Informing a carbon-based tree planting strategy for the White Rose Forest

An introduction to the main report and technical appendix

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White Rose Forest

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The contribution of tree planting to net zero

The UK is committed to reaching net-zero greenhouse gas emissions by 2050[1]. Achieving this target requires both a substantial reduction in emissions as well as a means of removing carbon dioxide (CO_2) from the atmosphere to balance any remaining emissions (see Figure 1). Currently, planting trees and creating woodlands is the most effective method we have to take carbon from the air.

The White Rose Forest (WRF) community forest commissioned the UBoC team at the University of Leeds to scientifically assess how much CO_2 could be removed from the atmosphere through tree planting across the WRF region. The resulting report, "Informing a carbon-based tree planting strategy for the White Rose Forest", lays out the potential carbon sequestration achieved by different levels of afforestation using indicative woodland mixtures across the thirteen local authorities in the WRF region.

The study demonstrates that new woodland creation of at least 2,800 hectares per year across the WRF region is likely to be required to sequester up to half of the region's remaining CO_2 emissions in 2050. The report includes a series of tables that are designed to give local authority planners a reasonable estimation of how much carbon can be accumulated through woodland creation over the next 30 years.

The report also highlights, for the first time, the important role played by the trees outside woodlands that occupy around 40% of the region's total canopy cover. These trees are estimated to collectively store the equivalent of over 10 megatonnes of CO_2 and take up around 360 kilotonnes CO_2 per year. The main report and two appendices which detail the methods used are available via the UBoC website, or via the WRF partnership on request.

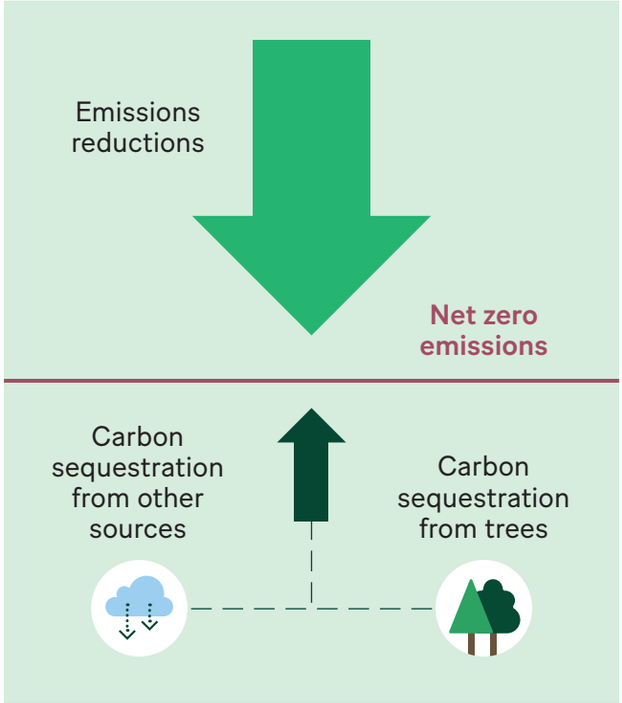

Figure 1: The UK Climate Change Committee estimate that greenhouse gas emissions could be reduced by 79–89% by 2050. To reach net zero the remaining 11–21% must be sequestered from the atmosphere. The proposed planting as part of the WRF plan could lead to up to 50% of the remaining CO_2 being sequestered in 2050.

[1]Net Zero Strategy: Build Back Greener, 2021, UK Government: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1028157/net-zero-strategy.pdf

How the numbers are calculated

We estimated likely future tree growth rates using Forest Research's Ecological Site Classification (ESC) tool[2]. The growth rates for four woodland mixtures were combined with the Forestry Commission's Woodland Carbon Code calculator[3] to determine potential CO_2 capture over time. The results of this calculation can then be scaled up to different planting areas, depending on the scenario. Our approach tells us the amount of CO_2 sequestered up to a given point in time, and at variable levels of planting.

For context, the amount of carbon sequestered annually in each scenario is compared against the emissions that are likely to remain depending on our progress towards decarbonisation. Two sets of projections form the basis for the future emissions scenarios. Firstly, the Emissions Reduction Pathways reports from the West Yorkshire Combined Authority[4] and the York and North Yorkshire Local Enterprise Partnership[5] provide a framework for reducing emissions to 2038. Secondly, the Sixth Annual Carbon Budget of the UK Climate Change Committee[6] indicates that emissions could be reduced to between 11–21% of 2018 levels by 2050.

The model can also be used to examine specific planting scenarios. "Planting for Our Future: White Rose Forest Action Plan 2021–2025" outlines a proposal to increase forest cover across the WRF region from 11% to 19% by 2050, an addition of 80,595 hectares of trees. Achieving this level of woodland creation could sequester up to half (52%) of the residual emissions in 2050, assuming that the emissions reduction pathways are followed (see Table 1).

Reaching net zero will require both a reduction in carbon released into the atmosphere and an increase in carbon absorbed, primarily through land use changes. Planting new trees and forests will be particularly important as it is the most reliable way to sequester carbon and provides a host of other benefits including habitat creation, flood risk reduction and positive impacts on our physical and mental well-being[7].

Being able to sequester half of the potential residual emissions in 2050 through the WRF Action Plan represents a significant contribution to the net-zero aspirations of the local authorities in the WRF region, and is in line with national and global efforts to limit warming to below 1.5°C.

[2]Forest Research Ecological Site Classification: http://www.forestdss.org.uk/geoforestdss/esc4.jsp

[3]Woodland Carbon Code: https://www.woodlandcarboncode.org.uk

[4]Tackling the Climate Emergency: Emissions Reduction Pathway Report, 2020, West Yorkshire Combined Authority: https://www.westyorks-ca.gov.uk/media/4268/emission-reduction-pathways-report.pdf

[5]North and West Yorkshire Emissions Reduction Pathways, 2021, York and North Yorkshire LEP: https://www.ynylep.com/Portals/0/adam/Stories/dZPBWh5Fz0mcAqqNaH1neA/Body/Y&NY%20carbon%20abatement%20pathways%20report%20-%20Element%20Energy.pdf

[6]Sixth Annual Carbon Budget, 2020, Climate Change Committee: https://www.theccc.org.uk/publication/sixth-carbon-budget/

[7]'A Brief Guide to the Benefits of Green Spaces', 2015, University of Leeds & United Bank of Carbon: https://leaf.leeds.ac.uk/green-space/

		2050		
Area of new WRF woodland by 2050 under modelled scenario (ha)	Implied annual planting rate (ha)	Total carbon sequestered (kt CO_2)	Annual carbon sequestration rate (kt CO_2 per year)	% of residual emissions in planting area sequestered annually*
80595	2779	5149 – 9775	559 – 931	16 – 52

Table 1: Projected carbon sequestration in 2050 under an example planting scenario. *Residual emissions scenario for 2050 assumes emissions reduction to 11–21% relative to 2018 based on the Sixth Annual Carbon Budget of the UK Climate Change Committee. Please see tables 4–9 in "Informing a carbon-based tree planting strategy for the White Rose Forest" for estimates of sequestration by local authority under different planting scenarios, and for a full explanation of the assumptions about emissions reductions.

Who are UBoC?

The United Bank of Carbon is a registered environmental charity based at the University of Leeds. UBoC is focused on protecting, planting, and restoring trees and forests both in the UK and across the world. UBoC develops methodologies to better understand the dynamic relationships between trees, natural and urban environments, and people. UBoC also provides a robust scientific underpinning for policy makers, to ensure that our research has real world impact that benefits both the planet and people.

The report and technical appendices are available via the UBoC website: *www.uboc.co.uk/white-rose-forest-action-plan*

Please contact us with queries about this work or to discuss how our model could help estimate carbon sequestration in your local authority or project.

For more information about the White Rose Forest and to read the White Rose Forest Action Plan 2021–25 visit: *www.whiteroseforest.org*

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