Policy briefing note - For the attention of:
UK Government and the devolved nations

woodknowledge WALES

FOREST POLICY BRIEFING NOTE

Newly planted commercial forest can achieve 269% greater climate change mitigation than semi-natural alternatives

Prepared by:
Gary Newman (Woodknowledge Wales);
John Healey, Eilidh Forster and Dave Styles (Bangor University)
Caren Dymond (Government of British Columbia)

Prepared on:
22nd June 2021

Expanding commercial conifer forestry is the most efficient strategy for achieving climate change mitigation through woodland creation, according to a new study published in *Nature Communications.*

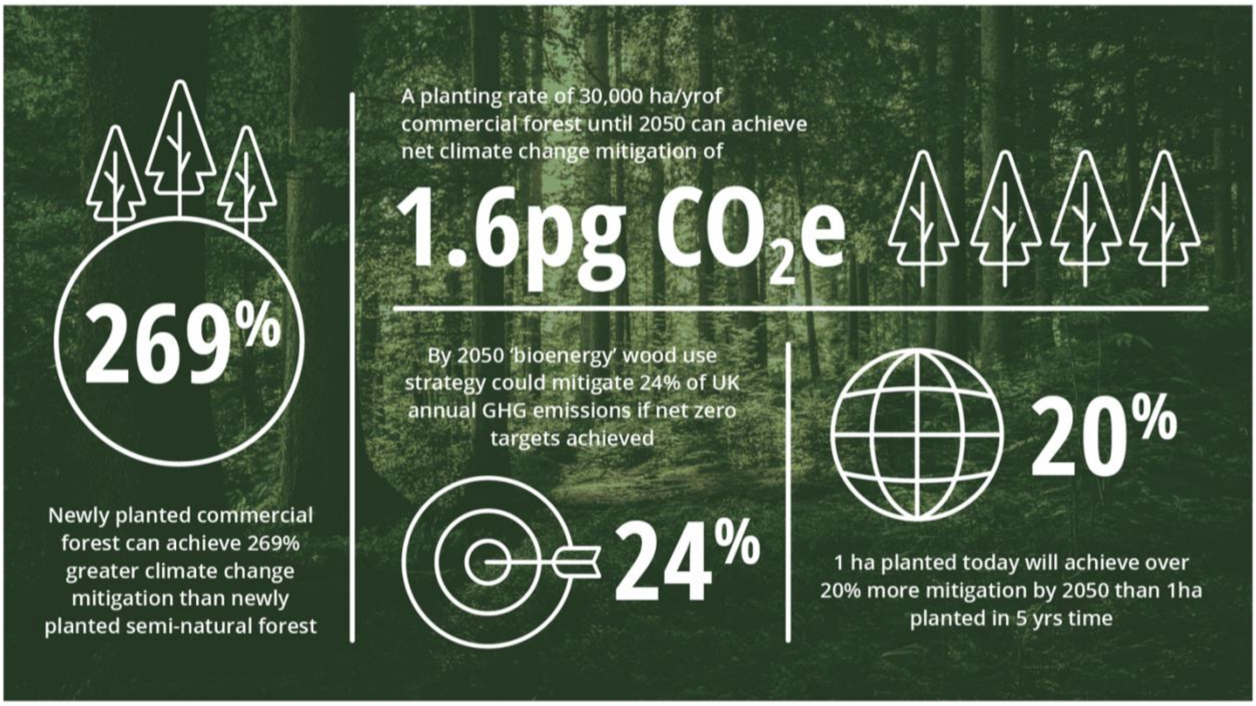
The ground-breaking research led by Bangor University, applied dynamic life cycle assessment to the UK's national planting strategy of 30,000 ha yr^{-1} from 2020-2050. A total of 33 different future scenarios were modelled.

An essential feature of the research, which is one of the first and most rigorous studies of its kind worldwide, is the inclusion of the carbon flows in the whole system: soil, trees, forestry operations and harvested wood product value chain.

This research contradicts existing opinion that decarbonisation is best served by planting native broadleaves or re-wilding.

Key findings

- Climate change mitigation from harvested stands surpasses unharvested stands 100 years after planting.
- Newly planted commercial forest can achieve 269% greater climate change mitigation than semi-natural alternatives
- A planting rate of 30,000 ha/yr of commercial forest until 2050 can achieve net climate change mitigation of 1.6 $PgCO_2e$ over 100 years



The research does not advocate one type of forest only. It merely concludes that where climate change mitigation is the main policy goal this is best delivered through a commercial conifer planting regime.

POLICY IMPLICATIONS

FINANCING DECARBONISATION

Commercial investment for the expansion of production forestry is compatible with achieving climate change mitigation targets. This research further supports the need for policies that encourage new models for private investment into forestry.

FINANCING FOREST CREATION

Policies, strategies and public grants that favour conservation forestry over commercial conifer forestry on the grounds of climate change mitigation are misguided.
Where policies, strategies and public grants favouring woodland creation are designed to meet both climate change mitigation and biodiversity conservation objectives (as well as delivery of other public benefits) they should promote a mixed portfolio of commercial conifer and conservation broadleaved woodlands, rather than just the latter.

GREENHOUSE GAS REMOVAL (GGR) SOLUTIONS

Afforestation and increasing wood in construction are two key GGR methods identified by UKCCC. This research demonstrates that these two GGR methods are synergistic thereby helping to reduce costs and increase the deployment potential.

URGENCY OF COMMERCIAL CONIFER WOODLAND CREATION

The research demonstrates that the benefits of commercial forestry for climate change mitigation are robust across a range of scenarios for future decarbonisation of the economy. It also demonstrates the crucial importance of tree growth rates, and thus the benefits of rapid acceleration of the rate of woodland creation to achieve early sequestration of substantial carbon stocks.

IMPORTANCE OF AN EFFICIENT HIERARCHICAL WOOD PRODUCTS VALUE CHAIN

The contribution of woodland creation to climate change mitigation will be maximised if the harvested wood is utilized in long-life span structural materials, with the added benefit of avoiding carbon emissions by substituting construction materials with a large carbon footprint. This would represent a major departure from the current dominant practice in the UK building industry and in the typical breakout of products from wood harvested in the UK. Major incentivisation and investment needs to be enacted as a matter of urgency to create this technological transformation so that it is in place in time for the wood harvest from an expanded area of new commercial woodlands.

Prioritising wood products with long service lives also ‘buys time’, delaying final use for bioenergy until carbon capture and storage (BECCS) technology is widely deployed, and leading to the carbon being locked up indefinitely.

AFFORESTATION FOR CLIMATE CHANGE MITIGATION

Rapid reduction and offsetting of carbon (i.e. carbon dioxide equivalent, CO_2e) emissions is urgently needed if we are to stop climate change. Expansion of sustainable forestry is widely seen as a key carbon offsetting strategy, as well as providing a source of renewable material that can reduce our dependency on fossil fuels. However, little is known about the comparative climate change mitigation potential of different types of sustainable forest systems. Fast growing commercial forests managed for wood production have been unfavourably compared[1] to restoration of natural forest in tropical regions but these conclusions are not transferable to a temperate context.

We conducted a study[2] comparing 33 different 'what-if' scenarios for UK afforestation and wood-use, varying conifer-broadleaf composition, the decision to harvest, and different wood product mixes. These represent current land use choices relating to three key forest management objectives: biodiversity conservation, carbon sequestration and sustained timber yield. We made some ground-breaking and potentially controversial findings. Our results show that newly planted commercial conifer systems are substantially superior at mitigating climate change than newly planted semi-natural broadleaf systems – mitigating up to 269% more CO_2e per hectare over 100 yrs. A national planting rate of 30,000 ha yr^{-1} from 2020 to 2050 could cumulatively mitigate up to 1.64 Pg CO_2e emissions by 2120 if met with commercial conifer forest, compared with just 0.54 Pg CO_2e for semi-natural broadleaf forest.

These findings provide important new evidence that supports prioritisation of conifers and hierarchical wood use to optimise the success of afforestation as a climate change mitigation strategy. This new insight comes at a critical juncture in land-use policy-making and could significantly boost the contribution of forestry and wood towards meeting net zero carbon targets.

Sustainable forestry

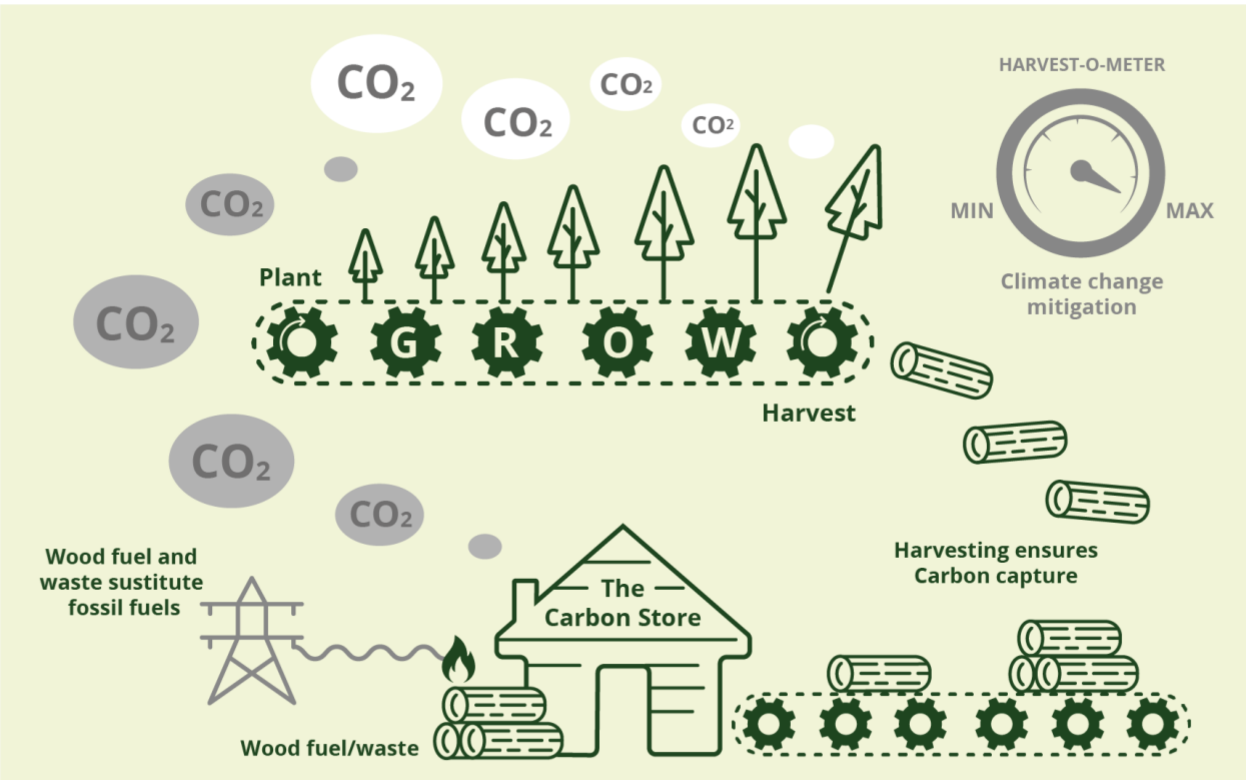
Sustainable forestry often implies the blended delivery of a suite of ecosystem services, including habitat provisioning, nutrient cycling, carbon sequestration and timber yield. In practice, though, forests are normally managed to prioritise one or two of these services, which generally reduces the provision of the others. Broadleaf forests of native species in the UK can support high biodiversity but achieve low carbon sequestration rates and timber yields in the kind of infertile upland sites of low value for agriculture, which is the land most economically available for woodland creation. In contrast, for these kinds of sites, whilst conifer-rich commercial forests may support lower (not necessarily low) levels of biodiversity, they can achieve much higher carbon sequestration rates and timber yield. There is no 'one forest type fits all' and the best solution for delivering the range of ecosystem services that society needs is likely a portfolio of different forest types across the landscape.

Carbon

Forests sequester CO_2 from the atmosphere through photosynthesis – offsetting GHG emissions. Different trees grow and sequester carbon at different rates. Unharvested forest systems build up a carbon stock that then plateaus as the forest reaches maturity. Harvesting and wood use alter this balance. Harvesting reduces carbon storage in the forest (due to losses from soil disturbance, decay of brash and wood removal) but can lead to carbon storage in harvested wood products. In addition, it can reduce emissions by using wood as a substitute for materials whose manufacture generates a high rate of carbon emissions, and for fossil fuels. The carbon dynamics of forestry value chains are complex and highly context specific and hence require careful assessment.

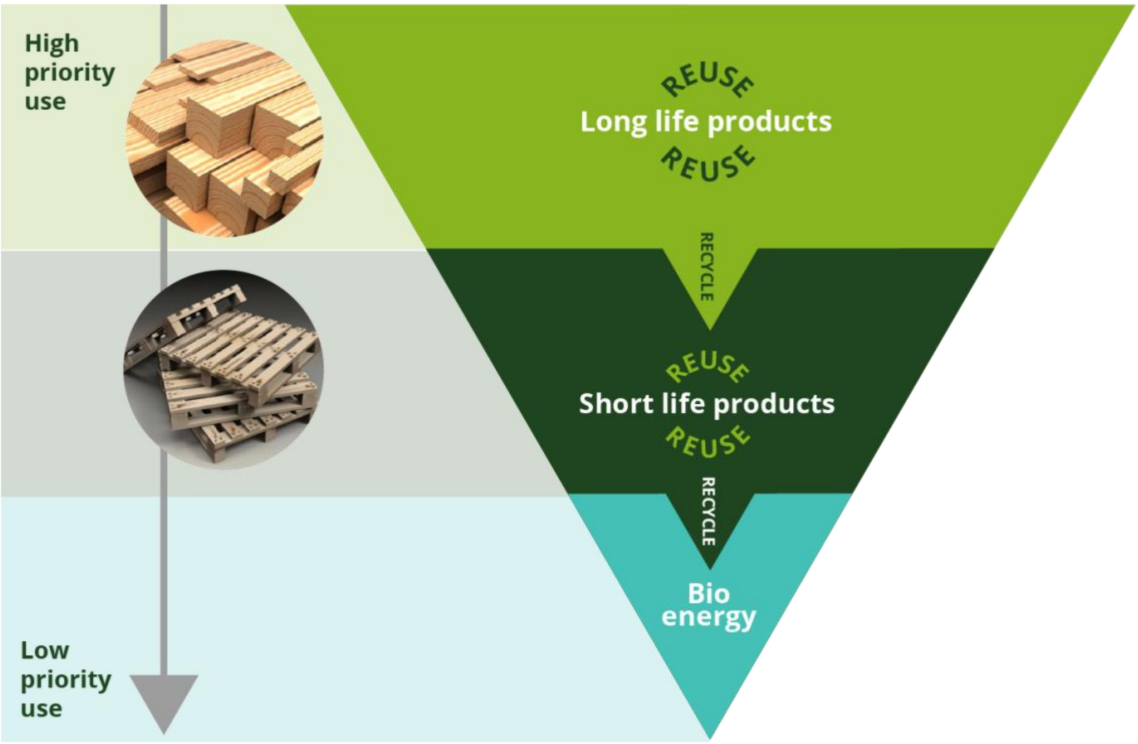
Life cycle assessment

Life-cycle assessment is the most rigorous method for determining the true impact of different land use and product options on storing carbon and therefore reducing climate change. The principle of life-cycle assessment is to consider the direct and indirect impacts of a product or system through its entire life. We calculated the net carbon (carbon dioxide equivalent, CO_2e) emissions, known as Global Warming Potential impact, for the establishment, management and growth of a forest, and for the carbon emissions from the processing, use and disposal of harvested wood. We also calculated the carbon emissions ***avoided*** due to using the wood as a substitute for mineral-based construction products (i.e. concrete and steel) and fossil fuels.



Hierarchical wood use

Hierarchical use of wood is important because it leads to carbon being locked-up out of the atmosphere for longer. Wood is subject to a cascade of uses, and as each product reaches the end of its use the material is put to another use in a prioritised order: durable wood product manufacturing, re-use, recycling, bioenergy generation, and disposal. In our study, we considered two key wood use strategies, one prioritising *hierarchical* use and one with emphasis on *bioenergy* production (65% of primary wood harvest is used for bioenergy). Uniquely, we also accounted for the effects of industrial decarbonisation over the 100-year study period (i.e. staged deployment of carbon capture and storage technology, CCS, according to UK Committee on Climate Change projections[3]).



Mitigation potential

Our paper[2] reveals that species choice is the overriding factor impacting the climate change mitigation potential of afforestation through the proposed national woodland creation strategy, regardless of whether harvesting is carried out. Unsurprisingly, unharvested conifer systems outperform unharvested broadleaves, due to faster growth and hence faster carbon sequestration rates. However, we also found that, in the long term, commercially harvested conifer systems outperform unharvested conifer systems. This suggests that there are net benefits to harvesting and using wood. Hierarchical wood use is important to maximise this benefit, and to ensure efficient and sustainable use of this natural resource. From a carbon perspective, harvesting was found to enhance mitigation in both the hierarchical and bioenergy wood use scenarios. This result was independent of the rate of decarbonisation of the wider economy.

Furthermore, our results suggest that, beyond the 100-year time frame considered in this study, harvested conifer systems will achieve increasingly greater mitigation than the non-harvested conifer systems. This is based on the assumption that the UK achieves a national planting rate of 30,000 ha yr-1 from 2020 to 2050 with trees harvested and processed in a hierarchical wood use scenario storing carbon in the built environment (~140 Tg of wood dry matter at the end of the studied time horizon) as well as biomass and cascaded products reaching their final use entering the growing BECCS (bioenergy with carbon capture and storage) pool and hence no longer being released back into the atmosphere at their end of life.

The urgency of woodland creation becomes highly evident, as our results show that less than 15% of the 100 year mitigation potential will be achieved by 2050, a key date for net zero carbon targets. A forest planted today will achieve 20% more mitigation by 2050 than one planted in 5 years' time. Decisions relating to harvesting strategy must not delay planting since managers can make these in response to market conditions nearer the time of potential harvesting.

Climate and biodiversity

The findings of this study do not intend to undermine the importance of the biodiversity and other ecosystem services delivered by different woodland types and management regimes, nor do they imply that climate change mitigation is always the most important service. However, they do clearly demonstrate that, when climate change mitigation is the primary objective, commercial conifer systems with hierarchical wood use can offer the greatest mitigation potential.

As pointed out previously: There is no 'one forest type fits all'. In order to deliver the range of ecosystem services that our global societies and planet need to thrive, we have to invest into a portfolio of different forest types across the landscape.

References

1. Lewis, S. L., Wheeler, C. E., Mitchard, E. T. A. & Koch, A. Restoring natural forests is the best way to remove atmospheric carbon. Nature 568, 25–28 (2019).
2. Forster, E. J., Healey, J. R., Dymond, C. & Styles, D. Commercial afforestation can deliver effective climate change mitigation under multiple decarbonisation pathways. Nature Communications. DOI 10.1038/s41467-021-24084-x (2021).
3. UK CCC. Net Zero: The UK's contribution to stopping global warming. https://www.theccc.org.uk/wp-content/uploads/2019/05/Net-Zero-The-UKs-contribution-to-stopping-global-warming.pdf (2019).