

Woodlands for climate and nature: a review of woodland planting and management approaches in the UK for climate change mitigation and biodiversity conservation

The RSPB commissioned an [evidence review](#) to help us consider how woodland expansion can deliver the greatest benefits for both climate and nature. Much of the existing science examines either climate or biodiversity aspects, but not both. We identified a need to examine the two aspects together to inform how woodland expansion can address both the climate and environment emergencies.

Key conclusions

- The report presents challenges for assumptions about a rotational forestry model for carbon sequestration and storage. We conclude that a greater focus could be placed on nature-based solutions to climate change, including native woodlands and priority open habitats such as peatlands, to store carbon whilst also helping to address the parallel ecological crisis.
- A diversity of woodland creation and habitat restoration will be required to meet both climate and biodiversity goals. Going beyond the UK Forestry Standard (UKFS) minimum provisions for biodiversity will be required in most cases. Grant schemes must be weighted appropriately to make native woodland creation and management an attractive prospect
- Soil type and existing land use has a significant influence on the carbon balance and biodiversity impacts of woodland creation, with the greatest climate and biodiversity benefits stemming from woodland creation on arable and improved grassland. Woodland planting on deep peat should be avoided, and previously afforested blanket bog should be restored to maximise the long-term security of the stored carbon. The climate and biodiversity impacts of planting on shallow peat will be site specific. Where shallow peat is adjacent to deep peat, planting can lead to carbon losses due to changes in the hydrological function of peatlands.
- Peatland protection and restoration should continue alongside woodland expansion, as a long-term carbon store and biodiversity rich habitat. This should be supported through strategic land use planning and a co-ordinated programme of further research, plus a policy framework which supports protection and restoration of carbon-rich habitats at the project-level.
- The report suggests fully accounting for the carbon life-cycle for significant woodland creation projects and within offsetting systems.
- Native woodland and other nature-based solutions to climate change potentially offer a more certain route to long-term carbon storage, which is less reliant on technological progress (e.g., carbon capture and storage) and structural changes in the forestry industry (e.g. toward more use of high-quality timber in construction and other long lived wood products).
- The short-lived nature of some Harvested Wood Products (HWP) has implications for carbon storage. This report suggests that over half of HWP have a service life of less than 15 years. This suggests that a large part of the timber from UK forests is not functioning as a meaningful carbon store within timeframes relevant to current climate change targets.

Introduction

It is essential that any future woodland expansion maximises benefits for nature, people and climate in order to tackle the climate and ecological emergency. This report looked at the evidence for the climate and biodiversity impacts of woodland creation across mineral soils, deep and shallow peats. It also considered different models of forestry and the fate of harvested wood products. This briefing summarises these findings and identifies a range of implications for public policy.

Leaf litter can build soil carbon in mineral soils. Beech wood, Hertfordshire



Mineral soils

- Fast-growing conifers offer higher rates of carbon draw down, but after felling, their carbon storage potential depends on the fate of harvested wood products.
- Slow-growing broadleaved trees under low intensity management can offer greater biodiversity value, and over a longer timeframe, greater carbon storage capacity and permanence than non-native tree species.
- Balancing production with environmental enhancement will involve trade-offs to deliver the type of woodland required to support the recovery of a range of rare and declining wildlife.
- Ancient and semi natural woodland should be protected. For biodiversity, native broadleaf trees should be favoured for new plantations, with management that supports wildlife.
- Woodland expansion on arable land and improved pasture can offer the greatest potential for carbon and biodiversity gains. Semi-natural grasslands can be more sensitive to biodiversity losses and offer less pronounced carbon gains.

Deep peat

- Woodland expansion on deep peat should be avoided as this is likely to have a negative impact on peatland biodiversity and soil carbon stores.
- Restoration of afforested peatland benefits biodiversity. Substantial ecological recovery is possible within 10-20 years, with potential for restored peatlands to become a carbon sink in this timeframe.
- Carbon losses can result in the case of peatland converted to woodland. Short-term gains from restocking on peatlands through tree growth may come at the expense of much larger losses over the long-term.
- Restored peatland represents a more secure carbon store than timber products. Peatland forestry is less likely to produce long-lived harvested wood products due to poorer quality timber. There is a need to consider the overall balance of afforestation and restocking in assessments of overall climate impact.
- More research is needed into both the greenhouse gas balance of peatland restoration in the near and long-term, and the hydrological impacts of forestry next to deep peat.
- The report concludes that a precautionary approach is needed, favouring protection and restoration of peatlands to address the possibility of damage to peat which outweighs carbon sequestration through tree growth.



Conifer plantation on deep peat, RSPB Forsinard. Credit Norman Russell (rspb-images.com)

Deep peat (red) and shallow peat (green) soils across the UK
Taken from the IUCN [UK Peatland Strategy](#)



Shallow peat

- What constitutes shallow peat is poorly defined. The IUCN UK Peatland Programme simply refers to a matrix of peat soils, whereas others suggest that it refers to peat soils between 30-50cm.
- The evidence base for the impacts of forestry on carbon in shallow peat soils is inconclusive.
- Shallow peat soils can lose carbon during site preparation, establishment and harvesting and can also be situated in a mosaic with deep peat, which can be negatively affected by adjacent planting.
- Where emissions associated with woodland creation can be minimised, soil carbon can recover to pre-forestation levels during the first rotation. The shallow peat resource is likely to be more vulnerable than deep peat in terms of the losses it can sustain.
- Biodiversity impacts of planting on shallow peat depend on a variety of factors and are likely to be site specific.
- Net effects are likely to be highly variable and a broad definition of 'shallow peat soils' may not be appropriate as a basis for applying general models, warranting a site-specific approach.
- The prevalence of shallow peats in areas identified as targets for woodland expansion means that urgent research is needed if new woodland is to have genuine benefits for climate change mitigation.

Nature-based forestry

- Native woodland creation offers greater benefits for biodiversity than non-native plantation forestry, and should be sited near to existing semi-natural woodland. As a route to woodland expansion, natural regeneration offers biodiversity benefits for some species. Carbon implications will depend on the pre-existing land uses.
- Biodiversity benefits of woodland management are dependent on the type of management and species objectives. Rare and declining species can benefit from a site-specific approach to management.
- Resuming harvesting in unmanaged woodland will result in an initial decrease in carbon stocks, but longer-term stocks can recover.
- Old-growth (ancient and semi-natural) woodland should be protected and maintained.
- Managing forests for biodiversity may generate more synergies with maximising long-term carbon storage whilst more trade-offs with maximising the rate of carbon draw-down. An exception is management to open up the canopy for biodiversity, e.g. coppicing, which can increase habitat variation, but reduce carbon stocks.
- Commercial plantations should be managed for greater species and structural diversity, with provision of undisturbed habitats and deadwood, to benefit biodiversity and to improve forest resilience.
- Replacing mono-culture stands to native broadleaves (e.g. restoration of plantations on ancient woodland sites) offers benefits to biodiversity. Short-term carbon losses will result but will be balanced by long-term gains.



Species and structural diversity in commercial plantations can improve outcomes for biodiversity. Credit: Kelly Thomas (rsfb-images.com)

Uses of harvested UK wood in 2018 (green tonnes)	Estimates of lifespan of HWP
Sawmills <i>Overall proportion of UK wood: 56%</i> Softwood 6 426 000 Hardwood 67 000 Of which*: 33% used in construction 36% used for fencing 24% used for packaging & pallets 7% used for other markets	Half-life of 30 – 50 yrs Service life of 35 yrs Half-life of 70 – 100 yrs Service life of 15 yrs Half-life of 6 yrs Variable
Wood-based panels <i>Overall proportion of UK wood: 11%</i> Softwood 1 210 000 Hardwood 1000	Service life of 25 yrs for particleboard
Fencing <i>Overall proportion of UK wood: 2%</i> Softwood 273 000 Hardwood 0	Service life of 15 yrs
Pulp mills <i>Overall proportion of UK wood: 4%</i> Softwood 486 000 Hardwood 67 000	1-2 yrs 2 yrs
Woodfuel <i>Overall proportion of UK wood: 23%</i> Softwood 1 900 000 Hardwood 700 000	Zero
Other uses <i>Overall proportion of UK wood: 2%</i> Softwood 174 000 Hardwood 66 000	Variable
Exported <i>Overall proportion of UK wood: 2%</i> Softwood 264 000 Hardwood 0	Variable

Harvested Wood Products (HWP)

- The fate of harvested wood is an important aspect of the greenhouse gas balance of the overall forestry system.
- Harvested wood products are a small carbon store compared to the forest carbon stock.
- Burning wood for energy releases carbon to the atmosphere. Forest-based bioenergy is not carbon neutral because the payback time until the carbon is reabsorbed can be very long.
- Increasing the proportion of wood used in long-lived applications has the potential to be more effective than use for bioenergy, but there are many challenges to shifting current production and usage patterns and to avoiding changes to UK wood production which create additional pressures overseas.
- To gain an accurate picture of the carbon implications of harvesting forests, harvested wood products and bioenergy life-cycle carbon analysis needs to be integrated with forest carbon balance analysis.
- HWP from UK forests currently have a highly variable service life, with ~60% going into short-lived uses of 15 years or less. Although fast growing coniferous forestry has the potential to rapidly draw down carbon, at present much of this will be rapidly lost to the atmosphere after processing.

Implications for public policy

The report has a range of implications for public policy if future woodland expansion is to deliver genuine climate change benefits, and corresponding benefits for biodiversity:

1. Well-implemented EIA processes will be necessary to ensure that new projects are sited, designed and managed to have overall positive impacts for biodiversity and climate.
2. Achieving net zero emissions and keeping the carbon locked away will require a balance between rapid draw-down and long-term storage. More emphasis should be placed on increasing habitat-based carbon stores.
3. Publicly owned and funded commercial woodland should deliver an exemplar approach to biodiversity enhancement, including within plans for climate change mitigation.
4. Biomass use can result in a high-level of carbon emissions. There is a need for a robust and integrated system of carbon accounting and life-cycle analysis for forestry and harvested wood products, including within offsetting systems such as the Woodland Carbon Code.
5. Protection and restoration of peatlands must continue to be supported through further research into the climate impacts of peatland restoration, as part of a strategic programme of restoration.
6. A review of woodland creation and management incentives, including tax incentives, will be required to identify how new, higher woodland creation targets can be achieved in a way that delivers biodiverse woodlands and public goods in return for public money. Delivering beyond UKFS minimum requirements will be needed to achieve multi-functional woodlands and forests.
7. Biodiversity and climate enhancements through woodland expansion will require a strategic approach, including accurate mapping of existing priority habitats and other land use data.