

Mapping potential areas for woodland creation in the UK.

Tom Bradfer-Lawrence^{1,2}, Tom Finch², Richard B. Bradbury^{3,4}, Graeme M. Buchanan², Andrew Midgley², Rob H. Field³

1. Biological & Environmental Sciences, University of Stirling, Stirling, FK9 4LA
2. Centre for Conservation Science, RSPB Scotland, 2 Lochside View, Edinburgh Park, Edinburgh, EH12 9DH, UK
3. Centre for Conservation Science, RSPB, The Lodge, Sandy, Bedfordshire, SG19 2DL, UK
4. Conservation Science Group, The David Attenborough Building, Pembroke Street, Cambridge, CB2 3QZ, UK

We undertook a mapping exercise to identify potentially suitable areas for woodland creation, to assess the feasibility of national woodland creation targets (full methods in SI). Areas considered unavailable for woodland creation included higher quality agriculture land and existing woodland (the modification of which could reduce agricultural or timber production, leading to offshoring of emissions), designated sites, priority habitats and peatlands (to avoid perverse outcomes for soil carbon or biodiversity) and existing buildings, infrastructure and archaeological features (Table S3). Some excluded areas were further buffered to limit possible negative spill-over effects of woodland creation, such as on peatland hydrology (FC 2000), or to reduce predation in sites designated for conservation of wading birds (Wilson et al 2014).

The raster layer value shows proportion of ground potentially available for woodland creation in each cell. These are limited to mineral soil types, i.e. areas with a total carbon content in the top 1m of < 100 t ha⁻¹. This information was extracted from the Harmonised World Soils Database (HWSD; FAO 2009) as per Field et al (2020).

We considered a range of landcovers to be either unsuitable or unavailable for potential woodland creation. Details of source layers are shown in Table 1. We sought to use the best national-level datasets available in this mapping exercise, but there are inevitably limitations surrounding comprehensiveness and resolution, particularly in terms of soil types. Agricultural Land Classification mapping for England does not separate grades 3a and 3b (MAFF 1988). We therefore used gradient to separate the two grades, with shallower ground (< 8 degrees) assigned to the higher quality 3a, which we assumed to be unavailable for potential woodland creation. This is a simplification imposed by limited availability of soil data, as some shallower-gradient land is also classed as 3b on the basis of stoniness or moisture (MAFF 1988). Therefore, we have likely underestimated the areas of 3b ground in England.

We excluded all designated sites even though woodland expansion is often a stated management aim for such sites. There is no national dataset with sufficient detail identifying where woodland expansion might be appropriate on designated sites. Nor is there a way to reconcile areas where e.g. SAC designations encourage woodland expansion, but overlapping SPA designations require maintenance of open habitat for wading bird species. While it is possible to design site-level management plans for these multiple, potentially competing, objectives, that information is unavailable at a national scale. We therefore took a precautionary approach and excluded designated sites, which will have led to an underestimate of potentially available ground for woodland expansion.

Table 1. Areas excluded when mapping potential for woodland creation in each of the four UK countries, with spatial layers used and details of pre-processing.

Area excluded	Rationale for exclusion	Pre-processing and buffers	Scotland	Wales	England	Northern Ireland
Higher quality agricultural land	Seek to minimise impacts on agricultural production.	None except pre-processing for England layer.	Land Capability for Agriculture 1 – 3.1 (JHI, 2016)	Agricultural Land Classification grades 1, 2, 3a (Welsh government, 2020; Natural England 2020a; Jordan & Higgins 2009). In England, Grade 3 was subdivided on the basis of gradient into 3a (< 8 degrees) and 3b (MAFF 1988).		
Designated sites ^a	To avoid impacts on open habitat species, with buffers to minimise potential spill-over effects. Where woodlands were included	300 m (Forestry Commission 2019), except where SPAs are designated for wading bird species, where	SPAs, SACs, NNRs and SSSIs (Scottish Natural Heritage 2020; Natural England 2020b; Natural Resources Wales 2020)		SPAs, SACs, NNRs and ASSIs (Northern Ireland)	

	in the designated sites, these were allowed to expand into the buffer zone.	700m (Wilson et al 2014).				Environment Agency 2019).
Non-designated peatlands	Prevent excessive impacts on hydrology and soil carbon.	100 m (Forestry Commission 2000)	Classes 1 and 2 from Carbon and Peatland map (SNH 2019), NFE soil (Forestry Commission 2020). BGS superficial geology (BGS 2020).	Phase 1 habitat survey (NRW 2020), Lowland Peatland survey phase 2 (NRW 2020), NFE soil (Forestry Commission 2020). BGS superficial geology (BGS 2020).	Peat Status Greenhouse Gas and Carbon Storage (Natural England 2019), NFE soil (Forestry Commission 2020). BGS superficial geology (BGS 2020).	Peat polygons from the AFBI soil series map (Jordan & Higgins 2009). Northern Ireland Peatland Survey (Cruickshank & Tomlinson 1988).

Priority Habitats	Prevent damage to open semi-natural habitats with high conservation value, such as heathlands and semi-natural grasslands.	50 m, following the SSSI impact risk zones used in England (Natural England 2019).	Subset from the Habitat Map of Scotland (SNH 2017).	Glastir Woodland Creation Sensitivity Layer - Priority Habitats (Welsh Government 2014).	Priority Habitat Inventory (Natural England 2020c), Excluding polygons of "good quality semi-improved grassland" and "No main habitat but additional habitats present"	Heathland, grassland and fen habitats (Northern Ireland Environment Agency 2019).
Existing woodlands	No need to buffer	None	National Forest Inventory (Forestry Commission 2018), excluding polygons of "Non Woodland"		Combination of Woodland priority habitats layer (Northern	

				<p>Ireland Environment Agency 2019), Northern Ireland Woodland Basemap (Northern Ireland Forest Service 2015, and OSNI data (OSNI 2020).</p>
<p>High elevations, LCA class 7 in Scotland, and other areas where predicted yield class was too low for the</p>	<p>To exclude areas unlikely to support trees.</p>	<p>Elevational limits defined according to the maximum elevation (OS 2019) of existing woodland (as defined above) within each 100</p>	<p>Derived from the existing woodlands layers above.</p> <p>Polygons potentially available for woodland creation but with predicted yield classes too low for the WCC to provide sequestration values were excluded from the modelling prior to prioritisation.</p>	

WCC to provide sequestration values.		km ² of the British National Grid, all areas above this limit were excluded. No buffer was included.		
Scheduled monuments	Excluded heritage sites to avoid impacts to buildings and buried archaeology.	20 m, as per the UK Forestry Standard (Forestry Commission 2017)	Scheduled monuments, battlefields, and World Heritage Sites except the cultural World Heritage Site of the Lake District (Historic Scotland 2020, Historic England 2020; Welsh Historic Environment Service 2016; Historic Environment Northern Ireland 2020).	
Transport infrastructure	Infrastructure footprint further buffered to maintain safety.	Between 2 and 12 m depending on the size of the road / rail (Highways England 2020; Fearnley 2015)	Roads and railways extracted from OS data (OS 2019).	Roads and railways extracted from OSNI data (OSNI 2020).
Urban areas and buildings	Smaller urban areas are still present in the	20 m, the UK Forestry Standard for	Buildings extracted from OS data (OS 2019).	Buildings extracted from

	agricultural land layers. Sought to minimise impacts on rural communities.	monuments (Forestry Commission 2017).		OSNI data (OSNI 2020).
Riparian areas	Not excluded from the mapping but considered unavailable for planting with non-native conifers under the UKFS. Broadleaved woodland can be planted in these buffers.	Conifer plantations have a 10 m buffer for small watercourses and 20m for larger watercourses, as per the UK Forestry Standard (Forestry Commission 2017).	Waterways extracted from OS data (OS 2019).	Waterways extracted from OSNI data (OSNI 2020).

Notes: ^a Excluding all designated sites is conservative, as some have woodland expansion as a stated management aim. However, it was not possible to identify the sites where this might be the case, nor resolve potentially competing management aims within the same site, such as woodland expansion and maintenance of open habitats for wading birds.

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