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UNIT GUIDE 2023-24

6. Understand how a woodland ecosystem and a simple woodland food chain or web function.

6.1. Identify a minimum of four influences on a woodland ecosystem

The definition of an **ecosystem** most referenced is that established by the Convention on Biological Diversity (CBD) and the Millennium Ecosystem Assessment (MA): "A dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit."

http://uknea.unep-wcmc.org/EcosystemAssessmentConcepts/tabid/98/Default.aspx#:~:text=UK%20NEA&text=The%20most%20widely%20used%20definition,interacting%20as%20a%20functional%20unit%E2%80%9D.

An ecosystem constitutes a natural system comprising flora, fauna, and their surrounding environment. Within this system, intricate interconnections frequently exist between the living and non-living elements. The **biotic** components refer to the living aspects of an ecosystem, including animals and plants, while the **abiotic** components encompass the non-living elements, such as climate (including rainfall and temperature), light, rocks, water, and soil.

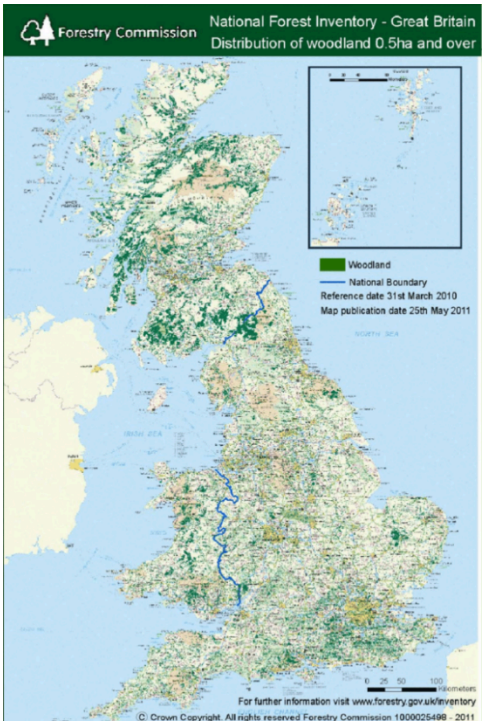
A woodland ecosystem is therefore all the biotic and abiotic components in a woodland.

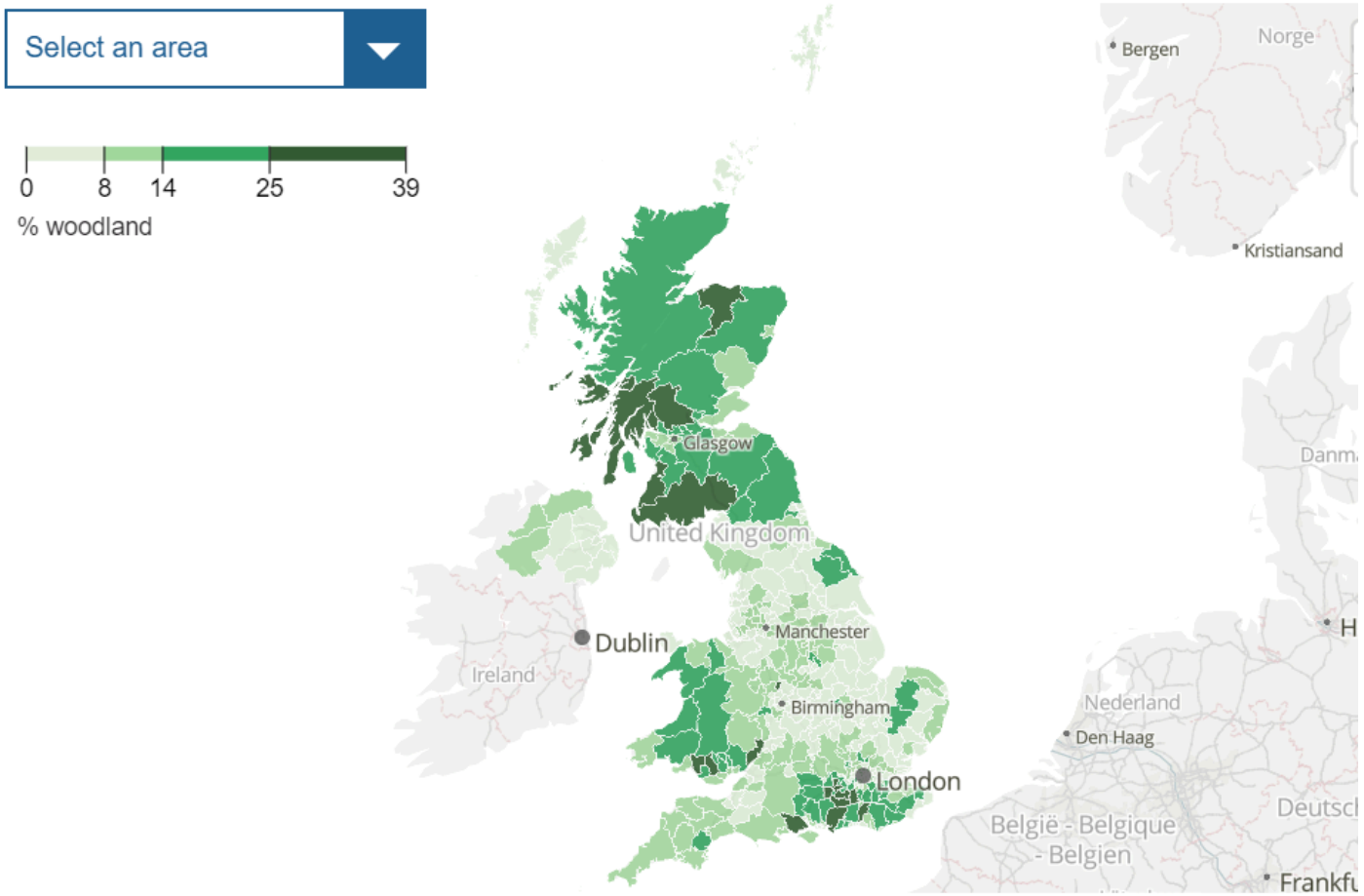
In the United Kingdom and a substantial portion of Europe, the categorisation of ecosystems is largely seen as coinciding with that of habitats. **Habitat** is defined as an ecological or environmental space that is occupied by specific animal or plant species.

The UK has **four mainland-based ecosystems**. These are:

- heaths
- moorlands
- wetlands
- **woodlands**

The map below shows the distribution of woodlands in the UK.





Source: Forest Research, Department of Agriculture, Environment and Rural Affairs, Office for National Statistics

https://www.ons.gov.uk/visualisations/dvc1588/map-trees/index.html

Types of Woodland in the UK:

Ancient woodland refers to forested areas that have existed since at least the year 1600. The presence of certain slow-colonizing plants, such as wood anemones and enchanter's nightshade, serves as an indicator of the woodland's age.

Broad-leaved woodland consists of trees characterised by broad, varied leaves rather than needles. Most of these trees are deciduous, meaning they shed their leaves during the autumn season.
Wet woodland is characterized by the presence of trees like willows, birches, and alders, which flourish in poorly drained or seasonally inundated soils.

Caledonian forest is predominantly composed of Scots pine trees, although other species such as birch, rowan, and willow may also be found. This type of woodland is exclusive to Scotland.

Secondary woodland arises through natural processes on land that was previously deforested. Typically, it has a lower diversity of species compared to ancient woodland.

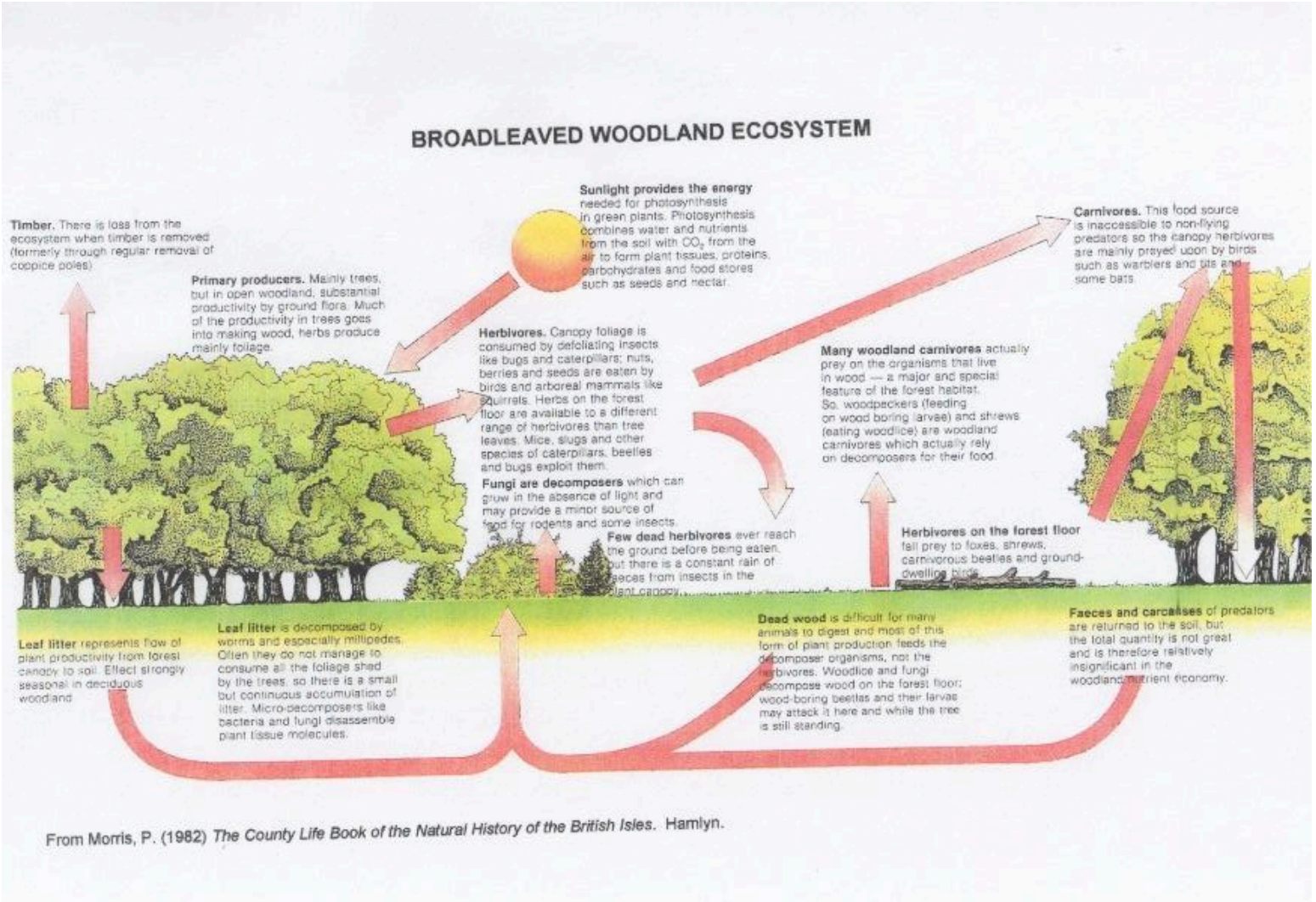
The forest ecosystem comprises two primary types of factors: biotic and abiotic.

1. *Biotic* factors encompass all living organisms within the forest, including *plants, animals, insects, fungi, and bacteria*. *Trees*, as the most prominent biotic element, play a crucial role in defining the ecosystem, both in terms of their visibility and their contribution to biomass.

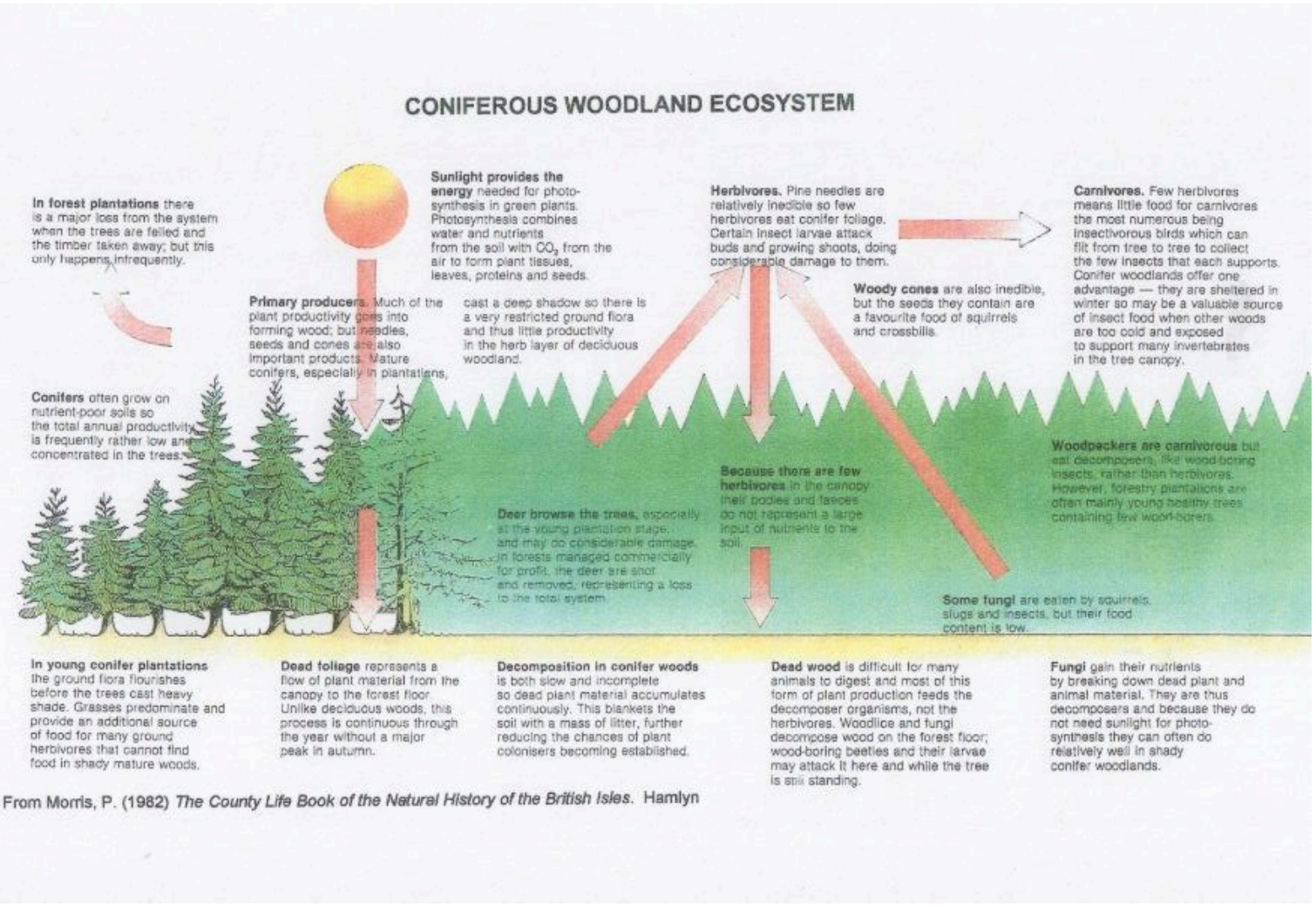
2. In contrast, *abiotic* factors refer to the non-living components that affect the living organisms within the ecosystem. These include elements such as *soil, sunlight, water, temperature, and minerals*. Among these, sunlight is perhaps the most critical yet often overlooked abiotic factor, as it is essential for photosynthesis. Other abiotic components, such as temperature and the chemical properties of soil and water, also significantly influence the ecosystem's dynamics.
The concept of an ecosystem is fundamentally based on the interactions between biotic and abiotic factors. The study of these interactions, along with the habitats of organisms in a specific area, is known as niche ecology, while the term biomass refers to the total mass of living matter in significant ecosystems.

Key *abiotic* variables include *water, sunlight, oxygen, soil, and temperature*, with water being particularly vital, often described as essential for life itself, as all living organisms depend on it.

It is important to note that dead organic matter, such as fallen leaves, is classified as biotic because it originated from once-living organisms. Although these materials are no longer alive, they retain their classification as biotic components due to their previous life status. Conversely, abiotic factors do not include any remnants of living organisms.



From Morris, P. (1982) *The County Life Book of the Natural History of the British Isles.* Hamlyn.



From Morris, P. (1982) *The County Life Book of the Natural History of the British Isles*. Hamlyn

Ecotones are areas that act as boundaries or transitions between two ecosystems, such as marshlands between dry and wet ecosystems, mangrove forests between terrestrial and marine ecosystems, grasslands between desert and forest, and estuaries between saltwater and freshwater. They are of great environmental importance, as they contain many species of fauna and flora due to their influence on both ecosystems. Ecotones can be natural or man-made, with the edge effect referring to changes in population or community structures at the boundary of two habitats. Ecotones have a greater variety of organisms, offer good nesting places for animals, serve as a bridge of gene flow, and act as buffer zones, protecting bordering ecosystems from damage. They are also a sensitive indicator of global climate change, as shifting boundaries between ecosystems are thought to be due to climate
change.

Figure 1. The ecotone complex example and examples of microhabitat factors: (**a**)—"bilberry-type spruce forest—5-year-old clear-cut site" EC; (**b**)—downed deadwood; (**c**)—forbs (*Trientalis europaea* L.) and subshrubs (*Vaccinium vitis-idaea* L.) in the ground vegetation; (**d**)—coniferous regeneration (*Picea abies* (L.) H.Karst.).

https://www.mdpi.com/1999-4907/14/11/2125

urban ecotones (also called anthropogenic ecotones, they are interfaces between urban areas and natural landscapes)

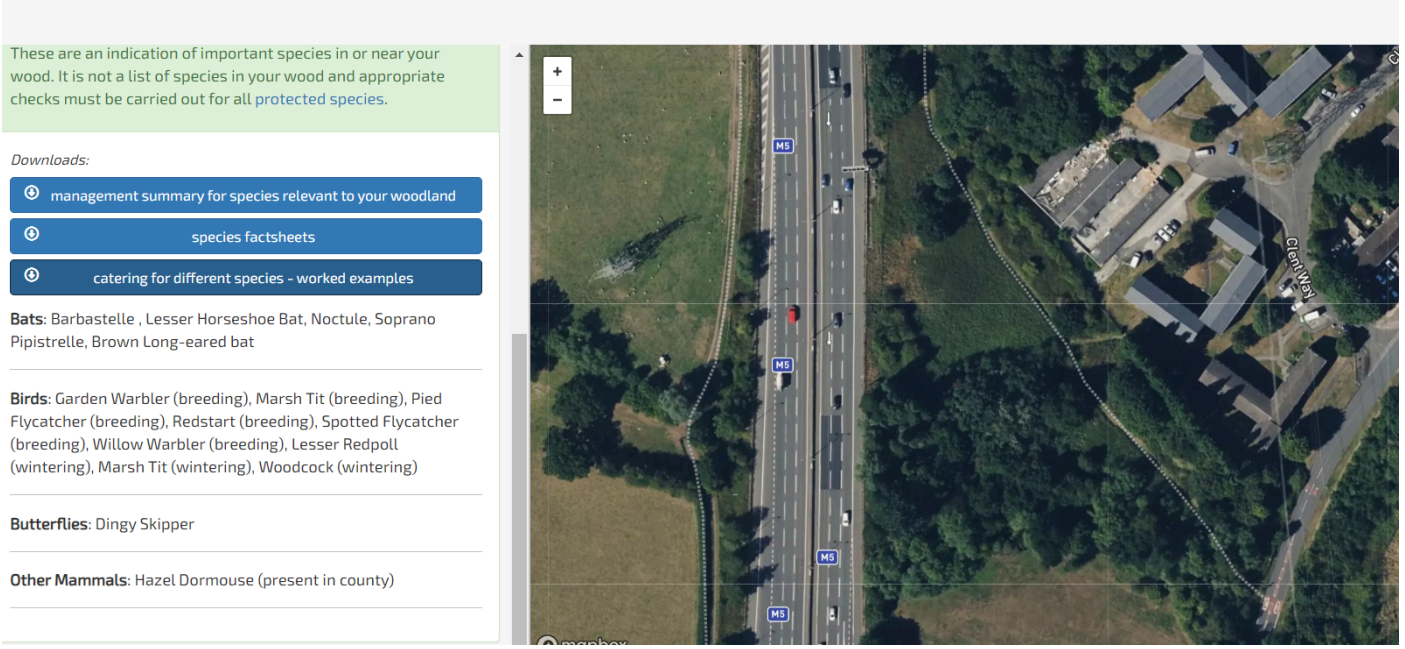
Edge effect and Ecotones

A woodland edge garden maximises beauty and biodiversity

https://www.marklaurence.com/wp/the-woodland-edge-garden/

An ecotone is a region of overlap where one ecosystem (biome) changes into another. This might occur gradually, like when a forest transitions from scrubland to moorland, or abruptly, such as when a woodland edge gives way to an open field. As the two biomes overlap and form the ecotone, a smooth transition results in a rich biodiversity.

Bartley Green Ward, Clent Way
Surrounding woodland and wildlife habitat
https://woodlandwildlifetoolkit.sylva.org.uk/toolkit

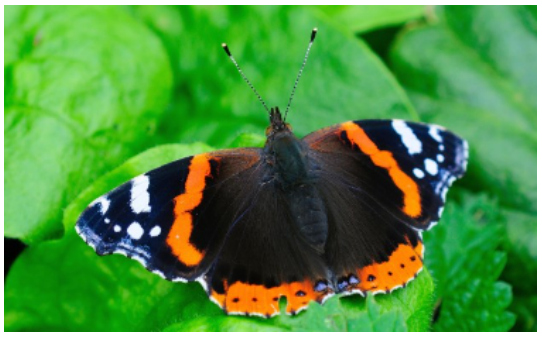


Wildlife

Note that managing invasive plants and animals is likely to benefit most important wildlife species. See also the section in Woodland Guidance on Invasive species and disease.

			Key Management Actions												
Species These results are an indication of priority species in or near your wood. Their presence will depend partly on your woodland's structure and features. It is not a list of species in your woodland and appropriate checks must be carried out for all protected species.	European Protected Species	**Key features** Many priority species inhabit broadleaved woods, however, some will also use conifer and mixed woods, particularly the young thicket stages - especially birds such as tree pipit, lesser redpoll and sometimes willow tit. Many of the habitat features described here, such as deadwood, ride edges etc., can be of value in conifer and mixed plantations as well as in broadleaved woods, and can be integrated into commercial management of plantations.	Thinning and/or selective felling	Small group felling	Control of invasive vegetation	Retention and creation of deadwood	Rotational Coppice	Manage standard trees/groups	Creation/management of rides and glades	Enhancement of woodland edge	Deer management	Fencing (to manage grazing)	Retention of/increasing water levels or wet features	Minimal intervention	New woodland creation (planting/natural regeneration)
Bats															
Barbastelle	✓	Mature woodland (closed canopy, humid); deadwood; flower-rich meadows and grazed wooded landscapes			✓	✓				✓	✓	✓	✓	✓	✓
Lesser Horseshoe Bat	✓	High forest/ mature woodland; glades, rides, woodland edge and scrub key for foraging and invertebrate supply; deadwood as snags, limbs and standing important; roosts/ breeds in buildings, hibernates underground			✓	✓				✓	✓	✓	✓	✓	✓
Noctule	✓	High forest/ mature woodland; glades, rides, edge, scrub, wetland; tree cavities, deadwood			✓	✓			✓	✓	✓	✓	✓	✓	✓
Soprano Pipistrelle	✓	High forest/ mature woodland; glades, rides, edges and scrub; wetland sites; Tree crevices, old buildings; deadwood			✓	✓			✓	✓	✓	✓	✓	✓	✓
Brown Long-eared bat	✓	Mature woodland; wet woodland; tree cavities, deadwood; dense native understorey; open habitats			✓	✓				✓	✓	✓	✓	✓	✓
Birds															
Garden Warbler (breeding)		Young woods, thicket, coppice, scrub; nests in dense shrub vegetation	✓	✓	✓		✓		✓	✓	✓		✓		✓
Marsh Tit (breeding and wintering)		Dense, diverse shrub layer in mature woodlands; deadwood / natural cavities	✓		✓	✓	✓		✓		✓	✓			✓

A few wildlife examples in the backyard of Clent Way Estate, Bartley Green



A food web in a UK woodland includes many components, such as *producers, primary consumers, secondary consumers, scavengers, and decomposers*:

Producers: Trees, shrubs, and small plants that produce their food through photosynthesis

Primary consumers: Mice, squirrels, and rabbits that eat the producers

Secondary consumers: Foxes and hawks that eat the primary consumers

Scavengers: Foxes and vultures that scavenge

Decomposers: Insects, microorganisms, and mushrooms that break down dead organisms

Pollinators: Butterflies and other winged insects that help with pollination

Here are some other animals that live in UK woodlands:

Barn owls: Hunt small mammals like mice, shrews, and voles in grassy areas around woodlands

Larger birds and squirrels: Live in the canopy

Smaller birds: Live in the understory

Energy is a vital part of ecosystems, and it flows through them in a one-way stream from producers to consumers.
Energy is passed through the ecosystem as organisms eat and are eaten, changing form as it goes. This process is represented by food chains and food webs, where arrows indicate the direction of energy flow.

The diagram below shows a food web starting with an oak tree. It includes species such as the speckled bush cricket, snail, hedgehog, tawny owl, and badger.
In the video, an example of a food web was shown, with arrows showing energy flow between organisms (Figure 4). For example, an arrow points from the grass and another goes from the rabbit to the fox, indicating the rabbit gets its energy by eating grass, and the fox obtains energy from eating the rabbit.

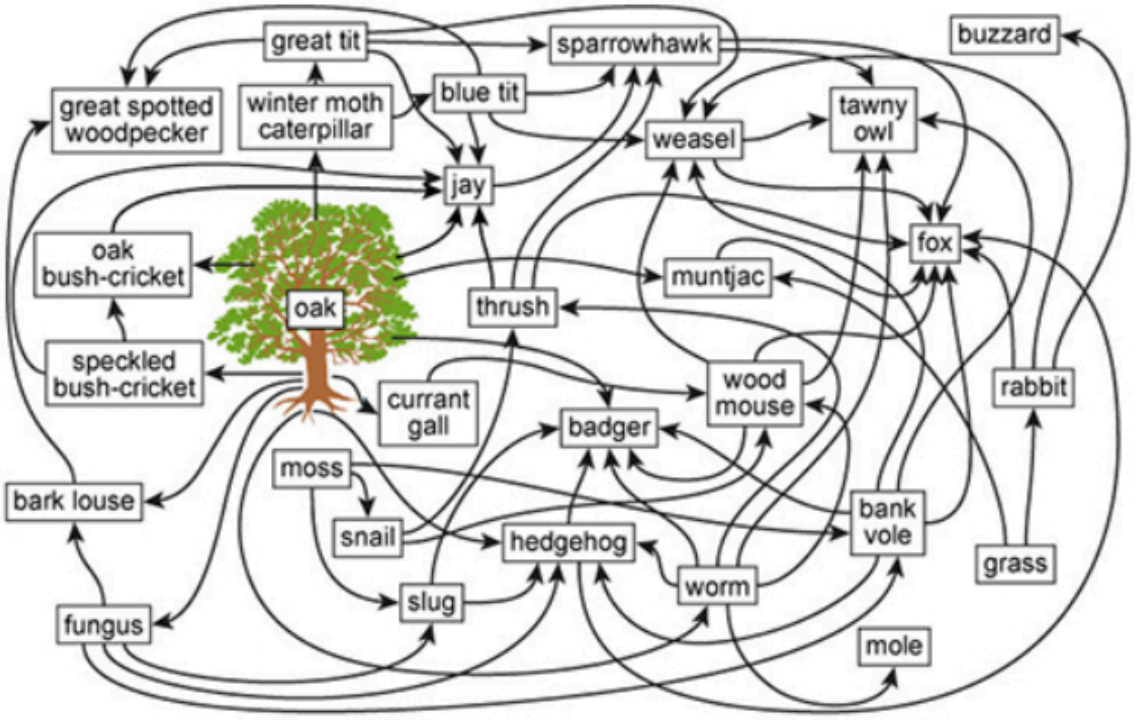


Figure 4 A food-web for selected species in an oak woodland ecosystem.

https://www.open.edu/openlearn/science-maths-technology/scales-space-and-time/content-section-2.5

In Figure 4, the fox has eight arrows pointing to it, indicating that at least eight different organisms form its food supply. If one of those animals were not present in the ecosystem, the fox would have other food choices.
The winter moth caterpillar, currant gall and speckled-bush cricket only have one arrow leading to them, indicating that their food/energy supply entirely comes from the oak. What does this tell us about the value of oaks in the ecosystem?

The single arrow pointing to these species suggests that they only eat oak tissue, so the loss of this plant from the ecosystem would likely mean the loss of the insects that feed on them, as they would not have alternative food sources. This could have further consequences on species that eat the caterpillar, currant gall or cricket.

The oak woodland ecosystem shown in the below image contains a variety of organisms that can be categorized into different trophic levels (Trophic level is defined as the position of an organism in the food chain and ranges from a value of 1 for primary producers to 5 for marine mammals and humans):

Producers	Primary Consumer	Secondary Consumer	Tertiary Consumer	Quaternary Consumer	Decomposer
Oak Tree	Speckled bush cricket	Oak bush cricket	Jay	Sparrow-hawk	Fungus
Moss	Snail	Thrush	Sparrowhawk		Fungus
Oak Tree	Currant gall	Woodmouse	Weasel	Fox	Fungus

Producers: These are organisms that can produce their food through photosynthesis, such as the oak tree and moss.
Primary consumers: These are organisms that eat producers, such as the speckled bush cricket, snail, currant gall, and oak bush cricket.
Secondary consumers: These are organisms that eat primary consumers, such as the thrush, jay, wood mouse, and weasel.
Tertiary consumers: These are organisms that eat secondary consumers, such as the sparrowhawk and fox.
Quaternary consumers: These are organisms that eat tertiary consumers, but there are no quaternary consumers present in this ecosystem.
Decomposers: These are organisms that break down dead organisms and waste products, such as the fungus.
Therefore, the components of the oak woodland ecosystem shown in the image can be categorized as producers, primary consumers, secondary consumers, tertiary consumers, and decomposers.

A balanced ecosystem is crucial for maintaining biodiversity. When a predator is absent, prey populations can grow unchecked, leading to overgrazing or overconsumption of resources. This can disrupt the entire food chain, potentially causing significant ecological damage.

Predators play a vital role in maintaining balanced ecosystems in UK woodlands. Their presence helps to regulate prey populations, preventing overgrazing and ensuring a sustainable environment for all species. Here are some examples of how predator absence can disrupt UK woodland ecosystems:

1. Deer Overpopulation:
Without wolves or other large predators, deer populations can grow unchecked.
Overgrazing by deer can strip woodlands of vegetation, leaving them bare and vulnerable to erosion.
This can harm tree regeneration and biodiversity.

2. Rabbit Population Explosion:
Without foxes or other predators, rabbit populations can increase dramatically.
Rabbits can strip woodlands of young trees and shrubs, hindering regeneration.
Their burrowing can also cause damage to tree roots and contribute to soil erosion.

3. Impact on Bird Populations:
Predators like hawks and owls help to control populations of rodents and insects.
Without these predators, rodent and insect populations may surge.
This can damage trees and hurt bird populations that rely on these prey items for food.

4. The reintroduction of pine martens can play a significant role in controlling grey squirrel populations. While not a sole predator, pine martens can effectively hunt and consume grey squirrels, particularly in areas where their habitats overlap.

5. Reduced Biodiversity:
Predator absence can lead to a simplification of the food web. This can reduce biodiversity and make the ecosystem more vulnerable to disturbances like disease or climate change.
Reintroducing predators to areas where they have been absent can help restore balance to woodland ecosystems and protect biodiversity.
However, this must be done carefully to avoid unintended consequences and ensure the well-being of both predator and prey populations.

The *European pine marten* has proven to be an effective natural predator of the invasive grey squirrel in the British Isles. Here's a breakdown of its impact:
1. Predation:
Direct predation: Pine martens actively hunt and kill grey squirrels, reducing their population size.
Fear response: The presence of pine martens can cause grey squirrels to alter their behaviour, such as spending more time in hiding or avoiding certain areas, which can also contribute to population decline.
2. Habitat preference:
Overlap: Pine martens and grey squirrels share similar habitat preferences, particularly in wooded areas. This overlap in habitat increases the likelihood of encounters and predation.
3. Impact on red squirrels:
Indirect benefit: By reducing grey squirrel populations, pine martens indirectly benefit native red squirrels. This is because grey squirrels outcompete red squirrels for resources and transmit squirrel pox, a deadly disease to which red squirrels are susceptible.
4. Geographic expansion:
Recolonization: The expansion of pine marten populations into areas where they were previously absent has led to a decline in grey squirrels and a subsequent recovery of red squirrels in those regions.
Overall, the European pine marten has emerged as a valuable tool in the ongoing effort to control the invasive grey squirrel population and protect native red squirrel populations in the British Isles. The success of pine marten reintroduction programs highlights the importance of considering natural predator-prey relationships in conservation efforts.

https://theconversation.com/grey-squirrels-are-oblivious-to-threat-from-pine-martens-giving-native-reds-the-advantage-131064#:~:text=Researchers%20sifting%20through%20masses%20of,and%20consuming%20whatever%20is%20available.

The major influences on woodland ecosystems in the UK today are a complex interplay of natural and human-induced factors. Here are some of the key influences:

<u>Natural Influences</u>:
Climate Change: Rising temperatures and altered precipitation patterns are leading to changes in species composition, phenology, and ecosystem processes.
Natural Disturbances: Events like storms, fires, and insect outbreaks can significantly impact woodland structure and function.
Soil Conditions: Soil properties, including pH, nutrient content, and water retention, influence plant growth and community dynamics.
Topography: The physical characteristics of the landscape, such as slope, aspect, and elevation, affect microclimate and vegetation distribution.

<u>Human-Induced Influences</u>:
Land Use Change: Deforestation, afforestation, and land conversion for agriculture and development have profound effects on woodland ecosystems.
Pollution: Air, water, and soil pollution can harm plants, animals, and microorganisms, leading to ecosystem degradation.

Invasive Species: The introduction of non-native species can disrupt native ecosystems and outcompete native plants and animals.
Forest Management Practices: Harvesting, thinning, and planting can influence forest structure, composition, and resilience.

Scientifically Established Influences:

Climate Change: Numerous studies have documented the impacts of climate change on UK woodlands, including shifts in species distribution, earlier flowering times, and increased tree mortality.

Nitrogen Deposition: Atmospheric nitrogen pollution has been shown to alter plant species composition and nutrient cycling in UK woodlands.

Acid Rain: While acid rain has decreased in recent years, its legacy continues to affect sensitive ecosystems, particularly in upland areas.

Forest Management: Research has demonstrated the effects of different forest management practices on biodiversity, carbon storage, and ecosystem resilience.

It's important to note that these influences are often interconnected and can have cascading effects on woodland ecosystems. Understanding these influences is crucial for effective forest management and conservation efforts.

In my opinion, the **four main influences on woodland ecosystems** are:

Climate change: Rising temperatures and changes in precipitation patterns are altering the growth rates and distribution of trees, as well as increasing the frequency and severity of droughts and storms.

Human activity: Deforestation, urbanization, agriculture, and recreational activities are all impacting woodland ecosystems. Deforestation reduces habitat for wildlife, while urbanization and agriculture can lead to pollution and fragmentation of habitats.

Invasive species: Non-native species that are introduced to a new environment can have negative impacts on native species and ecosystems. Invasive plants can outcompete native plants for resources, while invasive animals can prey on native species.

Pollution: Air, water, and soil pollution can harm woodland ecosystems. Air pollution can damage trees and reduce their growth rates, while water pollution can contaminate drinking water and harm aquatic life. Soil pollution can reduce the fertility of the soil and make it difficult for plants to grow.

Four main influences on woodland ecosystems

Influence: **Mammal** Invasive Species  The grey squirrel was introduced to the UK from North America in 1876 and its population has grown rapidly since then with detriment to our native red squirrel. Grey squirrels damage our forests and woodlands by stripping bark from trees' main trunks (at the base and up in the canopy) and branches. When they strip a complete ring of bark around the tree, it will kill the tree.	**Pros** **Not really** ● Food source for some predators like birds of prey like goshawk, pine marten, fox	**Cons** ● According to government data, grey squirrels in England and Wales are estimated to cause around **£37 million worth of damage to trees annually**, primarily through bark stripping, resulting in lost timber value, reduced carbon capture, and the need for tree replacement due to damage. ● estimated control costs the total economic loss to forestry attributable to the grey squirrel has been estimated at **£6,097,320 annually** and, based on the area of at-risk woodland and the squirrel population in each country, 65% of all costs are incurred in England https://rfs.org.uk/wp-content/uploads/2021/03/analysis-of-the-cost-of-grey-squirrel-damage-to-woodland-publication-copy-180121.pdf https://www.gov.uk/guidance/manage-threats-to-woodland-destructive-animals-invasive-species#:~:text=Grey%20squirrels%20damage%20our%20forests,it%20will%20kill%20the%20tree.

Influence: **Invertebrate** **Pest** Eight-toothed spruce bark beetle 	**Pros:** **Not really** ● Recycles dead wood: Helps speed up the decomposition of dead and dying wood	**Cons:** ● A serious forestry pest if left uncontrolled, the eight-toothed spruce bark beetle has the potential to cause significant damage to the UK's forestry and timber industries. https://www.forestresearch.gov.uk/tools-and-resources/fthr/pest-and-disease-resources/larger-eight-toothed-european-spruce-bark-beetle-ips-typographus/

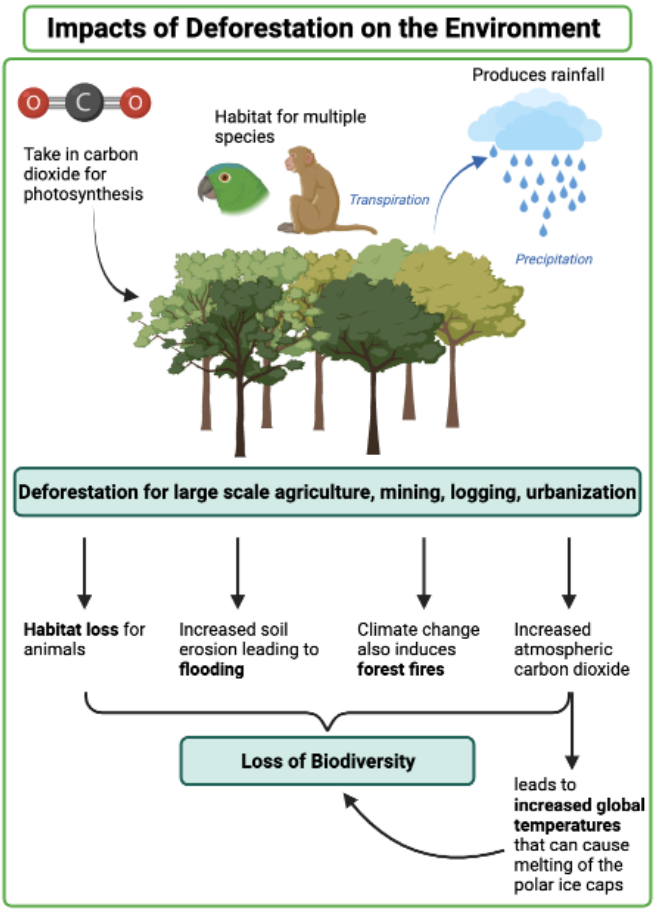
(Picture: Gyorgy Csoka, Hungary FRI, Bugwood.org)		

Influence:	**Pros:**	**Cons:**
Fungi Amanita muscaria Fly agaric 	● Fungi cannot make their own food using energy from sunlight but grow by absorbing food and water from their surroundings – most importantly from living and dead plants, and animals. ● Many fungi live on the roots of trees and other plants. This is known as a mycorrhizal association (from the Greek 'myco', meaning fungus, and 'rhiza', meaning root). **The fungi help the plant take up more nutrients by increasing the effective surface area of the roots and in turn, take sugars from the plant.** ● Woodland fungi such as types of Amanita, Boletus, Lactarius and Russula will only grow with certain trees. ● many trees grow less well without fungi.	● The main con of Amanita muscaria, is that it is highly toxic and can cause hallucinations and psychotic reactions if eaten.

Influence: Abiotic factor	**Pros:**	**Cons:**
Wind Speed In UK woodland, "wind speed" is considered an abiotic factor as it is a non-living component of the environment that significantly influences the ecosystem, particularly affecting the growth and distribution of plants within the woodland by impacting factors like seed dispersal and potential damage from strong winds; essentially, it's a measure of the wind's strength and direction within the forest environment.	● The primary benefit of moderate wind speeds in UK woodlands is that it provides shelter from strong winds, reducing soil erosion, protecting young plants, and minimizing the risk of windthrow (trees being uprooted) by creating a calmer air environment within the woodland canopy ● wind helps spread seeds in woodlands by carrying them away from the parent plant. This process is called anemochory.	● High wind speeds can cause physical damage to trees like broken branches, uprooting, and even tree death, especially in exposed areas. https://www.forestresearch.gov.uk/tools-and-resources/fthr/pest-and-disease-resources/chronic-oak-decline-dieback/biotic-and-abiotic-factors-which-contribute-to-oak-decline/drought-and-high-winds/#:~:text=Abiotic%20factor%20that%20contributes%20to,trees%20contributing

Deforestation: A Growing Threat to Our Planet

Deforestation, driven primarily by the increasing human population, is a pressing environmental issue with far-reaching consequences. As land is cleared to accommodate infrastructure and agricultural needs, forests, vital ecosystems that serve as buffers against extreme weather events, are being decimated.



Key Impacts of Deforestation:

Climate Change: Forests absorb significant amounts of carbon dioxide, a major greenhouse gas. Deforestation releases this stored carbon into the atmosphere, contributing to global warming and climate change.
The process by which forests decrease the levels of atmospheric carbon dioxide is photosynthesis. Photosynthesis is the process used by plants to convert sunlight into energy. During this process, plants absorb carbon dioxide from the atmosphere and release oxygen. This helps to reduce the amount of carbon dioxide in the atmosphere.

Carbon sequestration: Trees absorb carbon dioxide from the atmosphere through photosynthesis.

Deforestation: When trees are cut down, this carbon is released back into the atmosphere as carbon dioxide.

Greenhouse effect: Carbon dioxide is a greenhouse gas, meaning it traps heat in the Earth's atmosphere.
Increased temperature: As more carbon dioxide is released, the greenhouse effect intensifies, leading to higher temperatures. Therefore, deforestation contributes to climate change by increasing the amount of carbon dioxide in the atmosphere, which traps heat and raises global temperatures.

Biodiversity Loss: Forests are home to many plant and animal species. Deforestation destroys habitats, leading to habitat loss and biodiversity decline, which can have cascading effects on ecosystems.
There will be a decrease in biodiversity due to an increase in habitat loss in the polar regions.

Habitat loss: As global temperatures rise, polar ice caps and glaciers melt at an alarming rate, leading to a significant loss of habitat for polar species.

Reduced food availability: Melting ice can disrupt food chains, as aquatic species lose their icy habitats and terrestrial species struggle to find prey.

Increased competition: As species are forced into smaller areas, competition for resources intensifies, further impacting biodiversity.

Disease outbreaks: Warmer temperatures can create conditions that favour the spread of diseases among polar species.
Therefore, the overall impact of increased global temperatures on biodiversity in the polar regions is overwhelmingly negative, primarily due to habitat loss and its associated consequences.

Extreme Weather Events: Forests play a crucial role in regulating rainfall patterns and mitigating the impacts of natural disasters. Deforestation can lead to more frequent and severe droughts, floods, and storms.
Counter process
Decreases carbon dioxide and increases rainfall.
Decreases carbon dioxide: Forests absorb carbon dioxide from the atmosphere through photosynthesis, helping to mitigate climate change.
Increases rainfall: Forests release water vapour into the atmosphere through transpiration, which can lead to increased cloud formation and precipitation.
Therefore, forests play a crucial role in regulating the climate and water cycle.

Soil Erosion: Tree roots help to hold soil in place. Deforestation can lead to soil erosion, degrade agricultural land and increase the risk of landslides.

Addressing deforestation requires a multifaceted approach, including sustainable land management practices, reforestation efforts, and policies that promote forest conservation. By protecting our forests, we can help mitigate the impacts of climate change, preserve biodiversity, and ensure a more sustainable future for generations to come.

The increasing human population is causing a loss of biodiversity because deforestation is undertaken to enhance the infrastructure to meet the growing needs of the population. This is the most accurate and comprehensive reason for the link between population growth and biodiversity loss. Deforestation destroys habitats, disrupts ecosystems, and reduces the availability of resources for many species, leading to their decline and extinction.

6.2. Identify the effects that one catastrophic event can have on an ecosystem

A team of experts from across Europe has produced a list of 15 overlooked and emerging issues that are likely to have a significant impact on UK forests over the next 50 years.

The first issue is mentioned under the headline: 'Catastrophic Forest Ecosystem Collapse (Issue 1)'.

There is substantial evidence indicating a rise in natural disturbances affecting European forests, primarily due to wind, fire, and bark beetle infestations, often worsened by historical management practices that have simplified these ecosystems (Patacca et al., 2023). Large-scale disturbances are increasingly impacting forests in the UK; for instance, winter storms in 2021 resulted in the loss of 12,750 hectares of forest due to windblow in Great Britain (Forestry Commission, 2022). Projections related to climate change suggest an increase in the frequency and intensity of extreme weather events, including heatwaves, droughts, floods, and storms (IPCC, 2023). In the future, a combination of interconnected hazards and their cascading effects will probably lead to the partial or complete collapse of forest ecosystems, affecting both their ecological communities and the ecosystem services they provide. Lindenmayer et al. (2016) characterise forest collapse as an "abrupt, long-lasting, and widespread change in ecosystem state and dynamics that has major negative impacts on biodiversity and key ecosystem services." However, the specific definition of forest collapse may differ based on local circumstances. Changes may occur either abruptly or gradually, involving various uncertain successional pathways and subsequent effects such as wildfires or insect outbreaks. The repercussions on the provision of ecosystem services are expected to be significant (Cantarello et al., 2017). Timber productivity is anticipated to decline; salvage and phytosanitation logging will increasingly dominate harvesting activities; and timber markets will experience greater volatility due to unpredictable surpluses and deficits, both within the UK and across the global supply chain. There will be considerable alterations to ecological communities, with a potential risk of species extinction (Martin et al., 2015). The collapse of forest ecosystems will have profound short- and long-term consequences for the forestry sector, as well as for the broader environment, economy, and society.

https://academic.oup.com/forestry/article/97/3/349/7328865?login=false

Severe storms persist in affecting various regions of the UK, with additional storms anticipated shortly.

Storm Agnes (September 2023) approached from the Southwest of England and West Wales, delivering gusts reaching 80 mph in exposed areas along the Irish Sea. Subsequently, Storm Isha produced winds exceeding 100 mph, with some of the most significant measurements recorded at Brizlee Wood, located near Alnwick in Northumberland. Given the Met Office's issuance of "threat to life" warnings, it is understandable to be apprehensive about the impact of such extreme weather on our environment.

The Impact of Storms Agnes and Isha on the Environment
Storm Agnes and Isha were two significant weather events that had a profound impact on the environment in the United Kingdom. The high winds and heavy rainfall associated with these storms led to several environmental consequences.
Key Impacts:
Coastal Erosion: The strong winds and waves generated by these storms can accelerate coastal erosion, leading to the loss of beaches, cliffs, and dunes. This can have serious implications for coastal communities and ecosystems.
Flooding: Heavy rainfall from the storms can contribute to flooding, particularly in low-lying areas and river basins. This can cause damage to property, infrastructure, and agricultural land.
Tree Damage and Deforestation: High winds can uproot trees and cause damage to forests. This can lead to deforestation, which can have negative consequences for biodiversity, soil erosion, and carbon sequestration.

Wildlife Disruption: Extreme weather events can disrupt wildlife habitats and negatively impact animal populations. For example, flooding can displace animals and destroy their nests, while strong winds can damage trees that provide food and shelter.
Water Pollution: Storms can also contribute to water pollution by washing pollutants into rivers and streams. This can harm aquatic ecosystems and make water supplies unsafe for drinking.
Long-Term Implications:
The impacts of storms like Agnes and Isha can have long-term consequences for the environment. For example, coastal erosion can lead to the loss of valuable habitats for marine life, while deforestation can contribute to climate change. It is important to take steps to mitigate the effects of these storms and to adapt to changing weather patterns.

https://barnescommon.org.uk/storm-damage-on-the-common/

The UK's forests, particularly in upland and western regions, are increasingly vulnerable to wind damage and windthrow due to the changing climate. This heightened risk is primarily attributed to:
More frequent and intense storms:
Climate change is leading to an increase in the frequency and severity of storms, resulting in higher wind speeds.
Rising winter rainfall: Increased precipitation can saturate soils, weakening tree root anchorage and making them more susceptible to uprooting.
Faster tree growth: Warmer temperatures can accelerate tree growth, potentially leading to stands reaching critical heights earlier.

Key Factors Influencing Windthrow Risk
Windthrow risk is influenced by several factors, including:
Site exposure: Western areas and higher elevations typically experience higher wind speeds.
Tree species and rooting form: Shallow-rooted and fast-growing species are more vulnerable.
Soil conditions: Shallow, waterlogged, or sandy soils increase the risk of windthrow.
Stand spacing: Open-grown trees and closely spaced stands (less than 2 meters) have lower risk.

Thinning regime: Regular thinning can reduce risk in low-moderate risk stands but stands are at their highest risk immediately after thinning. In high-risk areas, no-thin practices or self-thinning mixtures are recommended.
Tree height: Taller trees have a greater turning momentum, making them more likely to uproot.
Mitigation Strategies
To mitigate the risks of wind damage and windthrow, forest managers can consider the following strategies:
Site selection: Choose planting sites with favourable soil conditions and exposure to reduce risk.
Species selection: Plant species with deep roots and good wind resistance.
Stand structure: Maintain diverse stand structures with varying heights and species to reduce wind vulnerability.
Thinning practices: Implement appropriate thinning regimes, considering the stand's risk level and the need for natural regeneration.
Monitoring and early detection: Regularly monitor forests for signs of stress or damage and take prompt action to address potential issues.
By carefully considering these factors and implementing effective management strategies, forest managers can help to protect UK forests from the increasing threat of wind damage and windthrow.

Sources:

http://uknea.unep-wcmc.org/EcosystemAssessmentConcepts/tabid/98/Default.aspx#:~:text=The%20most%20widely%20used%20definition,since%20all%20its%20elements%20interact.
https://www.internetgeography.net/topics/uk-ecosystems/#:~:text=such%20as%20bats.-,Woodlands,include%20oak%2C%20ash%20and%20beech.&text=Deciduous%20trees%20typically%20have%20fertile,trees%20are%20grown%20for%20timber.
https://cdn.forestresearch.gov.uk/1991/03/fcop028.pdf
https://www.woodlandtrust.org.uk/media/49219/ancient-woodland-restoration-maximising-ecological-integrity.pdf
https://www.forestresearch.gov.uk/tools-and-resources/fthr/biomass-energy-resources/fuel/woodfuel-production-and-supply/woodfuel-production/forestry-for-woodfuel-and-timber/woodland-health/
https://study.com/skill/practice/evaluating-the-effects-of-human-activity-on-the-environment-biodiversity-questions.html
https://urban-water.co.uk/floodplain-importance-in-building-resilience/
https://www.cam.ac.uk/research/news/experts-predict-catastrophic-ecosystem-collapse-of-uk-forests-within-the-next-50-years-if-action-not
https://academic.oup.com/forestry/article/97/3/349/7328865?login=false
https://research.fs.usda.gov/treesearch/45635
https://rfs.org.uk/news-list/helping-woodlands-survive-storms/#:~:text=Forest%20Research%20assessments%20show%20that,in%20and%20around%20Kielder%20Forest.
https://from.ncl.ac.uk/the-impact-of-storms-and-saving-the-oak-treescape