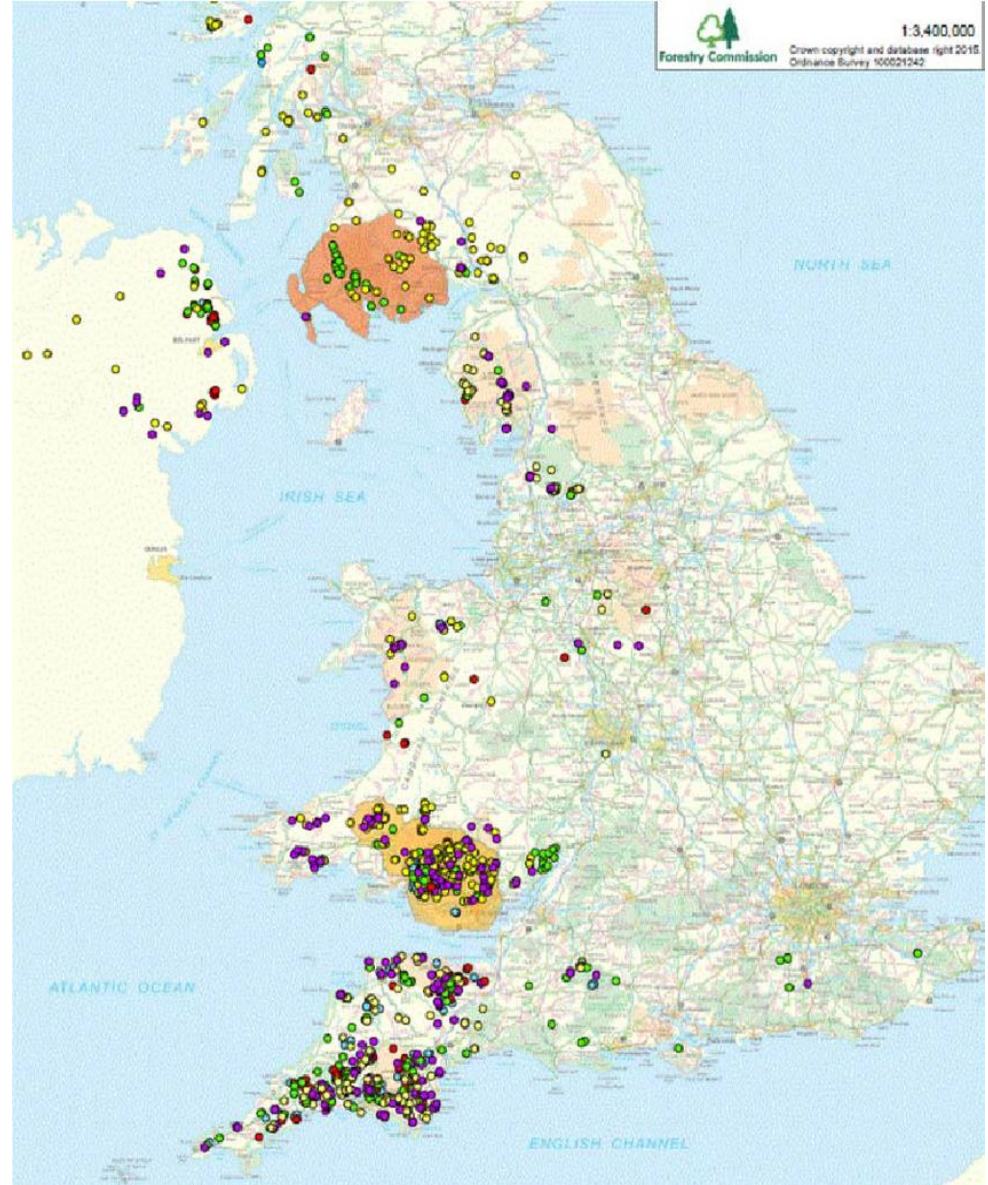
- Crown dieback
- Epicormic growth wilting
- Wilting, blackened leaves



Chestnut trees (*Castanea sativa*), until 2015 were found infected if exposed to heavy inoculum pressure by their close proximity to heavily infected plants of other species, usually larch trees or rhododendron shrubs. However, in 2015 infected sweet chestnut trees were found at a small number of sites in South-West England, mostly in Devon and Cornwall

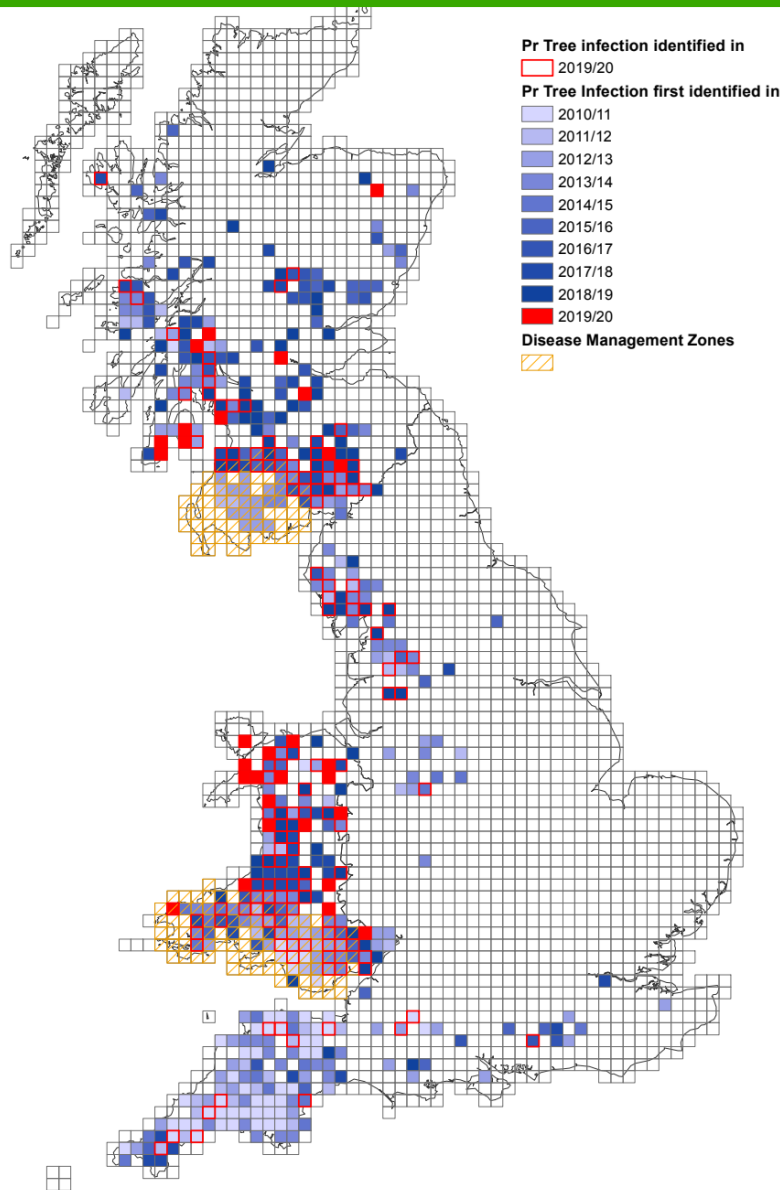


2012



2018

**Pr Outbreak Summary
Showing When 10km Squares
Became Infected By Year
As At Feb 2020**



- West of UK dominance
- Red squares most recent
- Hatched areas are disease management control
- Trees affected – larch, oak, beech and sweet chestnut

Ash dieback – *Hymenoscyphus fraxineus*

- UK's 3rd most abundant tree
- >400 years
- Supports specialist deadwood species – lesser stag beetle
- 14% nationally rare and scarce lichens
- Upland mixed woodlands – listed as a priority habitat under the Biodiversity Action Plan



Signs of ash dieback

Disease confirmed in UK (Oct 2012) 20 years after its arrival in eastern Europe

A real danger to UK's 80 million ash trees – could change landscape – Dutch Elm disease



- Spread via wind-blown spores
- Spread across Denmark in just 3 years
- Economic consequence
- 2% naturally resistant
- Now in 184 sites around Britain
- Globalisation of plant trade to blame
- First mature tree cases in Carmarthenshire spring 2017

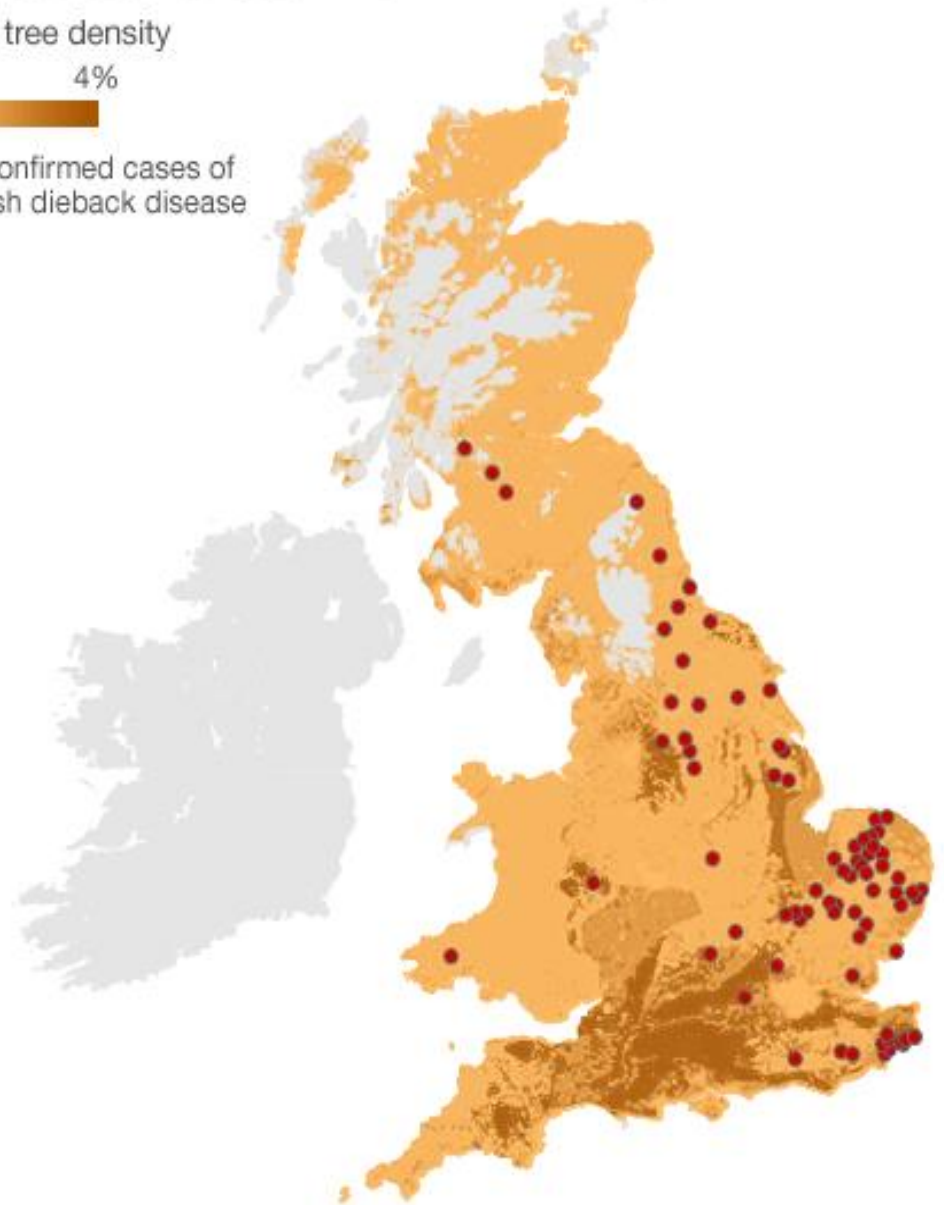
Ash dieback across Britain

Ash tree density

0% 4%

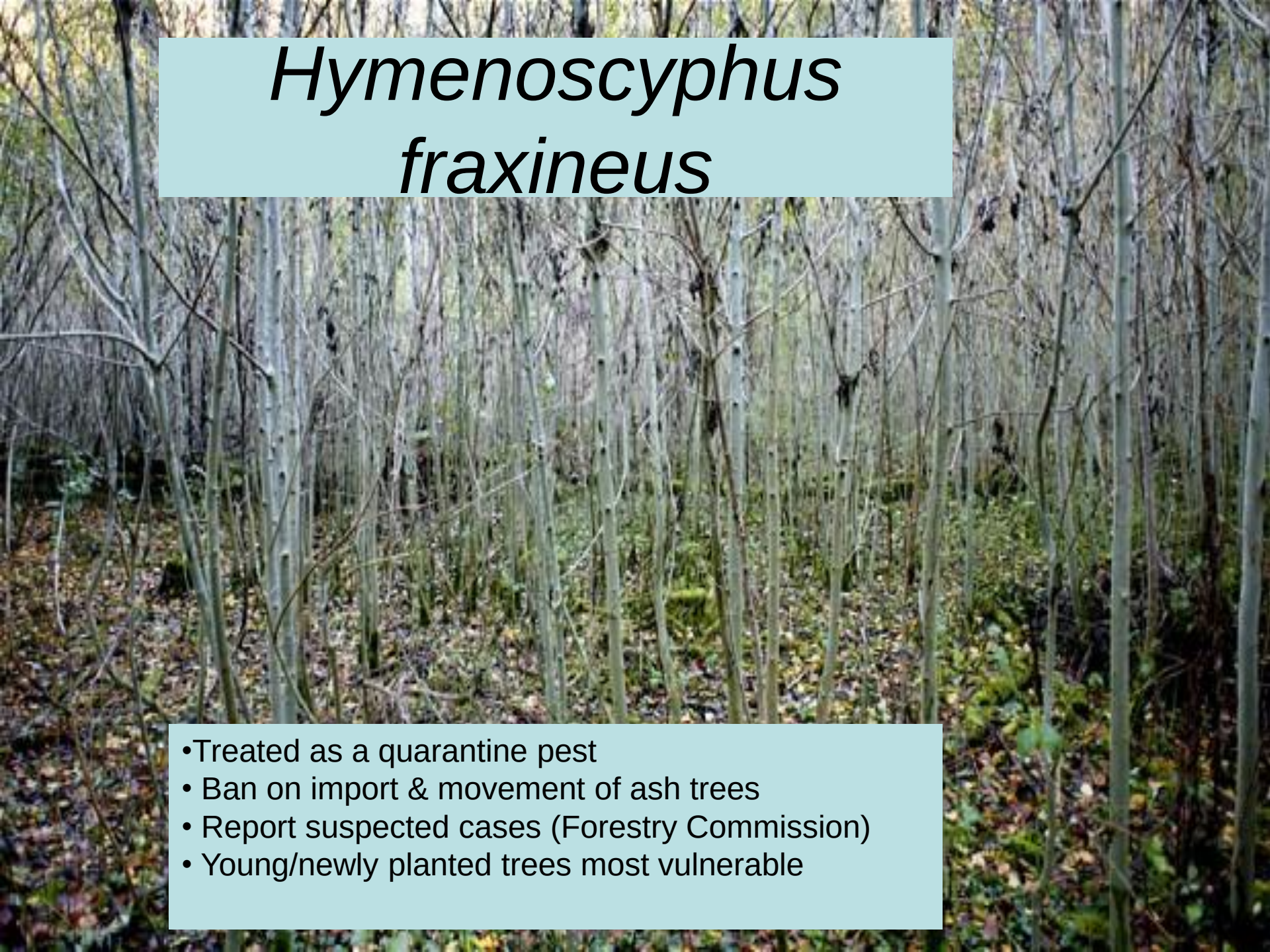


• Confirmed cases of ash dieback disease



Information correct at 1400 on 7 Nov 2012. No data for Northern Ireland. No nursery cases included.

Source: Countryside Survey, Forestry Commission



Hymenoscyphus fraxineus

- Treated as a quarantine pest
- Ban on import & movement of ash trees
- Report suspected cases (Forestry Commission)
- Young/newly planted trees most vulnerable

Notifiable Diseases - fungi

2. Red Band Needle Blight -

Dothistroma septosporum

- Corsican Pine & Lodgepole Pine
- Defoliates – climatic change – wet, warm spring & summers



Nordmann Fir *Abies nordmanniana*
principally affected in UK



- Tan bands develop after shoots elongate
- Turn reddish brown before shedding
- Can be confused with needle rust, sunburn, herbicide burn or moisture stress

The Need for Resilient Woodlands

- Woodlands need to be able to recover from disturbance such as a disease outbreak or fire, and tolerate disturbance without change (eg withstanding extreme weather events such as gales or flood). Adaptive change requires forest managers to take more flexible and adaptive management approaches.
1. Choose the tree species wisely. Match to site type and the predicted climatic conditions of the future
 2. Think carefully about the silvicultural management system you employ and the infrastructure you will need to undertake it. Be prepared to adapt your plans
 3. Select the most appropriate provenance and consider the contribution that your actions have for genetic diversity and genetic conservation

So how can we start managing the challenge?

- Look to source Grown in Britain
- Use income from thinnings to fund the work
- The plan should map out different species, length of rotation, growth rates and value of timber
- Create fire, windstorm and flood contingency plans
- Create landscape and wildlife corridors, and think about replacing mature trees that characterise the landscape
- Manage deer, squirrels and invasive species
- Thin to encourage regeneration
- Enrichment planting to diversify species

- Understand your soils and the growing conditions to help choose the right species for the specific site
- Diversity of species – including ‘minor species’
- Genetic diversity and more southerly origins
- Species capable of withstanding hotter, drier climate
- Link woodlands in the landscape
- Enlarge existing woodlands
- Build in usable access routes for forestry machinery and haulage

Current reliance on a small number of species increases vulnerability

At present, both broadleaf and conifer woodlands are dominated by a small number of species, which makes them more vulnerable to pests, diseases and climate change impacts:

Figure 1 Species make up of broadleaved woodland in England

Source: Forestry Statistics 2013, Broadleaves, National Forest Inventory, Preliminary estimates of quantities of broadleaved species in British woodlands, with special focus on ash (2012). (Pest and diseases to watch for in blue.)

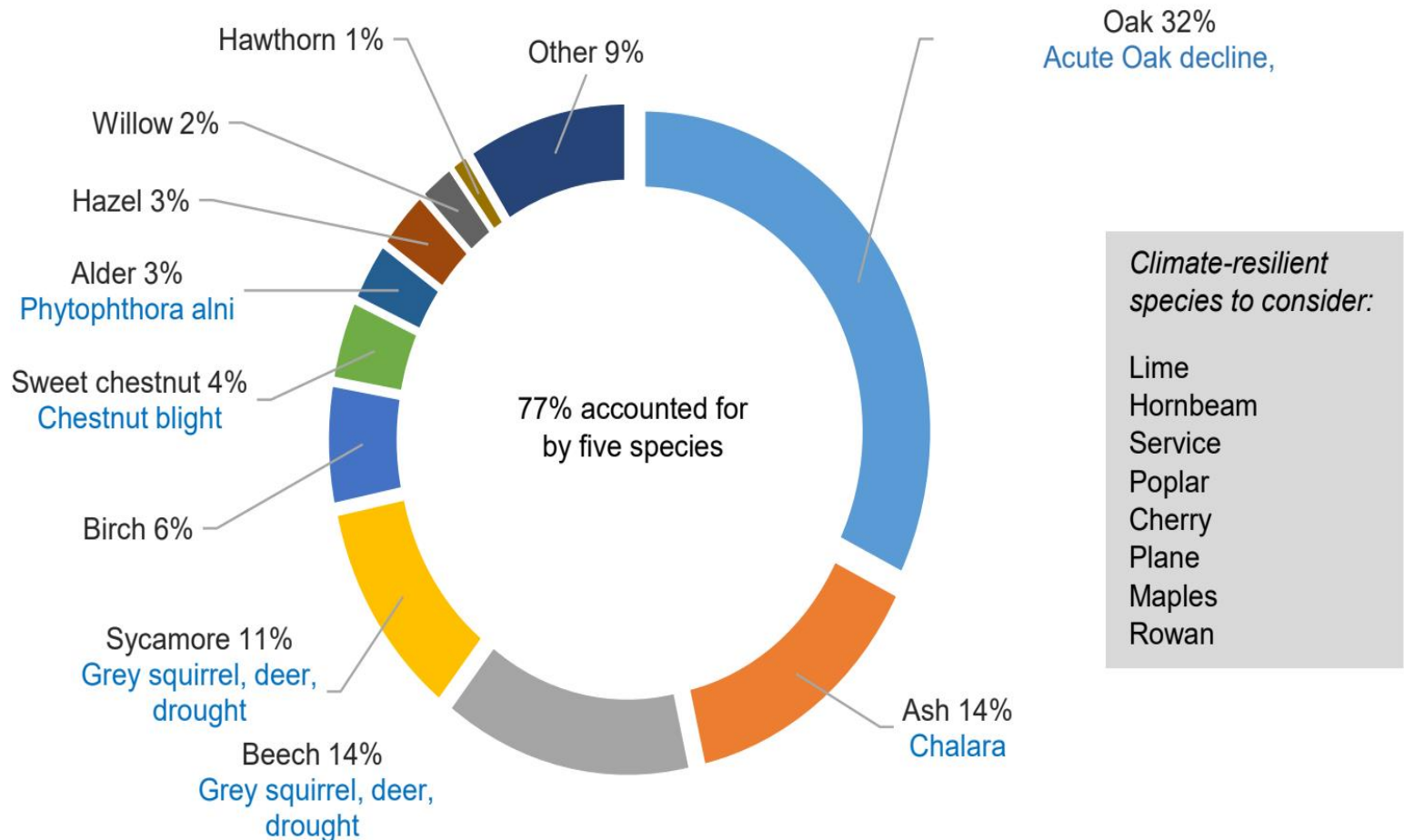
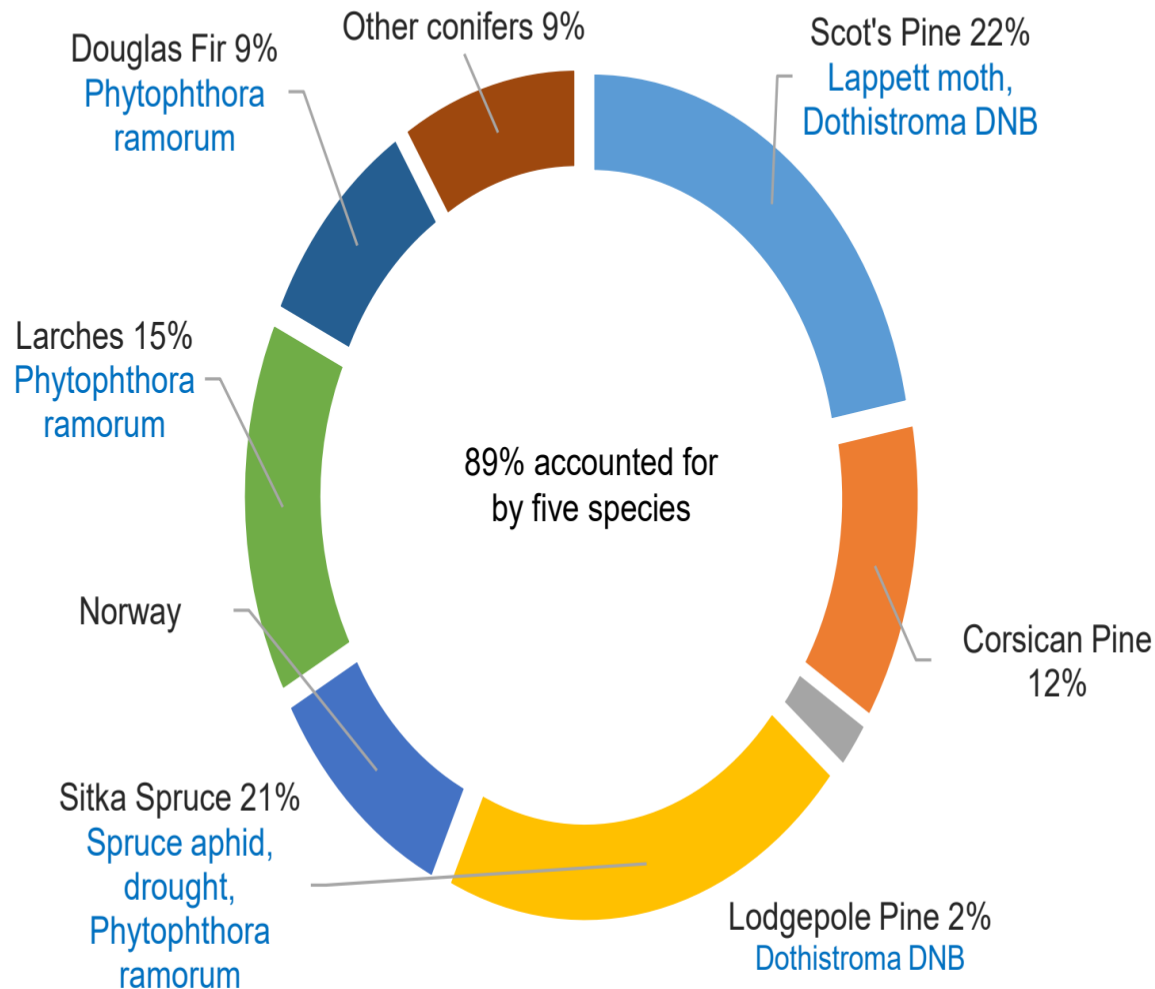


Figure 2 Species make up of conifer woodland in England

Source: Forestry Statistics 2012, Conifers, National Forest Inventory, Standing timber volumes for coniferous trees in Britain (2012)). (Pest and diseases to watch for in [blue](#).)



Climate-resilient species to consider:

Weymouth Pine
Macedonian Pine
Serbian Spruce
Oriental Spruce
Western Hemlock
Western Red Cedar
Coast Redwood
Giant Redwood
Atlas Cedar

Green indicates positive impact and orange/red indicates negative impact. The darker the colour, the greater the expected consequences.

	2020s	2050s	2080s
Opportunities			
Increase of potential yield of Sitka Spruce in Scotland			
Threats			
Forest extent affected by red band needle blight			
Decline in potential yield of beech trees in England			
Wildfires due to warmer and drier conditions			
Forest extent affected by green spruce aphid			
Loss of forest productivity due to drought			

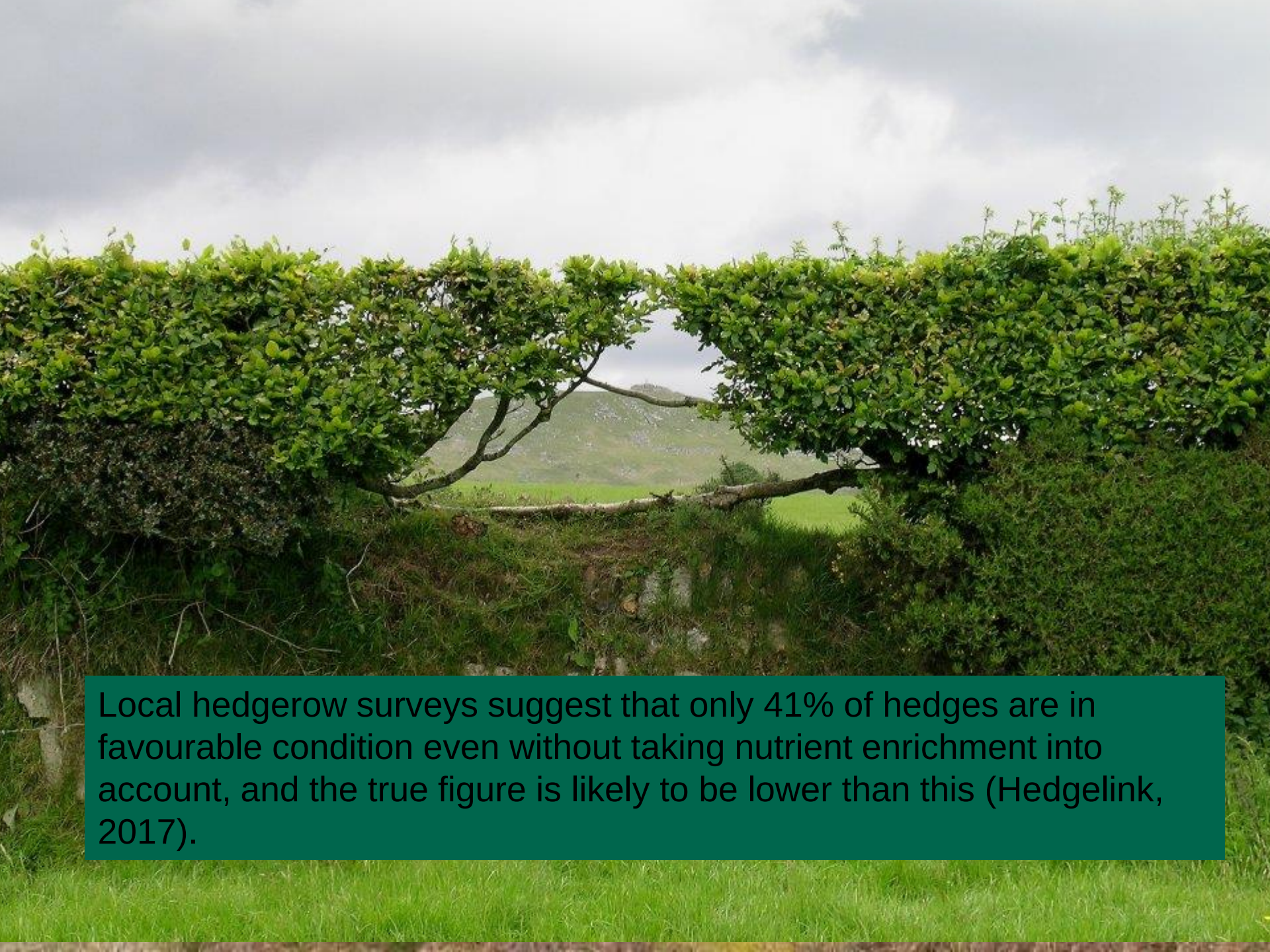
N.B. The Forestry Commission has high confidence in the predictions of these consequences.

The Forestry Commission estimates that by the 2080s, 65% of its public forestry estate will be classed as 'unsuitable' without any adaptation. Put another way, this is a 35% decline in productivity.

Hedgerow Management

- Livestock enclosure
- Define boundaries
- Rare in Europe
- Agricultural mechanisation – demise



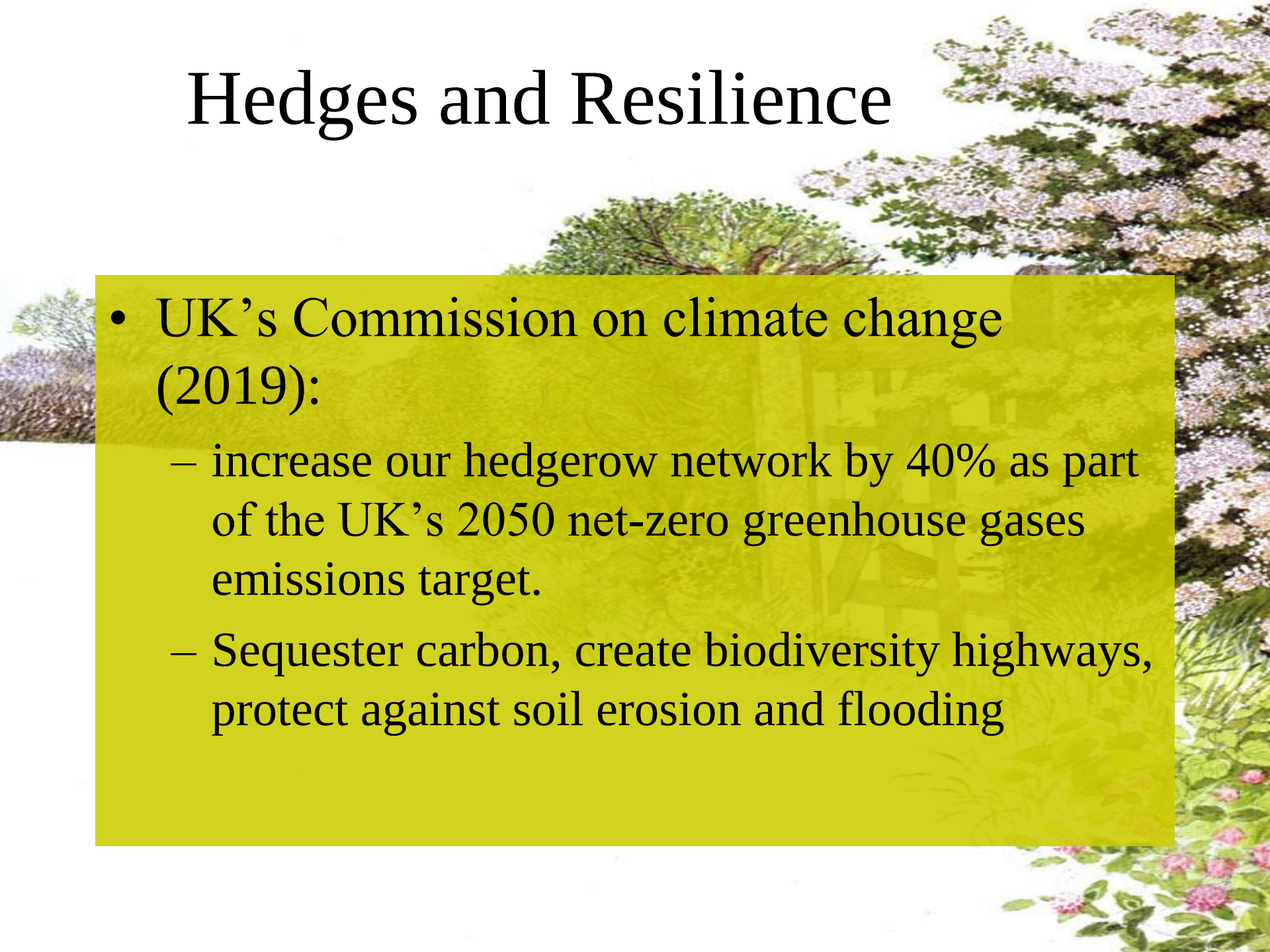


Local hedgerow surveys suggest that only 41% of hedges are in favourable condition even without taking nutrient enrichment into account, and the true figure is likely to be lower than this (Hedgelink, 2017).

Nutrient enrichment is the single most important reason for poor condition, 38% failing on this criterion. The other main reasons for poor condition are excessive gaps and hedgerows being too low or too thin.



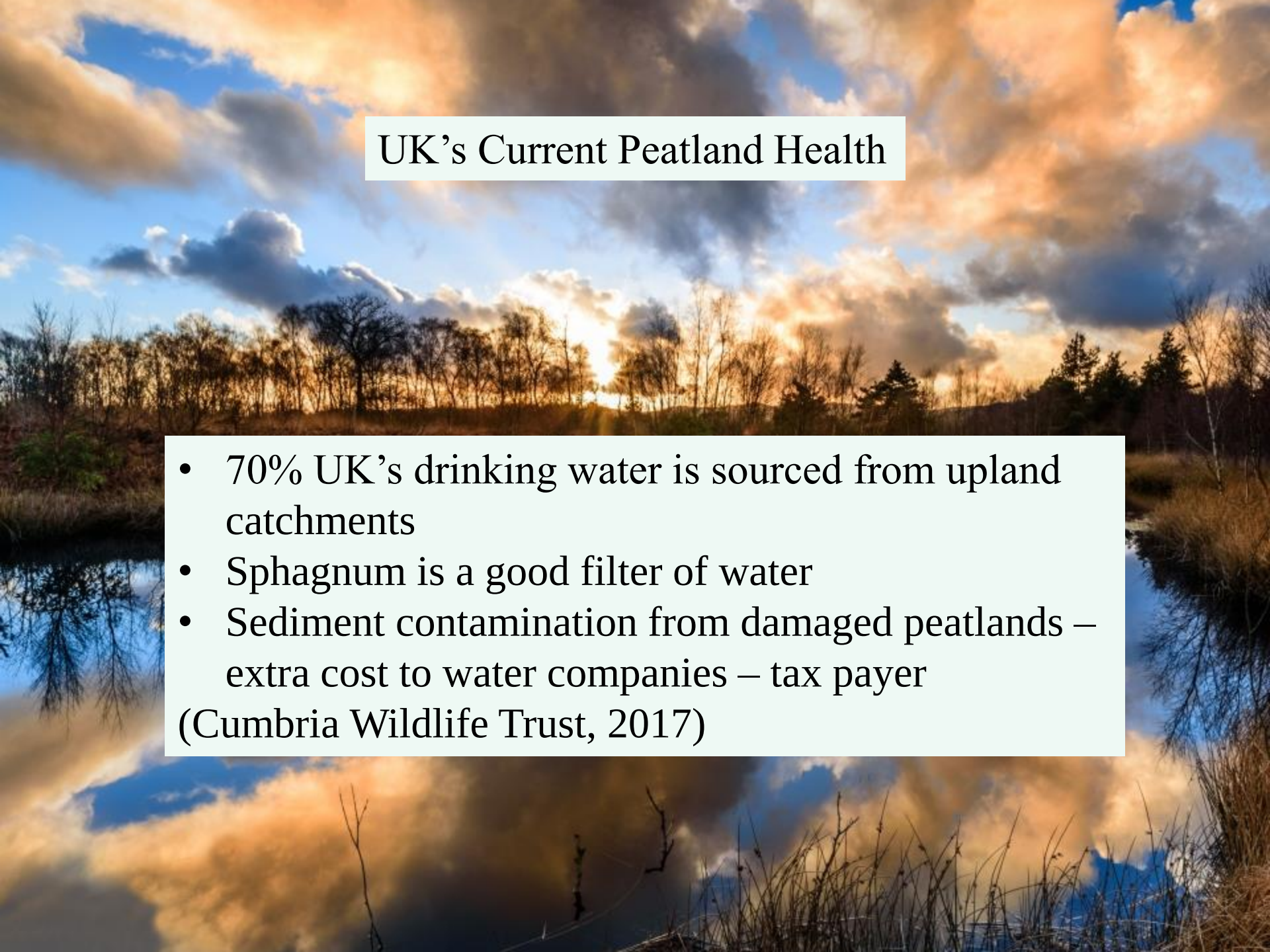
Hedges and Resilience



- UK's Commission on climate change (2019):
 - increase our hedgerow network by 40% as part of the UK's 2050 net-zero greenhouse gases emissions target.
 - Sequester carbon, create biodiversity highways, protect against soil erosion and flooding

UK's Current Peatland Health

- At least 80 per cent of UK peatlands are damaged by drainage, heavy grazing, regular burning, cultivation, forestry or other management.
- It can take over 1000yrs to generate 1m of peat
- 28 mil tonnes C stored in Lake District alone
- 5% loss of UK peat soils = annual man-made C emissions



UK's Current Peatland Health

- 70% UK's drinking water is sourced from upland catchments
 - Sphagnum is a good filter of water
 - Sediment contamination from damaged peatlands – extra cost to water companies – tax payer
- (Cumbria Wildlife Trust, 2017)

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.

Types of peatland:

- Blanket Bog (BB)
- Lowland raised mire (flat ground near Cumbria)
- Valley mire (Lake District)





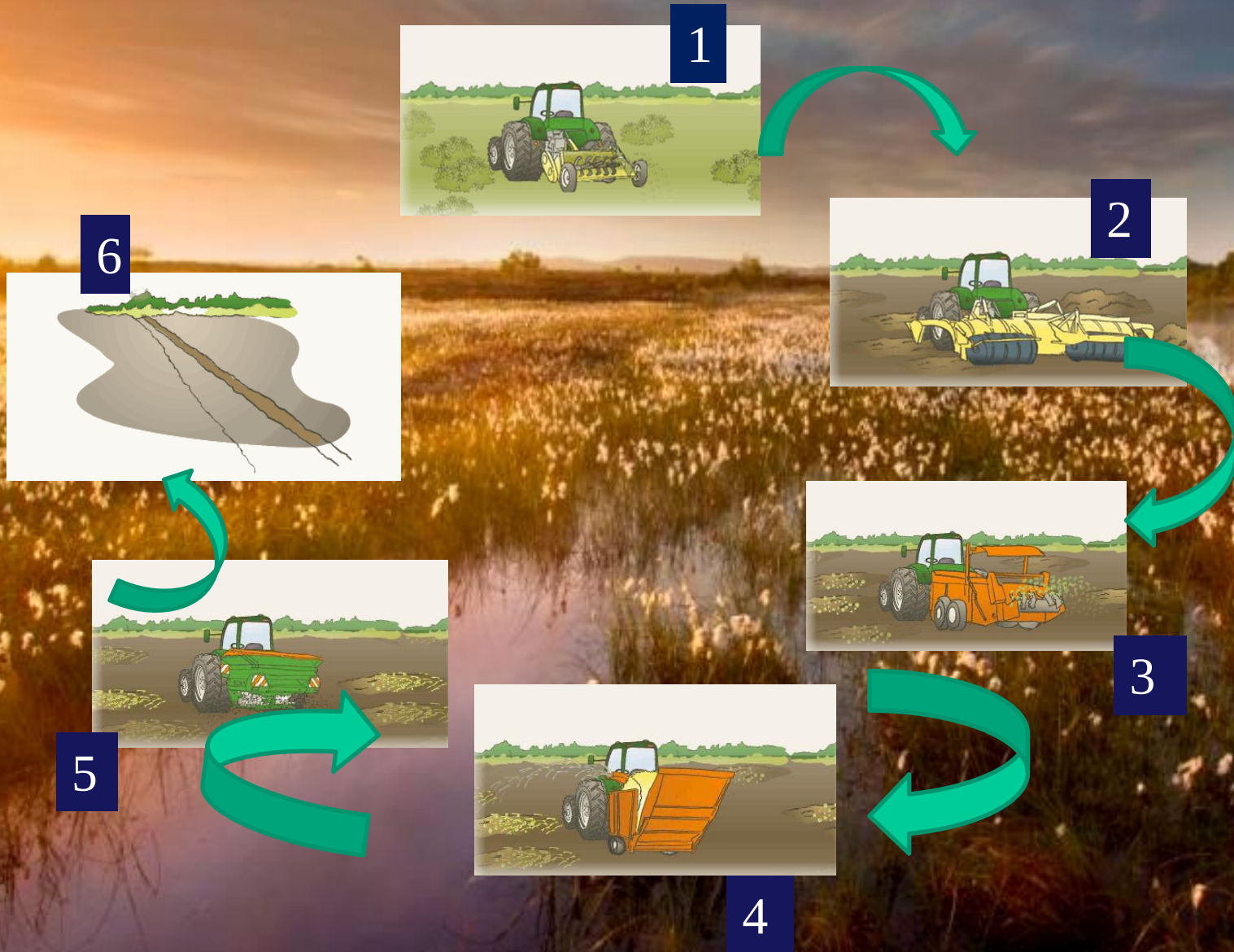
Analogy used by IUCN (2016) is that of a patient arriving at A&E:

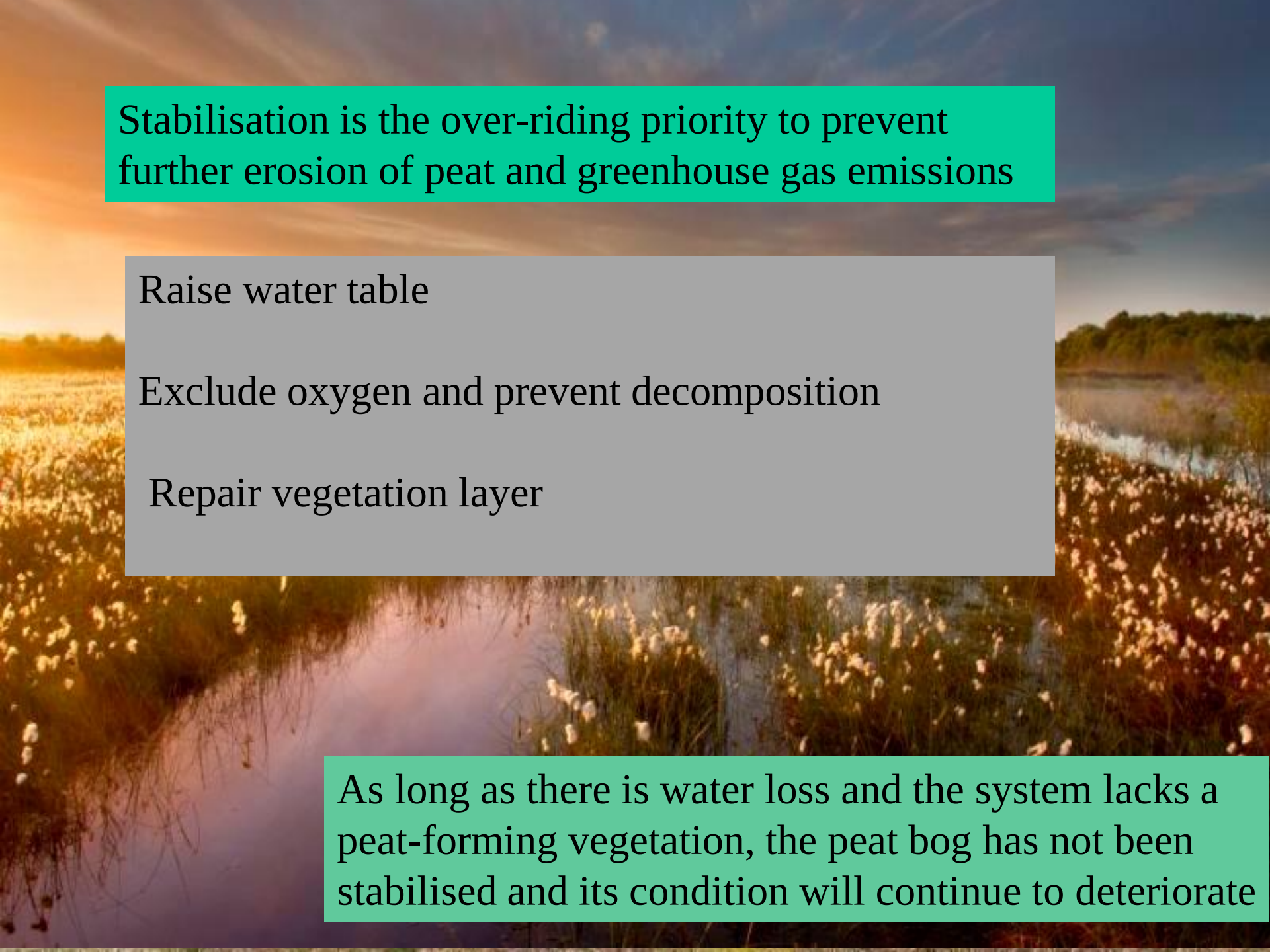
1. Assess the patient
2. Stabilise condition
3. Long-term healing & recovery plan

STEPS TO PEAT RESTORATION

- Re-establishment of typical peatland plant cover
- Hydrological regime
- Collecting donor seeds, vegetation

The textbook mechanical way





Stabilisation is the over-riding priority to prevent further erosion of peat and greenhouse gas emissions

Raise water table

Exclude oxygen and prevent decomposition

Repair vegetation layer

As long as there is water loss and the system lacks a peat-forming vegetation, the peat bog has not been stabilised and its condition will continue to deteriorate

The lost Archives



- Peat restoration is important for environmental reasons but what of anthropology and history?
- Plant, insect and microbial remnants in peat – historical record of landscape changes
- How past natural systems responded to climate changes

MoorLIFE 2020 Project

- 
- A wide-angle landscape photograph of a heathland under a blue sky with scattered white clouds. In the middle ground, a yellow excavator is positioned on a slope covered in purple heather. The foreground is filled with tall, dry grass and some low-lying shrubs. The background shows rolling hills and valleys, some with patches of green forest.
- Stabilising and revegetating 95 square km 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

Peak District National Park – reintroduction of sphagnum mosses

- 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)

FLOOD PREVENTION

- Water running over Sphagnum on blanket peatlands moves much more slowly (iCASP, 2008; IUCN, 2019)
- Water movement dominated by flow close to the surface
- Sediment released from bare peat strongly influences peatland stream ecosystems affecting both their 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
 - Control plot left



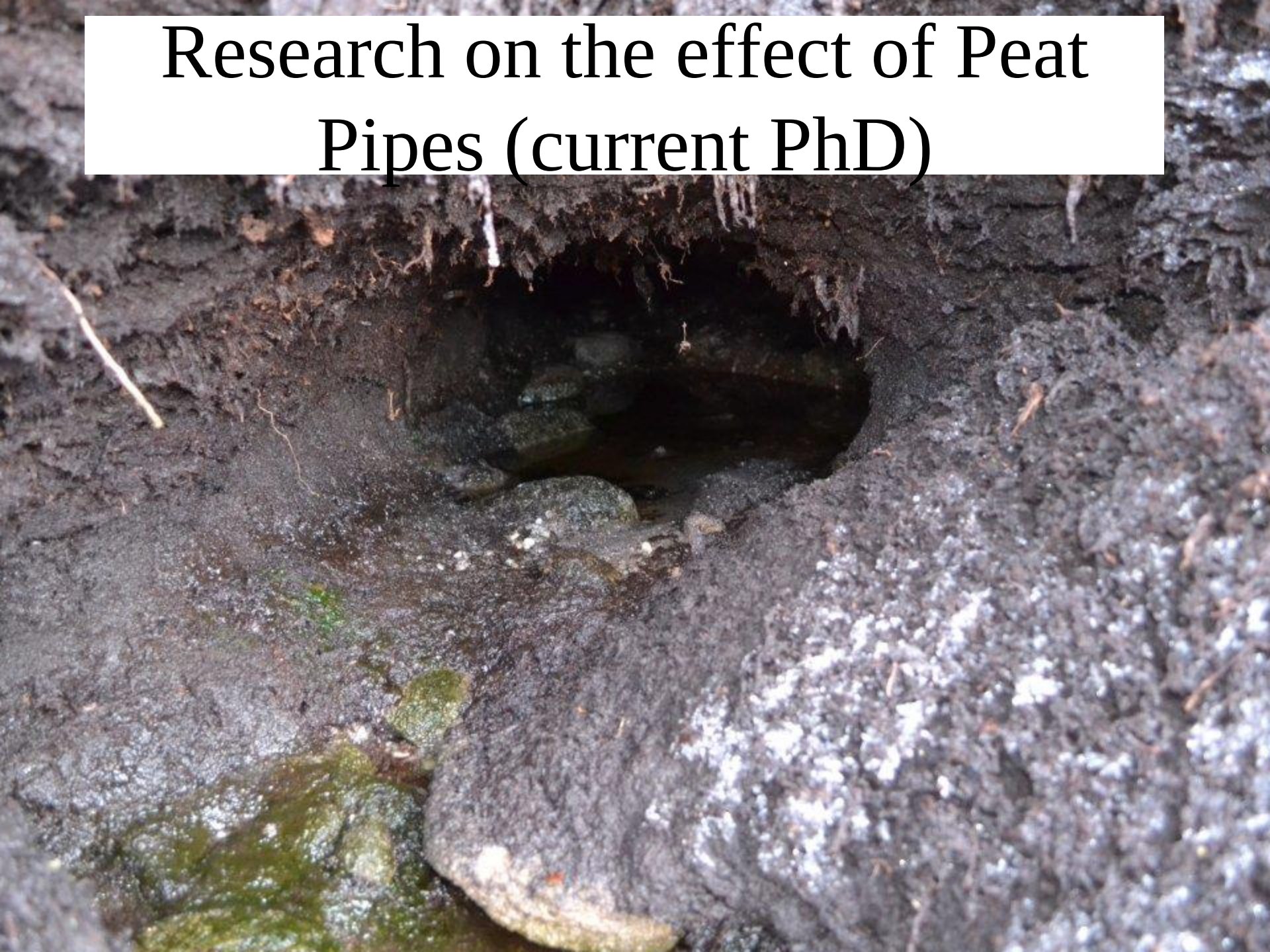
Kinder Catchment Monitoring Project, 2015

- 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

- 
- A wide-angle landscape photograph of a peatland. In the foreground, there is a field of purple heather. A yellow excavator is positioned in the middle ground, working on the peat. The background shows rolling hills under a blue sky with white clouds. A semi-transparent green box is overlaid on the bottom half of the image, containing two bullet points.
- Peatlands – largest store of carbon in UK
 - Building resilience against climate change has to include peat restoration.

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.

Upland Heath Action Plan: Powys

- Wet heath (soils/peat with impeded drainage)
- Habitat requires a high soil water table
- Dominated by Purple moor-grass *Molinia caerulea* and an understorey of bryophytes often *Sphagnum spp*
- Mosaic of blanket bog, acid grassland, freshwater, rock habitats, bracken and scrub



Areas of Concern

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



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



© Brecon Beacons National Park Authority
Plas y Ffynnon, Cambrian Way
Brecon, Powys, LD3 7HP

© Awdurdod Parc Cenedlaethol Bannau Brycheiniog
Plas y Ffynnon, Ffordd Cambrian
Aberhonddu, Powys, LD3 7HP

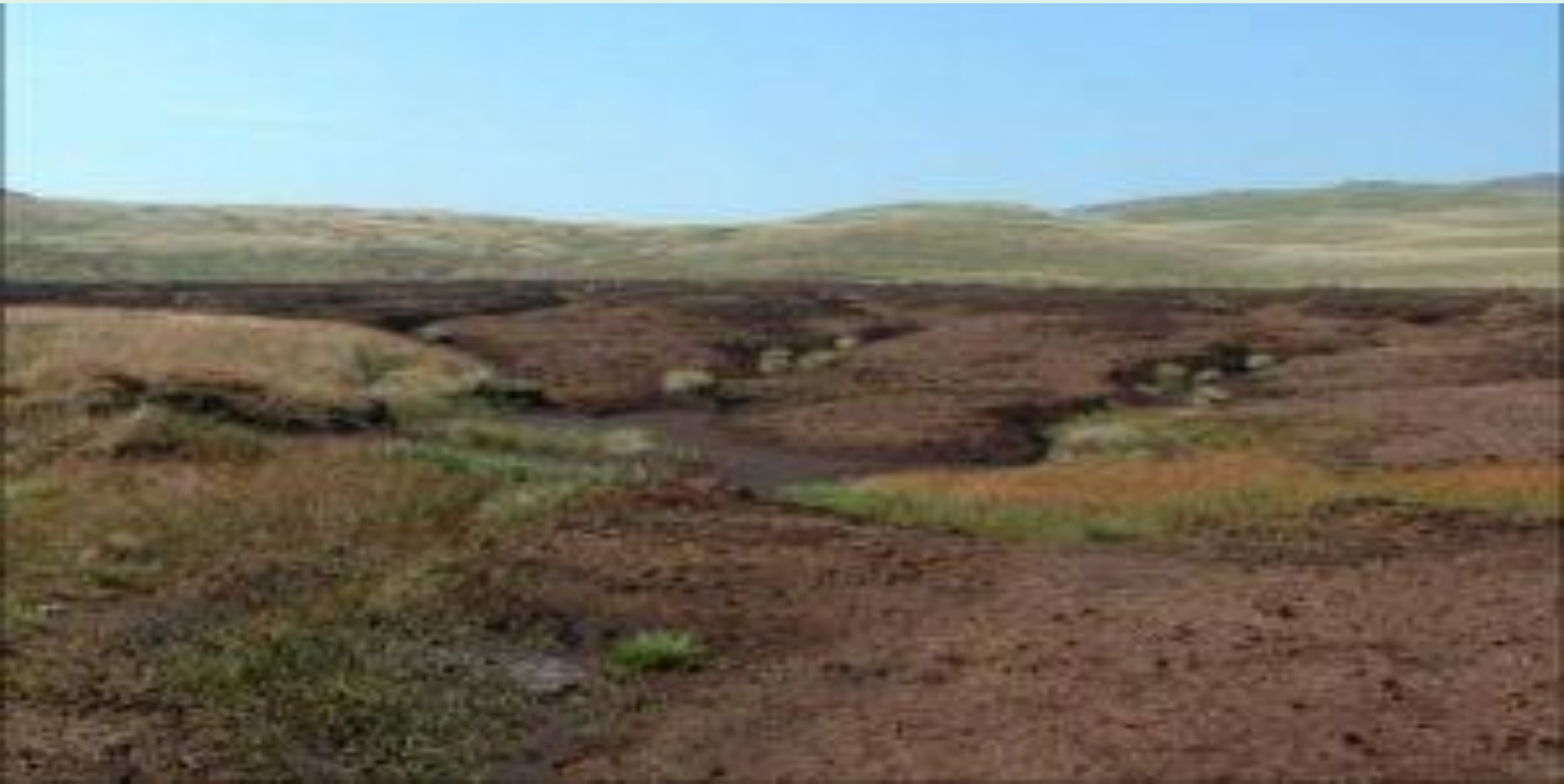
Waun Fignen Felen in 2000
Paul Sinnadurai

Scale: - 1:200	Date: - 27/07/2009
Centre: - 282294.23, 217795.78	Zoom: - 53.2589 (m)

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BEFORE RESTORATION WORK



First prevent exposed
peat being washed
away







Gorse spreading





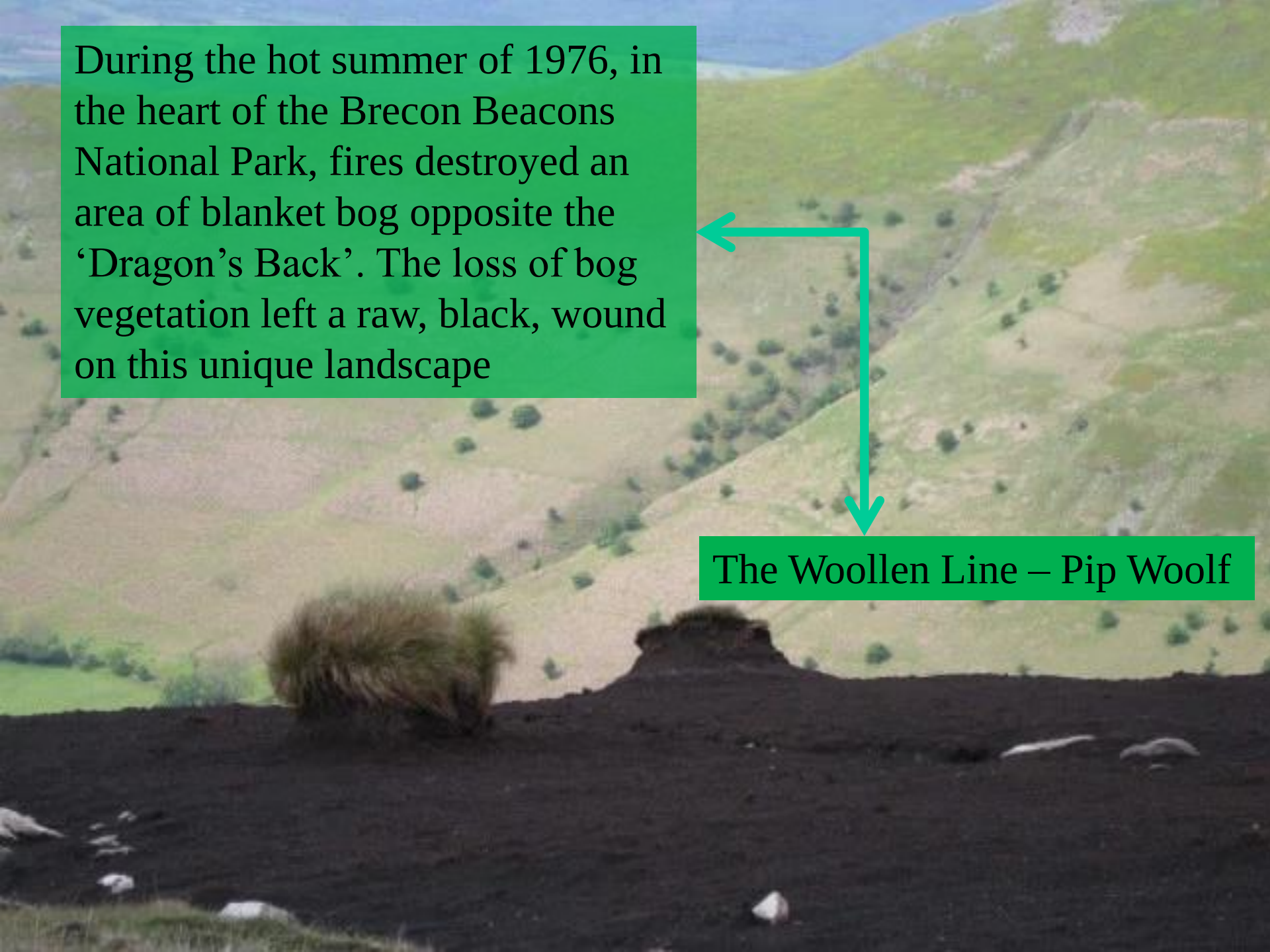


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	© Awdurdod Parc Cenedlaethol Bannau Brycheiniog Plas y Ffynnon, Ffordd Cambrian Aberhonddu, Powys, LD3 7HP		© Hawlfraint y Goron a hawliau cronfa ddata 2012 Arolwg Ordnans 100019322 2012. Ni chaniateir i chwi gopio, tan-drwyddedu, dosbarthu neu werthu y data yma i unrhyw drydydd barti mewn unrhyw ffurf.	
	Scale: - 1:3500 Centre: - 282308.7, 217789.48	Date: - 01/02/2012 Zoom: - 932.03 (m)		

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









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





Further Reading:

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

A close-up photograph of a coastal or saltmarsh environment. The image shows a dense cluster of green, fleshy-leaved plants, likely a type of succulent. Interspersed among these are several red, spiky structures, which appear to be the reproductive parts of the plants, possibly stamens or styles. The overall scene is a detailed view of the plant's morphology and its natural habitat.

Next Week : Coastal and Saltmarsh environments