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NATIONAL EXPERT- BASED ASSESSMENTS: UK

THE UK NARRATIVE ON FOREST RESTORATION



SUPERB
Upscaling Forest Restoration



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Table of Contents

Part 1: Narrative	3
Introduction: Historical evolution of forest restoration in the United Kingdom	3
Period 1: <1990	6
Section 1: General overview – how much, when and where	6
Section 2: Conditions prior to the interventions	10
Section 3: Technical aspects of the interventions	13
Section 4: Socioeconomic and political aspects of the interventions	17
Section 5: Results, successes and challenges	21
Period 2: >1990	27
Section 1: General overview – how much, when and where	27
Section 2: Conditions prior to the interventions	31
Section 3: Technical aspects of the interventions	34
Section 4: Socioeconomic and political aspects of the interventions	39
Section 5: Results, successes and challenges	43
Part 2: Summary table	50
Literature cited.....	55
Appendix 1: The principle conservation designations in the UK	67
Appendix 2: Specific measures taken under the UKWAS UK Woodland Assurance Standard (2021)	68

Part 1: Narrative

Introduction: Historical evolution of forest restoration in the United Kingdom

In UK forestry, the emphasis over the last hundred years has been on both a) restoring woodland cover and b) restoring the quality of woodlands; however, to varying degrees of importance throughout this period. At the beginning of the 20th century, forest cover was down to an estimated 4.7% (Forest Research, 2022), which created dangerous dependencies on other countries' timber, especially during World War I (Gambles, 2019). Hence, the national government's focus in the years following World War I was on (re)afforestation to drastically increase timber reserves over the following decades (Mather, 1991). Supported by a series of policies, it embarked on an intensive afforestation programme on both public and private land, which began in 1919 and continued until the 1970s (Raum & Potter, 2015). In response to the 1919 Forestry Act (HMSO, 1919), a new state forest organisation was established in the same year – the Forestry Commission – to lead the afforestation programme. During its early years, the Commission focused on acquiring land throughout the country, which was then planted with mainly non-native conifer saplings, leading to state-run monoculture forest plantations on public land. Private forest owners were given grant aid to encourage afforestation or expansion of existing forests on private land (Mather, 1991).

In the 1950s, the focus shifted from reforestation and forest expansion to the intensification of forest operations and timber production due to increased mechanisation. In addition, older privately owned mixed broadleaved forest stands were increasingly converted to mono-culture conifer forests with the help of government grant aid (Tsouvalis, 2000). By the mid-20th century, most native woodlands had been cleared for human development, commercial forestry or agriculture (Reid et al., 2021). With the exception of a small number of designated woodland sites – primarily the new national nature reserves and Sites of Special Scientific Interest established under the National Parks and Access to the Countryside Act of 1949 (HMSO, 1949) – the intensification of forestry continued until the 1970s. Thereafter, a broader justification for continuous state investment in forestry began to emerge (Slee, 2012). New policy objectives recognised a wider set of non-market public benefits delivered by forests, including landscape amenity, recreation opportunities, wildlife habitat, and, later, carbon sequestration and woody biomass production (Raum & Potter, 2015).

This shift was partially influenced by new European and other international stimuli, especially since the 1990s, and led to a gradual change in forestry policy and management (Raum & Potter, 2015). The creation of the Ancient Woodland Inventory (NCC, 1981), the introduction of the Broadleaved

Policy (Forestry Commission, 1985a), the diversification of plantation forests, a growing interest in forest habitat and species restoration, and the establishment of community forests on urban fringes were typical examples (Raum, 2020). New statutory conservation designations were also set up, and old ones strengthened, for instance, through the Wildlife and Countryside Act 1981 (HMSO, 1981) (amended in 1985), the EU Habitats Directive (EEC, 1992), and the Countryside and Rights of Way Act 2000 (HMSO, 2000). Designations were either for a) nature conservation purposes (e.g., nature reserves; sites of special scientific interest), b) landscape conservation (e.g., areas of outstanding natural beauty) or c) natural heritage conservation purposes (e.g., national parks) (Appendix 1). They provided various degrees of protection to such designated sites and were accompanied by specific conservation and restoration guidelines and action plans. Many such designated sites included woodlands (Bishop et al., 1995).

Towards the end of the 20th century, forestry policy in the UK began to give more prominence to sustainable forest management, supported by dedicated policies (e.g., Sustainable Forestry: The UK Programme (Forestry Commission, 1994a); UK Forestry Standard: The Government's Approach to Sustainable Forestry (Forestry Commission, 1998a)), forest certification schemes (e.g., UKWAS, 1999), and grant aid schemes (e.g., Woodland Grant Scheme Mk III, 1994 (Forestry Commission, 2006)). In recent years, there has been a renewed focus on afforestation, particularly in the Midlands and the north of England, as well as a new interest in creating habitat networks and rewilding degraded landscapes (Raum, 2020). The former was inspired by international climate change-related obligations (namely, carbon sequestration), and the latter two by biodiversity-related regulations (Raum & Potter, 2015). Such restoration activities increasingly involved large-scale programmes, especially in upland areas, and the reintroduction of locally extinct or extirpated species (Campbell-Palmer, 2021; Sandon et al., 2019). There has also been a new initiative on restoring 'the lost temperate rainforests', originally stretching over the western part of the UK from southern England to Wales and Scotland (e.g., Bain, 2015; Shrubsole, 2022). Woodland cover rose to 13.3% of the UK land area by 2022 (Forest Research, 2022) (Table 1 and Figure 1).

Table 1. Woodland area in Britain/UK in hectares over time. Source: Forest Research, 2022.

Year	England		Wales		Scotland		Northern Ireland		UK	
	Area (000 ha)	%	Area (000 ha)	%	Area (000 ha)	%	Area (000 ha)	%	Area (000 ha)	%
1905	681	5.2	88	4.2	351	4.5	15	1.1	1140	4.7

1924	660	5.1	103	5.0	435	5.6	13	1.0	1211	5.0
1947	755	5.8	128	6.2	513	6.6	23	1.7	1419	5.9
1965	886	6.8	201	9.7	656	8.4	42	3.1	1784	7.4
1980	948	7.3	241	11.6	920	11.8	67	4.9	2175	9.0
1998	1097	9.5	287	14.4	1281	16.7	81	6.0	2746	12.0
2022		10.2		15.0		19.1		8.5		13.3

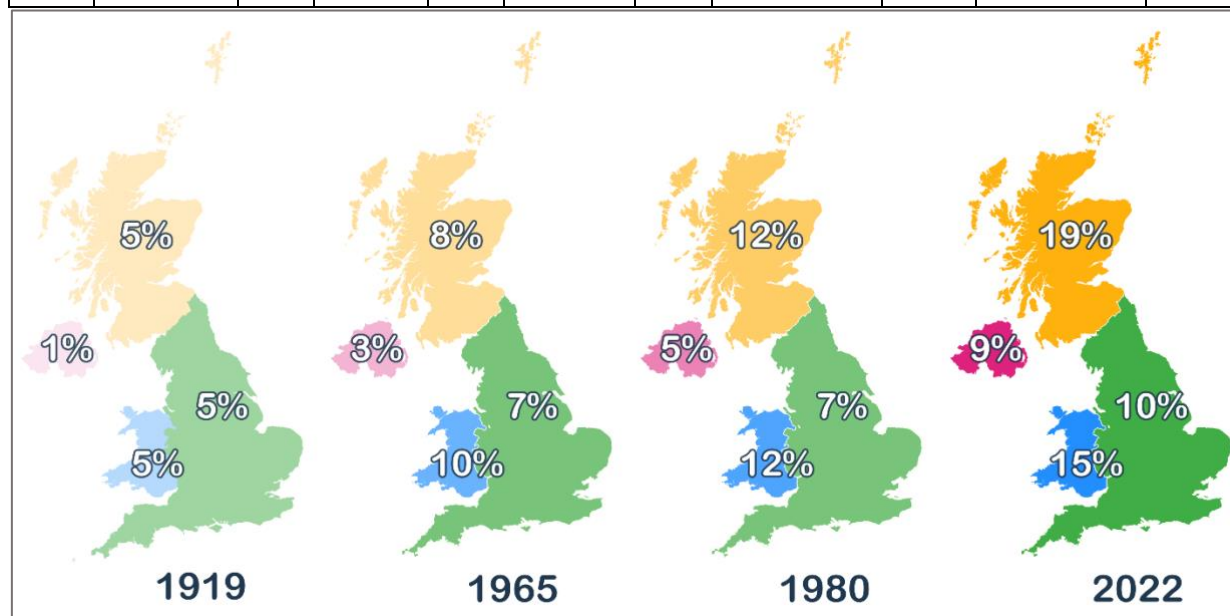


Figure 1. Changes in woodland area in the UK over time. 2019 is the last year for which this type of map is available. Source: adapted from Forest Research, 2022. Green is England, yellow is Scotland, blue is Wales, and red is Northern Ireland.

Although there is a difference in meaning between 'woods', 'woodland', and 'forest', for simplicity, these terms will be used interchangeably in this report. By definition, woodland in UK forestry statistics is land under stands of trees with a canopy cover of at least 20% or the potential to achieve this (including integral open space and felled areas awaiting restocking). There is no minimum size; woodland refers to woods and forests of all sizes. The National Forest Inventory, however, captures woodland only from 0.5 hectares onwards (Forest Research, 2022). Woodland encompasses native and non-native trees, as well as semi-natural and plantation areas (Defra & Forestry Commission, 2005).

It is important to point out that due to the devolution of political administration, which commenced in 1998, it may be challenging to maintain a clear UK focus in this report. In recent years, the articulation of forestry policy has increasingly been delegated to the country level (i.e., England,

Scotland and Wales), making any UK-wide analysis challenging. Also, Northern Ireland has had a unique political status since 1921 (Raum, 2021). Hence, from 2000 onwards, the main emphasis in this report will be on England.

Period 1: <1990

Section 1: General overview – how much, when and where

The period between 1919 and 1990 was dominated by a) restoring forest cover with the ultimate aim of increasing the government's timber supply and, to a far lesser degree, b) restoring the quality of mainly native woodlands.

To address the timber crisis caused by World War I and the already low forest cover before the war, the government's primary focus during much of this period was on state-led reforestation (Gambles, 2019). During the 1920s and 1930s, the newly formed Forestry Commission focused on land purchase, preparation, and planting (Gambles, 2019). The bulk of the afforestation took place on recently acquired land in Scotland, with a lesser extent in England (see Table 2). Most of this land was poor-quality and cheap agricultural land, including lowland heaths, upland heathland and moorland (Rackham, 2006; Foot, 2010). By 1939, the Forestry Commission had acquired 263,046 hectares of land, on which it had planted 230 new forests, covering 149,734 hectares, dispersed throughout the country. It had also become the largest landowner in Britain (Aldhous, 1997). The Commission's landholdings then included many of the often larger, royal forests (hitherto part of the crown estate) and smaller local council woodlands, which had all been placed under its responsibility as part of the 1923 Forestry (Transfer and Woods) Act (HMSO, 1923). Another 50,586 hectares were planted between 1919 and 1939 on private land, with the assistance of government grant aid. Nonetheless, there was merely a slight net increase in the gross woodland area during this period (Aldhous, 1997).

In the 1940s, before any significant recovery from the previous war could have been achieved, the Forestry Commission had to address another timber emergency caused by World War II. The brunt of the loss of standing trees was carried by established, privately owned forests and the former royal forests, such as the Forest of Dean and the New Forest. Most of the newly planted state-owned conifer plantations were still too young to be felled (Foot, 2010). In response to yet another timber crisis, the government enacted a series of Forestry Acts to aid restocking on privately owned land and/or restructuring private woodlands. It also introduced timber felling licenses to halt further

deforestation (HMSO 1943, 1944, 1945, 1947a, b, 1951) (Raum & Potter, 2015). Subsequently, older, privately owned, mixed broadleaved woodland stands were increasingly converted to monoculture conifer forests with the help of government grant aid (Tsouvalis, 2000). Some of these had existed for several hundred years and were thus considered to have a high conservation value (Lowe et al., 1986). In the years following World War II, in addition to establishing new large-scale planting programmes, especially in remote upland areas, and helped by further technological advances, the Forestry Commission mechanised and intensified its operations (Scott, 1966; Foot, 2010).

Conversely, in response to the 1949 National Parks and Access to the Countryside Act (HMSO, 1949), a new government agency, the “Nature Conservancy” , set out to select representative areas of the remaining semi-natural woodland and declared them as National or Forest Nature Reserves and Sites of Specific Scientific Interest to protect them against further intensive economic use (Ovington, 1964). Despite competition for land and a lack of finance and trained staff, eleven Forest Nature Reserves were declared until 1964, as well as 43 National Nature Reserves with woodland present. Following field surveys, early and still somewhat experimental restoration activities commenced on several of these reserves (Ovington, 1964).

The 1960s also saw the commencement of large-scale afforestation by private forest investment companies, especially in the Scottish uplands (Foot, 2010), which had been encouraged by a favourable tax system (Tompkins, 1989; Price, 1971). Generous tax benefits allowed wealthy landowners to offset their taxable income against expenditure on new forest plantations (Tompkins, 1989). In some areas of the uplands, entire landscapes had become dominated by coniferous plantations (Bunce et al., 2014), including those in national parks in England and Wales. This led to mounting criticism, especially of the Forestry Commission (Nail, 2010).

In the late 1970s, due to rising pressure from conservation groups, advancing scientific understanding, and increasing international environmental obligations, a more formal shift in perspective occurred in favour of more nature conservation in forestry (Raum & Potter, 2015). In 1981, supported by the 1981 Wildlife and Countryside Act (HMSO, 1981), for instance, old semi-natural woodlands throughout Great Britain began to be recorded in an ‘Ancient Woodland Inventory’ , offering a robust factual basis for further woodland conservation (Spencer & Kirby, 1992; Goldberg et al., 2011). Ancient woodlands were woodlands that had persisted since the Middle Ages; these were considered of exceptionally high conservation value (Peterken, 1977a). The continuity of woodland on a site since the threshold date of AD 1600, rather than the age or species of trees, determined whether a site was classed as ancient. Such ancient woodland may have been felled many times for timber or underwood production (Rackham, 1980) or felled and replaced with

plantations (Spencer & Kirby, 1992). Initially, the ancient woodland inventories for England and Wales were produced for each county (Spencer & Kirby, 1992).

In 1985, the Forestry Commission published a Policy on Broadleaved Woodlands (Forestry Commission, 1985a), accompanied by guidelines (Forestry Commission, 1995), aimed at halting the ongoing conversion of broadleaved woodlands to conifer plantations (Mason, 2007). In the years that followed, and further supported by the 1985 Wildlife and Countryside Amendment Act (HMSO, 1985), more emphasis was placed on forest conservation, including its regulative capacities, and evidenced by a range of new guidelines produced by the Forestry Commission (1989b; 1990; 1991b; 1998b). Tables 2 and 3 display the woodland area and the changes in woodland area in the UK between 1913 and the 1990s, for both state-owned and privately owned woodland. Figure 2 shows the changes in the total woodland area throughout this period.

Table 2. Woodland area in Great Britain (1913–1996) and Northern Ireland (1924–1996). Source: Aldhous, 1997. Values are '000 hectares.

	Effective date of survey or census						
	1913	1924	1939	1947	1965	1980	1996
Great Britain							
Total woodland	1294	1254	1376	1457	1740	2108	2406
Productive High Forest	877	573	771	757	1265	1881	2157
Conifer	522	328	464	403	915	1321	1521
Hardwood	355	245	307	354	350	560	636
Coppice/coppice with standard	246	215	220	146	30	39	40
Other woodland	171	466	385	554	445	188	209
Scrub	-	134	-	201	353	148	-
Felled	-	193	-	328	-	40	-
Other	-	139	-	25	92	-	-
Privately owned	1267	1204	1197	1205	1085	1216	1554
England	-	-	-	673	651	692	758
Scotland	-	-	-	436	351	422	669
Wales	-	-	-	96	83	102	127
State owned	27	50	179	252	655	892	852
England	-	-	-	117	234	255	223
Scotland	-	-	-	98	304	498	508
Wales	-	-	-	37	117	139	121



Northern Ireland							
Total woodland	-	18	24	24	-	-	94
Unproductive woodland	-	-	16	15	-	-	72
Other woodland	-	-	8	9	-	-	22
State owned	-	2	8	9	-	-	75
Privately owned	-	16	16	15	-	-	19

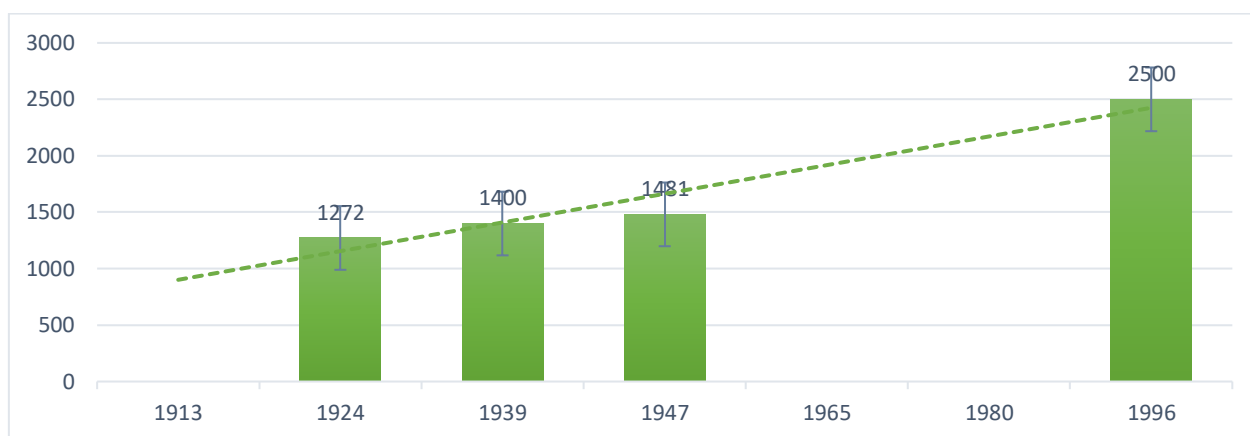


Figure 2. Total Woodland area in the UK 1913–1996 (values are '000 hectares)

Table 3. Changes in woodland area in Great Britain 1913–1996 (values are '000 hectares). Source: Aldhous, 1997.

	1913– 1924	1924– 1939	1939– 1947	1947– 1965	1965– 1980	1980– 1996
Total woodland area	-40	+122	+81	+283	+368	+298
Productive woodland						
High forest	-304	+198	-14	+508	+616	+276
Coppice/coppice with standard	-32	+5	-74	-116	+9	+1
Other woodland	+350	-81	+169	-109	-257	+21
Ownership						
Private	-63	-7	+8	-120	+131	+338
State	+23	+129	+73	+403	+237	-40

The main focus of UK forestry in the period 1919–1990 is summarised below:

Restoring woodland cover – (re)afforestation

The FAO (2018) defines afforestation as the “*establishment of forests through planting and/or deliberate seeding on land that, until then, was under a different land use, implying a transformation of land use from non-forest to forest*” (FAO, 2018). In the UK, the main emphasis had been on tree planting via saplings. New woodland, however, can also be created by natural colonisation of trees.

Restoring the quality of woodlands -designation of Woodland Sites for Nature Conservation

Woodland conservation objectives throughout this period were supported by a range of mechanisms, including the designation of woodlands as nature reserves or Sites of Special Scientific Interest, and later, through efforts to change general land-use policies that also applied to all woodlands across the country (Thomas et al., 1997). The latter was frequently motivated by European or other international regulations.

National nature reserves and Sites of Special Scientific Interest (SSSIs) are protected areas of importance for their flora, fauna, or geological features of particular interest, which are managed for conservation purposes and to provide unique opportunities for study or research. Many of these contain native woodland (Prosser & Townley, 2025). In the UK, native woodlands are grouped under the following three categories: ‘ancient woodlands’ , ‘ancient semi-natural woodlands’ , ‘and other broadleaved woodland’ . Ancient woodlands have been identified as the most important category for nature conservation (Thomas et al., 1997); they fall under two main groups: a) the Ancient Semi-Natural Woodlands (ASNW), which house native non-planted trees and are the most valued, and b) Plantations on Ancient Woodland Sites (PAWS) (Razzaque & Lester, 2020).

Section 2: Conditions prior to the interventions

Woodland Cover

At the beginning of the 20th century, forest cover in the UK was estimated to be only 4.7% of the land area (Forest Research, 2019). Ninety-seven per cent of the wooded land was in private hands, with the remaining royal forests belonging to the Crown Estate (Forbes, 1904; Holmes, 1975). Native broadleaved tree species dominated both private and royal forests (Coppock, 1960). Forestry was mainly practised in the context of larger estates owned by wealthy individuals or members of the aristocracy (Forbes, 1904; Holmes, 1975). These estate woodlands were a mixture of landscape gardening and arboriculture; however, very few were managed for timber production (Forbes, 1904). Some forests were kept to provide cover for game (pheasants, deer, partridges) for sporting reasons (Stewart, 1985; Raum, 2020). Initially, afforestation activities occurred on the Forestry Commission’ s

newly acquired land. This consisted mainly of poor quality agricultural land used for livestock grazing, including heathland (Birch, 1936). Heathlands were considered infertile habitats, low in nutrients and were characterised by plants such as heather, bracken, bilberry and gorse. Humans had highly modified open heaths for centuries, and they were maintained by cutting or grazing. Most lowland heathlands were found in parts of East Anglia, Surrey, the New Forest, and Dorset, as well as in scattered pockets in other areas, often with sandy soils (Woodland Trust, 2023b).

After World War II, agriculture became heavily subsidised, and affordable land in lower altitudes became rare. Foresters were thus forced into more remote, uphill heath- and moorland areas (Tsouvalis, 2000), such as Dartmoor, the Pennines, parts of Wales, and across Scotland (Woodland Trust, 2023b). Moorlands tended to be wetter habitats, such as valley fens and blanket bogs. These were often found on peaty soils and were characterised by low-growing shrubs, bog mosses and grasses. Similar to extensive open heathlands, large areas of open moorland were maintained by humans for livestock grazing or deer (Woodland Trust, 2023b). Although such exposed terrain in rough climates, frequently consisting of poor soil or deep peat, was challenging for commercial forestry (Tsouvalis, 2000), technological advances increasingly made new planting on such hitherto unplantable ground possible (Forestry Commission, 2011). In the 1940s, for instance, a plough was invented that could tackle layers of compacted heathland soils (Foot, 2010).

The principal factor restricting forestry on such land, especially in Scotland, was the perceived need to preserve existing agricultural units. Hill sheep farming predominated, and the limited but better manageable area of low and less exposed land was vital to hill farmers for winter grazing and fodder production. However, the same low ground was also the most desirable for afforestation. Forestry was thus seen in some quarters as a threat to the viability of traditional highland agriculture. There was, therefore, a conflict between the interests of forestry and farming, which created certain management problems on a local scale (Lindsey, 1977).

Woodland Quality

Commercial afforestation also disproportionately affected native woodlands, especially the larger plantations (Bain, 1987). In some areas, new conifer plantations were planted on land with existing native woodland; the latter was frequently removed to make space for the new plantation. In most cases, conifer planting led to the near-complete loss of semi-natural woods, with only small patches or fringes surviving. This had significant impacts on the flora, fauna, and soils of woodland ecosystems, particularly in ancient woodland sites (Mitchell & Kirby, 1989). Observed effects included

drying soils, increased water run-off, altered species distributions and water levels, and the degradation of natural drainage systems and small streams - along with the associated loss of their characteristic flora and fauna (Bunce et al., 2014). Overgrazing by excessive numbers of sheep and red deer had also hampered the natural regeneration of the surviving few native woodlands (Bain, 1987).

In a classic study of native pinewoods in Scotland, Steven and Carlisle (1959) surveyed the main known remaining pinewood stands. Due to the local oceanic climate, these woods were classed as temperate rainforests, a rare global habitat. The study found that only a relatively few primary stands were left, mostly small and in poor condition, and not regenerating naturally. Most of the pines were old; the principal age class was from 140 to 190 years, and there were relatively few trees under 100 years old. The authors concluded that if no positive action were taken to preserve them, the smaller remnants of the pinewoods would likely disappear altogether, and the larger woods would shrink in area, mainly due to heather burning on adjacent grazing grounds, which would erode their margins. A later review by Bain (1987) showed that further damage had occurred through ploughing and planting with non-native conifers, with less than 12,000 hectares of the ancient habitat remaining.

Although the fragmentation of woodland and the extinction of the larger woodland carnivores had changed natural processes, in woodland nature reserves, considerable importance was placed on setting aside areas to develop naturally without further human intervention. However, most of these woodlands had been regularly grazed at the time, and no naturally grown tree saplings were present (Ovington, 1964). Another problem that had to be addressed occasionally when woodland was left to develop naturally was the issue of invasive plants. Non-indigenous plants, especially rhododendron and sycamore, were highly competitive; for instance, at Denny and Matley Forest Nature Reserve, self-sown sycamore appeared to replace oak on a traditional oak site. Fire and wind storms, on the other hand, although considered a catastrophe to the forester, were regarded as natural events that were potentially very important for the dynamic processes of natural woodlands (Ovington, 1964).

Section 3: Technical aspects of the interventions

Restoring Woodland Cover – Afforestation

To address the severe timber shortage, in 1918, it was decided to increase forest cover from three million acres to four and three-quarters million acres over the following eighty years (Acland, 1918). 150,000 acres were to be planted by the newly established state-run Forestry Commission over the first ten years, and 50,000 by private landowners with government financial assistance (Acland, 1918). In response to the renewed timber crisis during World War II, the Commission increased the total area of new forests to be planned under the original Acland report from four and three-quarter million acres to five million acres (2.024 million hectares) over the next fifty years, i.e. 1993. Almost half of this was to be planted by private landowners with the help of governmental financial incentives (HMSO, 1943). During the 1920s and 30s, the Commission focused on acquiring, preparing and planting land. Most of this land was too poor for agriculture, including lowland heath and was frequently used for grazing (Rackham, 2006; Foot, 2010).



Figure 3. Early plough and D2 Caterpillar Tractor, 1946. © Crown Copyright Forestry Commission, Jim Christie and Forestry Memories.

The new plantations consisted of even-aged, non-native and fast-growing conifer species (Coppock, 1960). Scots and Corsican pines were the principal species used, totalling 223 million, with Sitka and Norway spruces a good second, accounting for about 161 million trees. European and Japanese larches came third with about 69 million, and Douglas fir followed with 39 million trees. Beech and oak led the hardwood species with roughly 15 million each, while ash accounted for nearly 6 million (Birch, 1936). Very few hardwoods had been planted in Scotland; beech was used most often. The majority, however, were Norway and Sitka spruces; the climate and soil conditions generally favoured coniferous growth (Birch, 1936). New forestry units ranged from the Isle of Wight in southern England to the very north of Scotland, from sea level to an altitude of 1,500 feet, and from the chalklands and sandy areas of southeastern England to the old Palaeozoic hills of Wales. The chalklands were considered suitable for beech, the sandy areas for Corsican and Scots pines, the poorer hill pastures for Sitka and Norway spruces and bracken-covered slopes for quick-growing conifers such as larches and Douglas fir (Birch, 1936).

Ploughing and draining were frequently required for afforestation (Low, 1987). In the wet, western, peaty districts, for instance, much of the land required draining, consisting of channels about nine inches wide and a few inches deep at frequent intervals. In many areas, a strong plough had to be used to break up the surface (Birch, 1936). Methods differed, but on most land, a sod was first cut and turned over, and the new saplings firmly set in the inverted sod. Plants were placed 4 to 8 feet apart to be thinned later and were mainly planted in geometric blocks on open ground (Coppock, 1960). Direct sowing of seed had, in places, also proved successful (Birch, 1936). In many cases, newly planted land required initial fencing against deer, especially in Scotland, as well as rabbits. There was, however, a burst of natural colonisation by native trees and scrub on old grassland and heath in the 1950s, following the decline of rabbits due to myxomatosis (Thomas, 1960). Fences against deer commonly exceeded six feet in height and had to have as many as twelve lines of strong wire (Birch, 1936). Repeated fertiliser application was frequently needed on poorer sites to ensure satisfactory growth (Low, 1987). In many places, weed control was necessary (e.g., grass, heather, bracken, ling) as it tended to strangle the young plants and enabled the spread of fire (Birch, 1936).

Typical forest silvicultural management techniques on newly established plantations involved regular thinning and clear-cut harvesting of mature forests, followed by replanting (Brown et al., 2015). Pole stage crops were thinned regularly to enhance diameter growth and stem quality wherever possible. However, on high wind risk sites, leaving crops unthinned could help delay the onset of windthrow. After 45 to 60 years, crops were clear-felled and then replanted. Damage by bark-feeding insects and fungal pathogens was rarely severe, provided that insects were controlled by insecticide at the

time of replanting, and the spread of fungal butt rot was minimised by urea treatment of fresh stumps (Low, 1987). Due to the visual impact on the British landscape, which had led to widespread criticism, the Forestry Commission introduced more aesthetically pleasing handling of afforestation schemes. These included contour planting and the planting of broadleaved trees in sensitive locations, especially on the edges of hillside plantations (Crowe, 1966; Crowe, 1978).

Restoring Woodland Quality - Early Woodland Protection and Restoration Measures

One of the first tasks of the Nature Conservancy during the early 1950s was to identify representative areas of the remaining semi-natural woodland and declare them as nature reserves. Management within these designated sites was to be directed towards maintaining or enlarging their nature conservation value (Peterken, 1977b). An estimated 15,000 acres (6060 hectares) of woodland was involved. The size of the individual woodland reserves ranged from as little as 3 acres (1 hectare) to nearly 2000 acres (808 hectares); the average was about 200 acres (81 hectares). The average size of the reserves was least in Wales and greatest in Scotland (Ovington, 1964). Approximately 60% of the designated woodland area was to be protected by nature reserve agreements, and of the remaining 40%, three-quarters were directly owned, and the rest leased by the Nature Conservancy itself (Ovington, 1964). Established in 1951, the Beinn Eighe and Loch Maree Islands National Nature Reserve was the first of its kind. It covered 48 square kilometres, stretching from loch-side to mountain top, and contained sites of remnants of the native Caledonian Scots pine forests. Native woodland restoration and expansion have been (and still are) at the heart of its management activities (Clifford & Foster, 2002; Nature Scotland, 2021).

The primary nature conservation objectives in these reserves were, "*first, to maintain or increase populations of native wildlife species and, second, to maintain or enhance features of 'scientific interest'*" (Peterken, 1977b). Early activities involved conducting site surveys to create a baseline of their condition and developing management plans. At some reserves, fixed transects and sample plots were marked out, and plant and soil records were taken to provide a reference against which to measure future change. Surveys of the tree stock, the understorey vegetation and the soil were conducted at key woodland reserves, such as Beinn Eighe in Scotland and Yarner Wood in Dartmoor in England. Animal habitats were also catalogued at many woodland reserves using a standard procedure (Ovington, 1964). Oak (28% *Quercus petraea* and 8% *Q. robur*), pine (24% Scots pine) or birch (13%) were the most dominant tree species over about three-quarters of all wooded nature reserves. Others were beech (11%), ash (8%), mixed coppice (6%), and scrub, as well as 2% of other specialised woodlands, e.g., those of yew. Several woodland nature reserves were set aside primarily to protect trees of relatively rare species, such as *Salix*, *Sorbus* or *Ulmus* (Ovington, 1964).

As the number of nature reserves increased, the emphasis shifted from the selection and declaration of reserves, followed by baseline surveys, to the longer-term management of reserves. All of the designated woodlands had been managed in the past, and a decision had to be reached about future management, even if this meant doing nothing and letting nature take its course (Ovington, 1964). Since the relevant ecological knowledge at the time was incomplete, woodland reserve management was to be founded on an appraisal of ongoing ecological research, linked with a range of management actions suited to each particular site (Ovington, 1964). Due to the variety and particularity of the measures taken at these early restoration sites, this report focuses on the more general approaches rather than providing a detailed description of each particular site. In general, considerable importance was attached to setting aside areas left to develop without further human intervention. Lady Park Wood, a 45-hectare woodland site in Gloucestershire and Monmouthshire, for instance, was set aside indefinitely by the Forestry Commission for a long-term study on how woodland develops naturally (Peterken & Mountford, 2017). In some nature reserves, woodlands were not regenerating naturally, requiring more active management, especially during the early days, including fencing, site preparation, planting and fertiliser (Ovington, 1964).

During the 1980s, there was another shift in emphasis from ‘native woodlands’ to ‘ancient woodlands’ as these were considered particularly valuable for nature conservation (Thomas et al., 1997). A new inventory for ancient woodlands was created (Spencer & Kirby, 1992), and specific management guidelines for different types of semi-natural ancient woodlands were developed (Forestry Commission, 1985b, 1989b, 1994b). Management of each of these varied considerably. In many upland and wet woodlands, general recommendations were to reduce grazing and browsing pressures to allow natural regeneration (Forestry Commission, 1994b; 2003). Elsewhere, especially in lowland woods with a long history of management, such as coppice with standards, more active forms of silviculture were considered appropriate, especially during the 1980s, and seen as necessary to conserve the woodland’s character, flora and fauna, as well as its economic value (Forestry Commission, 1994b; 2003). In general, such management approaches were geared towards sensitive and low-key methods suited to the natural dynamics of these woodlands (Forestry Commission, 1994b, 2003) (Table 4). For any woodland to receive grant aid, management objectives and a work programme had to be agreed upon for a period of five years. A separate management plan was required for semi-natural woods, especially the larger ones (Forestry Commission, 1994b; 2003).

Table 4: Operational Guidelines – General principles for management. Source: Forestry Commission, 1994b; 2003.

- Maintain semi-natural woodland types. Management should be based on growing species native to the site and appropriate to the pattern of soils within the site. Existing abundant native species should remain a significant component.
- Maintain or restore diversity of structure (e.g., full range of age classes).
- Maintain diversity of species and increase where appropriate.
- Maintain diversity of habitat (including open areas).
- Maintain a mature habitat (e.g., retaining old, dead or dying trees, increasing rotation lengths).
- Minimise rates of change (e.g., scale and sequence of felling).
- Use low-key restocking techniques'

Section 4: Socioeconomic and political aspects of the interventions

During World War I (1914–18), the UK's dependence on timber imports became a major national security issue (Griffith, 1951; Holmes, 1975) when the country was largely cut off from its overseas timber supplies (Raum, 2021). The mining industry struggled to acquire the pit props it required for coal production, which in turn was needed for the manufacture of steel used in shipbuilding and armaments (Foot, 2010). In 1916, a Forestry Sub-committee, known as the Acland Committee, was set up to identify the most effective ways of increasing home-grown timber supplies. The Committee recommended a state organisation as being the most effective way of coordinating re-forestation to meet future timber needs. It proposed to increase forest cover from three million acres to four and three-quarter million acres to make the country autonomous from foreign timber supplies for up to three years. The Committee further suggested that two-thirds of this area was to be planted within the first 40 years at an estimated cost of £18,425,000 (Acland, 1918). The expectation was that, after 40 years, the return from forest products would make the scheme financially self-sustaining and eventually yield a profit (Birch, 1936).

In response to the Acland Committee's recommendations, the 1919 Forestry Act (HMSO, 1919) was passed, establishing the Forestry Commission as the new state-run forest authority for Great Britain (Holmes, 1975). The Commission was given wide powers to promote afforestation, the production and supply of timber, establish timber industries, acquire and plant land, provide grants, and

undertake research and education (HMSO, 1919). In Northern Ireland, forestry was placed under the responsibility of the Ministry of Agriculture in 1921 (Aldhous, 1997). During the 1920s and 1930s, the Forestry Commission, under the ongoing direction of the Treasury ministry, focused on acquiring inexpensive land; the land had become particularly cheap during the Great Recession (1929–1933) (Rackham, 2006; Raum, 2021). From 1924 onwards, tree planting programmes encompassed the building of forest workers' holdings, particularly in remote rural areas, such as the Scottish uplands (Robinson, 1927). This provided the Forestry Commission with a more permanent core group of workers who could quickly attend to emergencies, such as forest fires (Foot, 2010).

During the first decade (1920–1929), the Commission made net payments of £3,650,534 for afforestation. This expenditure covered the Commission's activities, including education and advances to private landowners (Birch, 1936). The cost for ground preparation, drainage, fencing, plants, planting, weeding, and replacement of failures (excluding supervision, forest protection, and overhead charges) from 1919 to 1933 averaged £9.4 (£ 9.8/11) per acre. Nurseries accounted for 28.6% of this cost, followed by planting at 15.2%, weeding and fencing at 13.1% each, ground preparation at 8.2%, forest protection and drainage at 8.1% each, and replacement of failures at 5.6%. The gross expenditures from 1920 – 1933 came to 7.5 million pounds, while income from all sources was 1.5 million pounds. Thus, the total cost was 6 million pounds. Cultural operations were responsible for 42.5% of the total cost, and land acquisition for 23.8%. The primary source of income was forest produce, accounting for 39.7% of the total, with rents and royalties at 35.4% (Birch, 1936). Job creation programmes, such as the Special Areas Schemes, provided further funding for forestry, particularly within the depressed regions of heavy industry and coal mining (Foot, 2010). By 1933, the Forestry Commission owned or had access to 455,220 acres of plantable land, comprising 274,166 acres in England and Wales and 181,054 acres in Scotland. About 60% of this was fully owned and had cost an average of £3.3 (£3.5.9) per acre. The remainder was held under feu or lease (Birch, 1936).

In response to the renewed timber crisis during World War II, the Forestry Commission increased the total area of four and three quarter million new forests planned under the Acland report to five million acres (2.024 million hectares), to be planted over the next fifty years (HMSO, 1943). This ambition was formalised in the new Post-war Forest Policy (HMSO, 1943) and supported by a suite of government financial incentives, including the 1946 Interim Planting Grant and the 1947 Dedication Basic I and II grants (Raum & Potter, 2015). The Forestry Act of 1951 emphasised timber production even more and requested the Forestry Commission to "*promote the establishment and maintenance of adequate reserves of growing trees*" (HMSO, 1951). This led to substantial

investments by the Commission in heavy machinery and new wood processing industries, such as sawmills and particleboard companies (Holmes, 1975). Although the increasing use of heavy machinery, fertilisers, herbicides, and pesticides (Tsouvalis, 2000) led to environmental protests (e.g., in Cumbria and north-west England), the Forestry Commission had to become more efficient and increase its tree growth. The first major dispute occurred in the Lake District in the 1930s over forestry plantations in the Duddon Valley (Foot, 2010).

During the first half of the Century, the Forestry Commission and private forest owners were the primary stakeholders in forestry. However, from the 1950s onwards, new timber processing industries became increasingly involved (Raum, 2018). Around the same time, a growing number of conservation organisations (e.g., the Campaign to Protect Rural England, the National Trust, and local Wildlife Trusts) began a more general debate about the British countryside, leading to new policies for its protection, including native woodlands (NCC, 1986; Foot, 2010). The National Trust, the Woodland Trust, local Wildlife Trusts and the Royal Society for the Protection of Birds also owned or managed substantial areas of woodland (Raum, 2018); many holding the newly designated woodlands (including Sites of Special Scientific Interest (SSSIs)). Other designated woodlands were owned or managed by state bodies, such as the Forestry Commission, the Nature Conservancy or local authorities (Thomas et al., 1997). Woodlands owned by conservation organisations or the state were more likely to be managed in ways sympathetic to nature conservation than those in private individual or estate ownership (Thomas et al., 1997; Raum, 2020). The City of London, for instance, managed its woodland SSSIs (e.g., Epping Forest (Essex) and Burnham Beeches (Buckinghamshire)) for nature conservation purposes (Ratcliffe, 1977).

During the 1960s, gradual changes in perception began to influence forestry policy (Raum & Potter, 2015). Various non-governmental organisations, as well as statutory bodies, deliberated on how to make the wider countryside, including forests, more attractive and accessible to the general public. The Council for the Protection of Rural England (CPRE), for instance, mobilised a campaign against tree planting on open land (Foot, 2010). The Countryside Act 1968, a product of these debates, required public bodies, including the Forestry Commission, *"to have regard to the desirability of conserving the natural beauty and amenity of the countryside"* (HMSO, 1968). The Forestry Commission subsequently began building recreational facilities, including forest holiday cabins (Nail, 2010). The 1979 EU Convention on the Conservation of European Wildlife and Natural Habitat (Council for Europe, 1979), implemented into UK law via the Wildlife and Countryside Act 1981 (HMSO, 1981), placed a more formal obligation on the protection of wild plants, animal species, and their habitats. The 1985 Wildlife and Countryside Amendment Act (HMSO, 1985) strengthened the

support for landscape amenity and conservation. It specifically instructed the Forestry Commission to keep a “reasonable balance” between “(a) ... afforestation, ... the production and supply of timber, and (b) the conservation and enhancement of natural beauty and the conservation of flora, fauna ...” (HMSO, 1985). The Commission responded by publishing a new Policy on Broadleaved Woodlands in the same year (Forestry Commission, 1985).

In the following years, more prominence was given to forest restoration, native broadleaved species, and the quality of soil and water, highlighting the new importance of functioning regulative systems of natural forests, and evidenced through a series of further guidelines produced by the Forestry Commission (1985b; 1989a; 1989b; 1990; 1991b; Raum, 2021). Around the same time, the Commission had reached its 1943 target of 5 million acres of forest cover in the UK (2.024 million hectares) (Mather, 1991), which accounted for approximately 9% of land cover (Forest Research, 2019). Due to a change in tax rules in 1988, large-scale upland conifer afforestation, mainly by private investors (Lynch, 1989; Tompkins, 1989), slowed considerably thereafter (Aldhous, 1997), whereas broadleaved cover began to increase (Bunce et al., 2014). Tax advantages were replaced by much-increased planting grant rates under the new Woodland Grant Scheme (WGS) in the same year (Mather, 1991). The need to restore not only forest cover, but also the overall quality of both new and old forests (commercial forests and native woodlands) became ever more apparent.

Section 5: Results, successes and challenges

Results

Restoring forest cover

Forest cover in the UK increased from 4.7% in 1919 to 12% by 1998 (Table 5 and Figure 4). No data were available for 1990. This represented approximately 9.5% of the total land area in England, 14.4% in Wales, 16.7% in Scotland, and 6% in Northern Ireland (Forest Research, 2022). The total woodland area in the UK was estimated to be 2.4 million hectares. The net area of state forests increased by almost 100% between the mid-1940s and 1980. The net area of privately-owned forests increased substantially after 1956 (Aldhous, 1997).

Table 5. Woodland area in the UK countries over time in hectares and percentages between 1905 and 1998. Source: adapted from Forest Research, 2022.

Year	England		Wales		Scotland		Northern Ireland		UK	
	Area (000 ha)	%	Area (000 ha)	%	Area (000 ha)	%	Area (000 ha)	%	Area (000 ha)	%
1905	681	5.2	88	4.2	351	4.5	15	1.1	1140	4.7
1924	660	5.1	103	5.0	435	5.6	13	1.0	1211	5.0
1947	755	5.8	128	6.2	513	6.6	23	1.7	1419	5.9
1965	886	6.8	201	9.7	656	8.4	42	3.1	1784	7.4
1980	948	7.3	241	11.6	920	11.8	67	4.9	2175	9.0
(1998)	1097	9.5	287	14.4	1281	16.7	81	6.0	2746	12.0

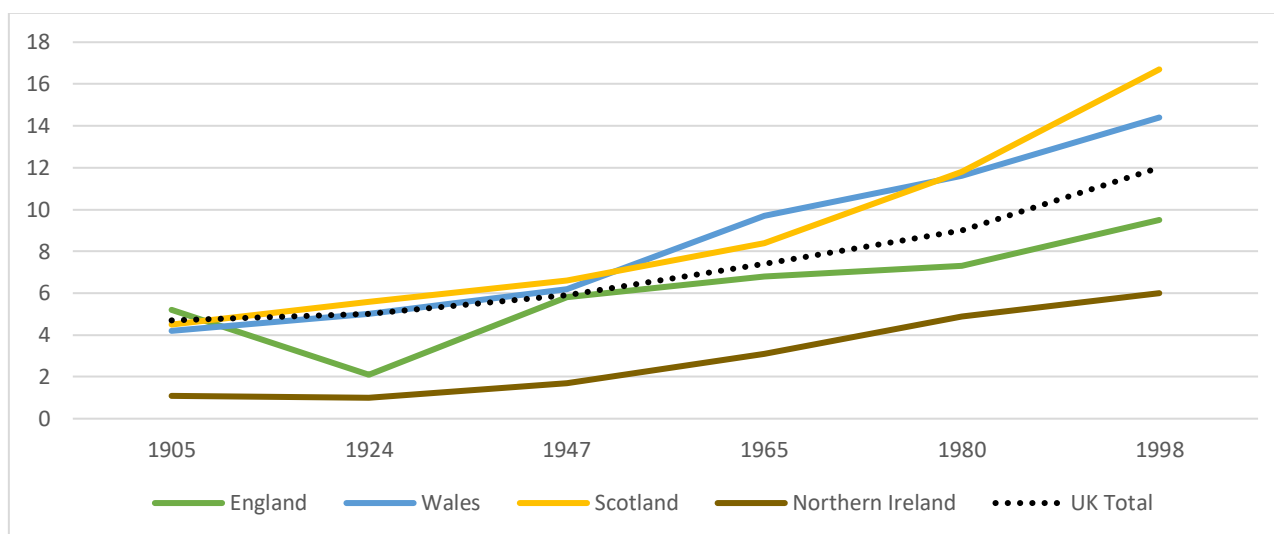


Figure 4. Percentage of woodland area in the UK countries over time. The trendline in black represents the total increase in woodland area in the UK between 1905 and 1998. Source: Forest Research, 2022.

Table 6 shows that whereas in 1947, the forested area in Britain covered in conifers was relatively similar (382.4) to broadleaved trees (341.5), the coniferous forest area had more than doubled in 1965 (Mason, 2007). Plantation woodland occupied 40% of the total area of surviving ancient woodland. Most of it had been planted after 1945 in response to government policies (Spencer & Kirby, 1992) (Table 7).

Table 6. Development of the forest area ('000 hectares) of Britain by main forest type over the period 1945 (to 2000). Percentage figures are given in parentheses. Source: Mason, 2007 (Forest Research, Woodland Surveys).

	High forest					
Census year	Conifer	Broadleaved	Coppice	Coppice-with-standards	Felled	Total
1947	382.4 (41)	341.5 (37)	48.6 (5)	93.0 (10)	61.1 (7)	926.7
1965	917.3 (67)	349.8 (25)	16.5 (1)	10.3 (1)	78.3 (6)	1372.1
1982	1321.0 (67)	560.3 (29)	27.6 (1)	11.6 (1)	39.8 (2)	1960.2
(2000	1379.5 (59)	880.7 (38)	12.7 (1)	10.8 (<1)	47.0 (2)	2330.8)

Table 7. Area ('000 hectares) of conifer and broadleaved high forest by four age class groups and percentage distribution (parentheses) for census dates from 1947 to 2000. Source: Mason, 2007 (Forest Research, Woodland Surveys).

Forest type	Census date	< 15 years	15-50 years	51-100 years	> 100 years
Conifers	1947	147.9 (39)	157.7 (41)	52.0 (14)	24.7 (6)
	1965	529.7 (58)	320.4 (35)	47.4 (5)	19.8 (2)
	1982	512.1 (39)	697.3 (53)	94.6 (7)	17.0 (1)
	(2000	219.5 (16)	1067.8 (77)	73.0 (5)	19.1 (1)
Broadleaves	1947	12.4 (4)	37.9 (11)	154.4 (45)	137.7 (40)
	1965	34.9 (10)	54.4 (16)	148.2 (42)	112.3 (32)
	1982	36.4 (6)	209.2 (37)	191.7 (34)	122.9 (22)
	(2000	57.9 (7)	269.6 (31)	376.9 (43)	176.3 (20)

Restoring the quality of forests

Although no formal goal in terms of percentage, hectares or total numbers of to be designated areas seemed to have been set, around 1990 about 16% of the total area of ancient woodland in England and 10% in Wales had been designated as nature reserves (National Nature Reserves, Local Nature Reserves, County Trust reserves) or Sites of Special Scientific Interest (Spencer & Kirby, 1992). In England, 98,423 hectares were within conservation areas, and in Wales, 10,783 hectares (Table 8). Eleven Forest Nature Reserves were declared until 1964, as well as forty-three National Nature Reserves with woodland present. Many of these areas had baseline surveys of flora and fauna conducted using standard procedures, and management plans were established. Nonetheless, many native and ancient woodland sites were still at risk of being lost or being in poor condition (Ovington, 1964).

Table 8. Total area of ancient woodlands in hectares within conservation areas in England and Wales in 1991. Source: Adapted from Spencer and Kirby (1992).

	Total
(a) Total area of sites (ha)	
England	
Ancient woodland	341 127
Area of ancient woodland within conservation areas*	53 756
Area of ancient semi-natural woodland within conservation areas	44 667
Wales	
Ancient woodland	56 575
Area of ancient woodland within conservation areas*	5 667
Area of ancient semi-natural woodland within conservation areas	5 116
(b) No. of sites	
England	
Ancient woodland	21 918
No. of sites within conservation areas*	2 020
Wales	
Ancient woodland	5 770
No. of sites within conservation areas*	432

*Conservation areas are defined here as Sites of Special Scientific Interest, National Nature Reserves, Local Nature Reserves and reserves owned or managed by voluntary conservation organisations (County Naturalist Trusts, National Trust, Royal Society for the Protection of Birds, Woodland Trust).

Successes

Total forest cover had more than doubled between 1919 and 1990, whilst the outlook for woodland conservation had also become more favourable during the latter half of this period. The 1943 goal of planting five million acres (2.024 million hectares) over a fifty-year period (HMSO, 1943) was achieved slightly ahead of schedule (Forest Research, 2022). Although overall tree planting declined considerably in the late 1980s (Aldhous, 1997), largely because the expansion of conifer plantations slowed, the area of broadleaved woodland increased. This growth was driven by the new broadleaves policy and subsequent adjustments to grant aid that incentivised broadleaved planting (Bunce et al., 2014). Unsympathetic large-scale upland conifer afforestation, primarily driven by private investors, came to a standstill due to a change in tax rules in 1988 (Price, 1997). Numerous nature designations, including native/ancient woodland, had also been established throughout the country.

The native and ancient woodland inventories, which formed the basis for further, more detailed surveys, had contributed to the development of new woodland conservation policies and guidelines. The inventories also provided a baseline against which the success of these policies could be monitored (Spencer & Kirby, 1992). After 1985, woodland inventories also became an important tool in implementing the Forestry Commission's Broadleaved Woodland Policy (Forestry Commission, 1985a,b) (Spencer & Kirby, 1992). Conservation designations have helped increase awareness of the importance of native and ancient woodlands and their protection. For ancient woodland sites within SSSIs, English Nature, the then government agency responsible for nature conservation, had considerable influence over the sympathetic management of these sites (Mitchell & Kirby, 1989; Thomas et al., 1997). However, whilst these early protective measures were vital, they tended to be localised and small-scale.

Challenges

During the challenging post-war years (World War II), forestry adopted the overriding maxim of: *"maximum wood production at least cost"* (Mason, 2007). This approach, however, combined with a labour shortage, the increased use of modern ploughs and other heavy machinery, fertilisers, herbicides, pesticides, and phosphates, led to severe land manipulation and pressures on ecosystems (Tsouvalis, 2000). As a result of large-scale afforestation, in some regions, especially in the uplands, much-loved landscapes had become dominated by coniferous plantation forests (Bunce et al., 2014), leading to criticism from individuals and conservation organisations (Foot, 2010). Whereas established broadleaved forests, especially old royal forests, tended to be connected with their

surrounding landscape (Peterken, 1996), new conifer plantations were mainly planted in even-aged and geometrical blocks on open ground (Coppock, 1960), altering cultural landscape patterns and vegetation cover (Bunce et al., 2014). The ecological differences between existing woodlands and non-native plantations were also considerable, including their diversity level and soil and understorey composition (Peterken, 1996). This type of afforestation often leads to increased water run-off, dry soils, shifts in species distributions and water levels, and even alterations to drainage systems and small streams—along with the loss or modification of their associated flora and fauna (Bunce et al., 2014). Clear felling and subsequent restocking of large areas also made these areas more prone to wind damage (Hibberd, 1985).

Planting methods used for establishing new native broadleaved woodlands often mimicked modern forestry practices, resulting in simple, homogeneous vegetation structures (e.g., even-aged, species-poor plantations) rather than the more species-diverse and spatially heterogeneous structures typically found in natural systems (Ferris-Kaan, 1995; Fuentes-Montemayor, 2022). In cases where the restoration of native woodlands involved natural regeneration, this approach was often challenging due to heavy grazing and browsing pressures (Hobbs, 2009). The tendency, therefore, was to fence woodlands in to prevent grazing and browsing. However, fencing implied intervention, producing unusual conditions, particularly where the fenced area is small. In practice, fencing may not promote natural regeneration because the ground vegetation may become more luxuriant and competitive, providing conditions where small mammals multiply and replace sheep or deer as destroyers of tree seedlings (Ovington, 1964).

Conclusion

Although the outlook for woodland planting and restoration had become more favourable, concerns remained about the scale of felling, the effects of the particular tree species being planted, and the degree of ground disturbance and clearance of coppice stools (Mitchell & Kirby, 1989; Thomas et al., 1997). In areas where a high proportion of ancient woods were within SSSIs, English Nature, which was responsible for SSSIs, had a relatively strong influence over the management of the whole site (Thomas et al., 1997). Most ancient woodland (85%) was, however, outside SSSIs, and such sites were significantly affected by clearances and unsympathetic forest management practices (Spencer & Kirby, 1992), even within what were protected landscapes (National Parks and Areas of Outstanding Natural Beauty (AONBs)). Future strategies, therefore, must consider how to achieve effective woodland conservation outside the SSSI system (Thomas et al., 1997). Moreover, whether the improvements achieved over these past 20 years would continue could only be known if the effects

of changing land use policies on woodland cover and composition were to be monitored. Such monitoring would need to determine whether the guidelines and recommended practices had been followed and also whether the expected conservation/restoration goals had been realised. Effective monitoring of national policies would thus also require setting clear targets for the amount of woodland to be maintained, restored, or created within a specific timeframe (Kirby & Rush, 1994).

Period 2: >1990

Section 1: General overview – how much, when and where



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Whereas earlier forestry policy focused almost exclusively on restoring forest cover for timber production, from 1990 onwards the Government placed greater emphasis on improving woodland quality. This shift occurred alongside continued efforts to expand overall forest cover in support of the UK's new carbon-reduction commitments (HMSO, 2021b). Although new international obligations linked to climate change called for a further increase in woodland cover, the UK land area covered by woodland increased by only 1.3% between 1995 and 2022, up from 12% in 1995 to 13.3% in 2022 (Forest Research, 2022). Woodland restoration, on the other hand, was strongly linked to the UK's global biodiversity commitments (e.g., EEC, 1992).

In the 1990s, woodland expansion focused on creating extensive new multi-purpose forests in the heart of England and central Scotland, as well as smaller community forests around urban areas. The

former would entail about 13,500 hectares of new planting, embracing 200 square miles of the Midlands (Mather, 1991). The new forest in central Scotland was planned across 620 square miles between Glasgow and Edinburgh (Scottish Government, 2000). The new community forests were planned on the urban fringes of twelve conurbations to contribute to the enhancement of city dwellers' quality of life (Mather, 1991; Nail, 2010). The nature and function of these forests differed significantly from those created under previous government policies. Environmental enhancement and the provision of recreation opportunities became primary objectives. Conversely, the relative importance of timber production was less, although not insignificant (Mather, 1991). In 2018, the UK government unveiled plans to create a new English Northern Forest, extending from Hull to Liverpool, encompassing five community forests. The aim is to plant 50 million trees by 2032, providing timber, recreational opportunities and environmental benefits (Woodland Trust, 2018).

In parallel, there was a rising recognition of the importance of enhancing both the quality of newly planted woodland and existing commercial forests (Woodland Trust, 2020) while also improving their resilience (Scottish Government, 2019; Fuentes-Montemayor et al., 2022). Although far from being perfect, a frequently used strategy to protect and improve such woodland was through certification. Forest certification is an economic instrument introduced in the 1990s as part of the sustainable forest management agenda to help reduce forest degradation and the loss of biological diversity (Razzaque & Lester, 2020). In 1998, the first UK Forestry Standard (UKFS) was introduced to establish a reference standard for sustainable forest management in the UK (Forestry Commission, 1998a); it serves as the basis for good forestry practice in woodland certification (Forestry Commission, 2017). Woodland certification has since been used widely throughout the country in state and private forests (Reid et al., 2021)

Since the inception of early conservation designations under the 1949 National Parks and Access to the Countryside Act, new forms of designations have been created primarily through international regulations (or existing ones strengthened), each focusing on different aspects of an ecosystem. The 1992 EU Habitats Directive (EEC, 1992), for instance, focused on the protection of over a thousand species, including plants, mammals, reptiles, amphibians, fish, invertebrates, and 230 habitat types; its overall aim was to improve biodiversity. Under the Directive, member states were required to designate Special Areas of Conservation (SAC) and introduce management plans to maintain or restore these habitats and their species to good condition (EEC, 1992). In response, a Biodiversity Action Plan (BAP) was launched in the UK in 1994 for habitats identified as the most threatened, thus requiring urgent conservation action (Defra, 1994). These 'priority habitats' included different woodland types under the broad habitat type 'Broadleaved, Mixed & Yew Woodland' (JNCC, 1995;

1998; JNCC & Defra, 2012). In the 2010s, due to new global and country-level obligations, much of the work carried out under the UK BAP was succeeded by the new UK Biodiversity Framework (JNCC & Defra, 2012).

In recent years, numerous activities related to 'rewilding' entire degraded landscapes have been undertaken (Bunce et al., 2014), particularly in Wales and Scotland, as well as restoring old rainforest sites in western coastal areas (Bain, 2015; Shrubsole, 2022). Alongside this, there has been a growing interest in the reintroduction of wildlife native to, but previously extirpated from, Britain (e.g., beaver lynx, butterflies). Various beaver populations have already been established in Devon and Scotland, with other releases planned (Fraser, 2010).

The main forestry foci of the time period 1990 – 2022 are defined/summarised below:

Restoring Forest Cover

Afforestation

As in Section 1

Restoring Woodland Quality

Forest Certification

"Forest certification schemes are owned by international non-governmental organisations and exist to promote good forest practice. They offer product labels to demonstrate that wood or wood products come from well-managed forests. Figures for certified woodland areas are often used as an indicator of sustainable forest management" (ONS, 2022). In the UK, certified woodland has been independently audited against the UK Woodland Assurance Standard (ONS, 2022).

Forest restoration

Forest restoration lacks an authoritative definition. In broad terms, however, it can be understood as the process of improving the health and functioning, as well as the productivity, of a forest. The former two may involve ecological restoration activities that strive to recover historic species composition and structure or functional approaches that emphasise the restoration of underlying biotic and abiotic processes (Stanturf et al., 2014). In traditional forestry circles, it may also involve

the (re-) introduction of productive forest management to woods that have not had any interventions for some time to enhance their productivity. In this chapter, we will focus on ecological and functional restoration.

Rewilding

Although similar to restoration, rewilding is a form of ecological/functional restoration that heavily relies on autonomous biotic and abiotic agents and processes to restore the natural conditions of entire landscapes. There is, however, an ongoing debate as to what ‘natural’ means in this context. Rewilding may involve the reintroduction of missing keystone species (including sometimes trees) but also non-native proxies for extinct species, such as large herbivores and carnivores or the creation of an interconnected network of habitats (Jørgensen, 2015; Stanturf et al., 2023).

It should be noted that, due to Brexit, there has been a rapid change in policies and programmes on the UK national level. Moreover, policy changes have accelerated in recent years due to a high turnover in UK governments, prime ministers and ministers – there have been five prime ministers since 2016. The evaluation of previous policies and examination of the evidence base can therefore struggle to keep pace, with each new policy and strategy being formed before a robust analysis of the existing ones has taken place (Krahulcová & Parobek, 2021; Westaway et al., 2023). Moreover, undertaking a UK-wide assessment of multiple policies and programmes has become prohibitively complex since the devolution of public administration in 1998, as each of the four countries develops its own strategies and targets. Therefore, the following section of this chapter will provide only a snapshot of some key developments.

Section 2: Conditions prior to the interventions

In the early 1990s, overall woodland cover in the UK had increased to about 12% (Forest Research, 2022). Roughly 63% of these were conifer and 34% broadleaved woodlands. Most of the new forest cover consisted of commercial coniferous plantations (Mason, 2007). The forestry practices favoured in these plantations, however, had reduced overall species and/or habitat diversity (Mitchell & Kirby, 1989). Intensive ground preparation techniques, the use of heavy shade-casting trees such as spruce, stands of similar species, the use of fertilisers and pesticides, and tree felling before they had reached maturity, all affected flora and fauna. Such practices also led to changes to woodland soils, including the type and amount of organic matter, pH, drainage, compaction and surface disturbance (Mitchell & Kirby, 1989). In the early 1990s, plantation forests occupied 40% of the total area of surviving ancient woodland (Spencer & Kirby, 1992). Plantations on these sites consisted of coniferous, broadleaved, or mixed tree species; many of these were privately owned (Goldberg, 2003). Stands including native broadleaved trees, however, had frequently been planted so closely that any seminatural elements of the understorey would have been suppressed (Spencer & Kirby, 1992).

Ancient semi-natural woodland formed only 23% of the total woodland area in England and 13% in Wales in the early 1990s (Spencer & Kirby, 1992). In England, 341,127 hectares of these were ancient woodland, spread over 21,918 sites, of which 205,992 hectares were still semi-natural and 98,423 hectares were within various conservation areas. In Wales, 56,575 hectares of ancient woodland were spread over 5,770 sites, of which 30,658 hectares were still semi-natural and 10,783 hectares were within conservation areas (Spencer & Kirby, 1992) (Table 9). About 16% of the total area of ancient woodland in England and 10% in Wales were within Sites of Special Scientific Interest or Nature Reserves (e.g., National Nature Reserves, Local Nature Reserves, County Trust reserves) (Spencer & Kirby, 1992). Ancient woodland was then highly fragmented; 83% of sites were less than 20 hectares, and only 2% were greater than 100 hectares. There was, however, considerable regional variation in this pattern of size distribution (Spencer & Kirby, 1992).

Table 9. Size class distribution for ancient woodlands in hectares in England and Wales in 1991.
Source: Spencer and Kirby (1992).

	Size category (ha)						Total
	1–5	6–10	11–20	21–50	51–100	101+	
(a) Total area of sites (ha)							
England							
Ancient woodland	29,181	35,281	48,893	81,472	57,800	88,500	341,127
The extent that is still semi-natural	24,533	27,356	35,185	50,850	31,032	37,036	205,992
Area of ancient woodland within conservation areas*	1,863	2,949	5,704	13,967	12,527	16,746	53,756
Area of ancient semi-natural woodland within conservation areas	1,743	2,673	5,108	12,216	9,869	13,058	44,667
Wales							
Ancient woodland	8,849	8,647	11,524	15,075	6,996	5,484	56,575
Extent that is still semi-natural	6,959	5,994	6,712	7,313	2,414	1,266	30,658
Area of ancient woodland within conservation areas*	484	741	1,499	2,237	706	-	5,667
Area of ancient semi-natural woodland within conservation areas	447	660	1,394	2,031	584	-	5,116
(b) No. of sites							
England							
Ancient woodland	9,216	4,948	3,632	2,769	886	467	21,918
No. containing semi-natural stands	8,136	4,296	3,152	2,416	785	428	19,213
No. of sites within conservation areas*	572	370	378	430	180	90	2,020
Wales							
Ancient woodland	2,957	1,284	868	519	109	33	5,770
No. containing semi-natural stands	2,486	1,072	714	446	96	29	4,843
No. of sites within conservation areas*	144	97	102	77	12	-	432

*Conservation areas are defined here as Sites of Special Scientific Interest, National Nature Reserves, Local Nature Reserves and reserves owned or managed by voluntary conservation organisations (County Naturalist Trusts, National Trust, Royal Society for the Protection of Birds, Woodland Trust).

Commercial forestry, generally consisting of clear-felling, followed by replanting, had a greater adverse effect on the larger ancient woodlands. In most cases, these practices led to the almost complete loss of semi-natural woodland in the stands, with only fringes or small patches surviving (Spencer & Kirby, 1992). In England, large stands were only common in places such as the Wye Valley in the southern Lake District, the New Forest in Hampshire, the Cotswolds in the Chilterns, and localised areas of Hertfordshire, Lincolnshire and parts of the Weald. The remaining woodlands were distant from each other and mainly occurred in a landscape where other semi-natural vegetation was scarce (Spencer & Kirby, 1992). The distinction between recent and ancient woodland may also have been blurred in woods heavily grazed by deer or sheep, as these often had poorly defined boundaries and impoverished vascular plant floras. It was, therefore, difficult to accurately define where the woodland had been lost and distinguish between secondary semi-natural woodland and grazed ancient stands (Spencer & Kirby, 1992).

In the 1990s, the Forestry Commission had become the largest owner of ancient woodland (about 62,000 ha), but only about 20% of these were semi-natural. By contrast, of the other main woodland owners, about 70% of the National Trust's holdings were semi-natural (Thomas et al., 1997). The Commission's major ancient woodland sites were often clustered around former royal landholdings, such as the New Forest (Hampshire), the Forest of Dean (Gloucestershire), and Rockingham Forest (Northampton). The National Trust was particularly prevalent in the Lake District and along the north Somerset/Devon coastal areas; the Woodland Trust holdings were more scattered because of a deliberate policy to acquire woods in every county during the 1980s (Reid et al., 1996). Wildlife Trust woods were similarly spread throughout the English counties. Local authorities held more ancient woodlands in southern and urban-dominated counties. The treatment of these differently owned ancient woodland sites varied (Thomas et al., 1997).

A report by Defra and the Forestry Commission (2005) listed the following main threats to native and ancient woodland: 1) climate change and fragmentation; 2) excessive browsing and grazing by deer and livestock; 3) inadequate or inappropriate management; 4) invasive species; 5) diffuse pollution; and 6) developmental pressures. These threats can be either absolute and immediate (e.g., loss of development or infrastructure) or more subtle and gradual (e.g., shading from even-aged conifers or invasive species, such as *Rhododendron*) (Defra & Forestry Commission, 2005). More widespread environmental changes, such as diffuse pollution and climate change, could also pose long-term threats to woodland. Tackling these threats required a strategic approach, which involved addressing the most severe and widespread threats first (Defra & Forestry Commission, 2005).

Section 3: Technical aspects of the interventions

The main restoration approaches throughout this period have been a) further restoration of woodland cover, including through larger-scale afforestation programmes, whilst continuing b) to restore the quality of both plantation forests and degraded native/ancient woodlands. The latter involved forest certification schemes and various forest conservation and restoration programmes. Specific restoration approaches ranged from restoring the overall quality of native/ancient woodlands, developing forest habitat networks, and rewilding, to reintroducing extinct, but native wildlife. Forest health and enhancing resilience to growing risks (e.g., climate change, insects, diseases) have also received increased attention over the last 15 years or so.

Restoring Woodland Cover – Afforestation

In terms of afforestation goals, the Government has set a UK-wide target to create 30,000 ha of new woodland every year from May 2024 (HMSO, 2021b). Each devolved administration has set its own specific target. For instance, the 2000 Scottish Forestry Strategy set a new target to expand woodland cover from 17% to 25% by 2050, to plant 10,000–15,000 hectares of new woodland each year (Scottish Government, 2000). The 2006 Northern Ireland Forestry Strategy aimed for a steady expansion of tree cover, with a broad objective to double the forest area by 2056, and to plant 900 hectares per year by 2020 (DAERA, 2006). In 2010, the Welsh Government set a target of 1,000,000 hectares of new woodland by 2030, requiring 5,000 hectares of additional woodland to be planted annually (Welsh Government, 2009). The England Trees Action Plan 2021-2024 (DEFRA, 2021) aimed to increase woodland cover in England from 10% to 12% by 2050 and plant at least 7,500 hectares per year by 2024. The 2021 Environment Act proposed statutory targets to increase UK woodland cover to 16.5% by 2050 (HMSO, 2021a).

Afforestation programmes mostly continued silviculture practices as before; however, there was a greater emphasis on broadleaved trees and good environmental forestry practices, which were supported by a series of governmental standards and guidelines (e.g., the UK Forestry Standard) and were required by various grants (e.g., the Countryside Stewardship Woodland Creation Grant). The UK Forestry Standard, for instance, recommended to “*plant at least 5% of the area of any new conifer woodland with broadleaved trees or shrubs*” (Forestry Commission, 1998a). Similar recommendations were made for existing conifer woodlands where the amount of broadleaved trees and shrubs was to be increased during restocking to at least 5% (Forestry Commission, 1998a). Although no explicit information on the species used in new plantings was found, recent data on

growing stock provide a species breakdown in public and private forests in Great Britain. The total volume of coniferous growing stock in 2021 was 396 million m³ over bark standing (Forest Research, 2022). "*Sitka spruce accounted for over one half (55%) of the conifer stock, followed by Scots pine (15%) and larches (9%)*" (Forest Research, 2022). Corsican pine is now rarely planted because of red band needle blight; plantings of larch are down because of *Phytophthora ramorum* (K. Kirby, pers. comm., 6.10.23). The total volume of broadleaved growing stock in 2012 was 245 million m³ overbark standing, with over half of it comprising oak (28%), ash (16%), and beech (12%) (Forest Research, 2022). Ash plantings are down because of ash dieback (Broome et al., 2019). Although minor and novel broadleaf species, such as alder, aspen, bird cherry, birch, holly, sessile oak, rowan, and goat willow, with ash, wych elm and hazel on self-drained (not acidic) soils, were recommended for interspersation with conifers (Forestry Commission, 1989a), actual numbers planted are relatively low. Initially, tree planting remained the most common woodland expansion strategy (Harmer, 1995). Especially in areas with increased herbivory pressure, planting saplings was generally considered a quicker and more reliable method for establishing woodland than allowing an area to regenerate or colonise naturally (Harmer, 1995; Harmer et al., 2001).

In existing broadleaved woodlands, the Forestry Commission Guidelines recommended that native or traditional broadleaved species be planted (Forestry Commission, 1998a). Where possible, the regeneration of broadleaved trees was encouraged, and assistance was provided to declining species, such as red squirrels, dormice, and barn owls (SOED, 1994). On the Forestry Commission's land holdings (now Forest Enterprise), conifers were removed from stream sides to help animals move through wildlife 'corridors', allowing ground vegetation to grow and improve the stream biota (SOED, 1994). More recently, there have been calls for 'natural colonisation/regeneration' to be incorporated more widely (Fuentes-Montemayor et al., 2022). It is perceived to lead to more heterogeneous and complex woodlands of higher ecological value (Harmer & Gill, 2000) and to maintain local tree genotypes, which are likely to enable better local adaptation to climate change (Harmer et al., 2015; Fuentes-Montemayor et al., 2022).

Restoring the Quality of Forests

Certification

Forestry certification schemes were first introduced in the UK in the 1990s to certify as many public and private forests as possible (Defra, 2015). The main schemes were the two global forest certification schemes: the Programme for the Endorsement of Forest Certification (PEFC) by PEFC

International and the Forest Stewardship Council (FSC) scheme. Both schemes offer product labels to demonstrate that wood or wood products come from well-managed forests. Such certified woodlands were then independently audited against the UK Woodland Assurance Standard (UKWAS), an independent certification standard for verifying sustainable woodland management in the UK (UKWAS, 2023). UKWAS outlines the requirements which must be met. For certified forests, this requires owners/managers to maintain, enhance or restore features and areas of high conservation value within Plantations on Ancient Woodland Sites (PAWS). In ancient semi-natural woodlands (ASNWs), *"adopting a precautionary approach, the high conservation value of ancient semi-natural woodlands shall be maintained and, where possible, enhanced"* (UKWAS, 2018). In statutory designated woodland sites, *"appropriate measures shall be taken to protect identified priority habitats and species in accordance with plans agreed with nature conservation agencies"* (UKWAS, 2018). More specific measures to be taken under the UKWAS (2018) are outlined in Appendix 2.

Protection and Restoration

Following the EU Habitats Directive (EEC, 1992), the primary focus in forest restoration in the UK was on habitats identified under the UK Biodiversity Action Plan (UK BAP) (Defra, 1994) as being the most threatened, known as the "priority habitats". These included the following habitats associated with the 'Broadleaved, Mixed & Yew Woodland' UK BAP broad habitat type: Traditional Orchards; Wood-Pasture and Parkland; Upland Oakwood; Lowland Beech and Yew Woodland; Upland Mixed Ashwoods; Wet Woodland; Lowland Mixed Deciduous Woodland; and Upland Birchwoods (JNCC, 1995; 1998; JNCC & Defra, 2012). The conservation objectives for these woodland priority habitats varied from site to site and even between different parts of the same site. The overall management objective, however, was to improve their natural state and condition. More specific goals included maintaining or enhancing the relatively natural elements, maintaining or enhancing the populations of all native woodland species in the area, and protecting or increasing the populations of any rare species present (Mitchell & Kirby, 1989). In replanted woodland areas, the conservation priority was to encourage thinning and the opening up of stand edges to benefit the surviving shrub layers and ground flora (Mitchell & Kirby, 1989; Kirby, 1988; Kirby & Thomas, 2017).

Building on previous, somewhat experimental restoration activities, practical measures included increasing dead wood through both an increase in the stock of over-mature trees and by not clearing fallen dead wood, removing rhododendrons and other invasive non-native species, and putting up fences in some areas to allow for natural regeneration (Forestry Commission, 1995; Pryor et al., 2002;

Thompson et al., 2003; 2005). In ancient semi-natural woodland, the Forestry Commission guidelines recommended planting native or traditional broadleaved species and those already “*present on the site and native to the area*” (Forestry Commission, 1989a). On private land, the restoration or restocking with native species of Plantations on Ancient Woodland Sites (PAWS) is further supported by the HS2 Woodland Fund (Forest Research, 2022). English Nature (now Natural England) also developed standard procedures for monitoring SSSIs (Rowell, 1993), as part of a new monitoring system (Thomas et al., 1997). Ancient Woodland Inventories (AWIs) were updated in some areas (e.g. southeastern counties of England) to support monitoring (Reid et al., 2021).

The introduction of the idea of ‘rewilding’ (Foote, 1990; Soule & Noss, 1998) in the 1990s strengthened previous calls for nature conservation, however, with a new emphasis on the restoration of entire degraded landscapes and ecosystems, and frequently relying on natural processes (Bunce et al., 2014). Such restoration included, for example, the conversion of landscapes without tree cover, especially in the uplands, to a more natural state, involving the reintroduction of trees and woods (Bunce et al., 2014). Similarly, proposals for the development of ‘habitat networks’ were made (e.g., Adams et al., 1992; Moseley et al., 2005) to offset some of the adverse effects of the increased isolation of woodlands, through the creation or restoration of semi-natural vegetation between different woods, like hedges (Hopkins & Kirby, 2007). Habitat networks were a key part of any habitat restoration activity (Peterken, 1996). Thus, these two approaches were frequently combined (Raum, 2020).

In recent years, a series of local-level projects, such as those in Ennerdale, Lake District, England, and Carrifran, Dumfriesshire, Scotland, have been established to restore native forests and their natural processes, thereby increasing their resilience (Bunce et al., 2014). ‘Wild Ennerdale’, a partnership project led by the principal landowners in the Ennerdale Valley, is one of the largest initiatives in England, allowing ecosystems throughout the valley to evolve with minimal to no human interference (Bunce et al., 2014). Carrifran, a 1,600-acre valley in Scotland, was once used for grazing farm animals and was purchased by an environmental group in 2000 for restoration. After conducting initial pollen analysis and erecting fences to protect against deer, sheep, and goats, the group began to restore the valley’s ecosystem to its pre-grazing state. Around 40 hectares (about 60,000 trees) were planted each year during the first seven years, consisting of juniper, downy birch and rowan to establish a natural treeline for the ‘Carrifran Wildwood’. In total, 650,000 native trees and shrubs have been planted since 2000 by volunteers and professionals (Ashmole & Ashmole, 2009).

In addition to the UK BAP woodland habitat types listed under the ‘Broadleaved, Mixed & Yew Woodland’ group, there has also been a particular interest in restoring the UK’s ‘temperate

rainforests’ in recent years (e.g., Bain, 2015). Various activities have already been initiated. Building on the idea of ancient woodland inventories, Guy Shrubsole, a British writer and countryside enthusiast, for instance, began plotting a comprehensive rainforest map in 2021, using crowd-sourced information collected through his ‘Lost Rainforests of Britain’ website (Shrubsole, 2022).

More activities are planned to save and restore some of these rainforest sites in the future. One of England’s first rainforest restoration projects has just been announced (10 June 2023) by the Devon Wildlife Trust in south-west England. The project will take place at a new nature reserve called Bowden Pillars Farm (30-hectare site) near the market town of Totnes. It will involve the planting of native tree species, such as sessile oak, birch, rowan, holly, alder, willow and hazel, and the support or reintroduction of mammals, such as stoats and pine martens and threatened birds, including redstarts, wood warblers, and pied flycatchers (The Wildlife Trusts, 2023).

Section 4: Socioeconomic and political aspects of the interventions

During this period, influences on UK forestry became even more complex, with domestic impulses increasingly being superseded by international obligations (Raum & Potter, 2015), particularly those related to climate change and biodiversity. For instance, forests played a prominent role at the 1992 UN Conference on Environment and Development in Rio de Janeiro (Bill, 2007). As part of the Rio Summit, the significance of forests for society was acknowledged in various international agreements, including the Convention on Climate Change (UNFCCC, 1992), the Convention on Biological Diversity (SCBD, 1992), and the Rio Forest Principles (UNCED, 1992). In the UK, in anticipation of these obligations, afforestation had already been put back on the agenda by the 1991 UK Forestry Policy (Forestry Commission, 1991a). The policy's two main objectives were: a) the sustainable management of the UK's existing woods and forests, and b) a steady expansion of tree cover to increase the many diverse benefits that forests provide (Forestry Commission, 1991a). Good environmental forestry practices were supported by a series of governmental standards and guidelines (e.g., the 1995 Management of Semi-Natural Woodlands Forest Practice Guides (Forestry Commission, 1995) and the UK Forestry Standard (Forestry Commission, 1998a, 2004; 2011; 2017)), and various grants (e.g., the Countryside Stewardship Woodland Creation Grant).

Two large National Forest schemes were inaugurated in the early 1990s to increase woodland cover. These were intended to contribute significantly to carbon sequestration while providing a tourism and recreational resource (Countryside Commission, 1990). The former scheme helped regenerate industrial landscapes, namely the defunct coalfields in South Derbyshire and South Leicestershire (Foot, 2010). Since the late 1980s, there have also been calls for increased public involvement in forestry (Richards, 2003), which has led to the idea of community forests. The Countryside Commission, the then-government body responsible for the enjoyment of the British countryside, took up this idea and launched a community forest programme in 1989 (Countryside Commission, 1989). In the following years, community forests were established on the edges of major cities throughout the country to revitalise urban fringes and contribute to the quality of life of city dwellers (Nail, 2010). This frequently involved tree planting and management activities on redundant industrial land, undertaken by local volunteers to encourage community ownership (Foot, 2010).

Published in 1994, the UK Government's 'Sustainable Forestry: The UK Programme' outlines the policies and actions required to meet its new global obligations of achieving sustainable forest management and expanding tree cover (Forestry Commission, 1994a). At the same time, the Government made provision to spend a total of £240 million, of which some £150 million was to support the management of state and private forests and a further £90 million to expand forest cover

over the following three years (1994–1997). The UK Forestry Standard provided the standards for the sustainable management of all types of woodlands in the UK, supporting ecosystem and landscape restoration (Forestry Commission, 1998a). Following the 1997 Kyoto Protocol, which came into force in the UK in 2005, the 2008 Climate Change Act (HMSO, 2008) and the 2009 Carbon Transition Plan (DECC, 2009) also encouraged afforestation as a cost-effective means of mitigating climate change. At the same time, calls have been made for the development of more renewable energy as a way of replacing carbon-intensive fossil fuels, including woody biomass (e.g., HMSO, 2006; FC, 2007; DECC, 2009). The 2006 Natural Environment and Rural Communities Act (HMSO, 2006), for instance, introduced an Energy Crops Grant Scheme for establishing approved energy crops, such as short rotation coppice trees.

Following the devolution of public administration in 1998, each of the four UK countries increasingly developed its own forest expansion strategy and tree planting targets (e.g., Scottish Government, 2000; 2019, DAERA, 2006; 2020; Welsh Government, 2009; 2018; DEFRA, 2018; 2021) to contribute to the UK's carbon reduction and biodiversity targets. For instance, England's Tree Action Plan 2021-2024 (DEFRA, 2021) sets out the actions to be taken to at least triple annual woodland planting rates by 2025, in collaboration with the private sector, the third sector, and local communities. To achieve the new tree-planting targets, the government also dedicated £500m of its new Nature for Climate Fund in 2021 and a further £18m of its species recovery programme (DEFRA, 2021). In England, woodland planting was further supported by the Countryside Stewardship Woodland Creation Grant, the Woodland Carbon Fund, and the HS2 Woodland Fund. In Scotland, it was supported by the Forestry Grant scheme. However, no publicly available data on the amount paid to private forest owners or NGOs for forest planting and restoration through each of these grant schemes was found.

A range of policies and mechanisms, including dedicated grant schemes, also supported the restoration of woodland quality. The 1992 EU Habitat Directive (EEC, 1992), the 2011 Bonn Challenge, the National Planning Policy Framework (2012 and 2018), the Environment Act (HMSO, 2021a), the Global Biodiversity Framework (2022) and the UK Environment Improvement Plan (Defra, 2022) were just a few examples. Different mechanisms were available to protect sites and to promote woodland conservation, such as designations specifically for nature conservation purposes or for protecting woodlands as parts of unique landscapes. Others intended to influence general woodland management (Thomas et al., 1997). Following the launch of the 1994 UK Biodiversity Action Plan (Defra, 1994), action plans were developed to aid the recovery of priority species and habitats throughout the country. Over the years, many projects have been initiated to restore native

woodland, especially in Scotland. These initiatives had been undertaken by various organisations, often in partnership with environmental NGOs, such as the Woodland Trust and the National Trust, which played a lead role (Newton et al., 2001).

In 2005, the Government's policy for native and ancient woodland and veteran trees in England, 'Keepers of Time' (Defra & Forestry Commission, 2005), set out principles and objectives specifically to protect and improve these woodland habitats, but now also individual trees of particular value (Defra et al., 2022). The goal was to preserve and enhance the natural condition of as many ancient woodland sites and veteran trees as possible (Defra & Forestry Commission, 2005). The document also introduced restoration targets, including maintaining the existing area of ancient woodland, increasing the net area of other native woodlands, and avoiding significant or unnecessary losses of known veteran trees (Defra & Forestry Commission, 2005). Since 2006, Natural England and its partners have continued to update the Ancient Woodland Inventory. The updated inventory identified more areas of ancient woodland in England and included, for the first time, woodlands smaller than 2 hectares. The Woodland Trust has also developed an Ancient Tree Inventory to identify and protect notable ancient and veteran trees (Defra et al., 2022). The Forestry Commission's practice guide on 'Managing ancient and native woodland' (Forestry Commission, 2020b) provides specific guidance to help land managers make appropriate management decisions.

To support the idea of rewilding, the rewilding network 'Rewilding Britain' was established in 2015. The network promotes the restoration of ecosystems and biological diversity, aiming to support rewilding projects across Britain. The 500 network members comprise landowners, land managers, local rewilding groups, and marine project partners across England, Scotland, and Wales (Rewilding Britain, 2022). Several projects linked to woodlands have already been initiated or planned. The UN Decade on Ecosystem Restoration 2021–2030 is expected to accelerate and further mobilise action and resources to scale up forest restoration (Fuentes-Montemayor et al., 2022). In response to new international obligations (CBD, 2022), the UK Government also committed to protecting and managing 30% of land by 2030. Local Nature Recovery Strategies (LNRSs), established under the Environment Act 2021, are one way to achieve this goal (Woodland Trust, 2023).

In 2022, of the total UK woodland area, 0.86 million hectares (27%) was owned or managed by the public forest estates (PFE), i.e., Forestry England, Natural Resources Wales, Forestry and Land Scotland, or the Forest Service (in Northern Ireland), ranging from 16% in England to 53% in Northern Ireland (Forest Research, 2022). The other forest owners comprised approximately 38.0% private owners, 12.4% private businesses, 8.2% charities, 6.3% local authorities, and 1.6% other public owners, as well as 0.5% crown, church, and educational institutions. Additionally, 21% of the

woodland area in Great Britain was held in mixed ownership (Forest Research, 2020). 20% of all ancient woodland across the UK was part of the public forest estates; it was predominantly made up of plantations on ancient woodland sites (PAWS) (c. 91,000 hectares). Private landowners, charitable organisations, and other public bodies, such as the Crown Estate, owned 80% of ancient woodland. Of this, approximately two-thirds was ancient semi-natural woodland (ASNW) (c. 313,000 hectares) and one-third was plantations on ancient woodland sites (c. 177,000 hectares) (Reid et al., 2021).

In the financial year 2021/22, net expenditure on public forests by Forestry England, Forestry and Land Scotland and Natural Resources Wales totalled £2.8 million. This comprised £12.4 million in England, £6.5 million in Scotland and £3.1 million in Wales. Recreation, conservation and heritage accounted for £72.8 million of the total expenditure, harvesting and haulage for £46.8 million and other expenditure for £138.7 million. Timber sales generated a total income of £188.8 million, while recreation, conservation, and heritage activities generated £33.2 million, and another £33.4 million came from other sources. Moreover, £69.5 million was paid in grant money relating to forestry: £45.8 million in Scotland, £14.8 million in England, £6.1 million in Wales, and £2.8 million in Northern Ireland (Forest Research, 2022).

Section 5: Results, successes and challenges

Results

Restoring forest cover

The woodland area in the UK (as of 31 March 2022) was estimated to be 3.24 million hectares. Of this total, 1.49 million hectares were in Scotland, 1.32 million hectares in England, 0.31 million hectares in Wales and 0.12 million hectares in Northern Ireland (Forest Research, 2022). The UK land area covered by woodland during 1995*–2022 increased by 1.3%, from 12% in 1995 to 13.3% in 2022 (Table 10). The woodland area had increased by over 300,000 hectares between 1998 and 2022. 13.8 thousand hectares of newly created woodland were reported in 2021/2022; most of this new planting (95%) occurred on private land (Forest Research, 2022).

Table 10. Woodland area in the UK, 1990/1995* to 2022 as a percentage of land area. Source: Forest Research, 2022.

Year	England	Wales	Scotland	Northern Ireland	UK
1995	8.4	13.8	16.4	6.0	12.0
2022	10.2	15.0	19.1	8.5	13.3

*No data was available for 1990; the earliest available data found was for 1995 or 1998

Although overall woodland cover did increase throughout this period, the aspired annual expansion targets were not achieved in any of the four countries. The deficit was highest in Wales and Northern Ireland (Reid et al., 2021). In the annual UK woodland survey, the majority of respondents (84% in the UK and England) who had visited woodlands agreed or strongly agreed that *"a lot more trees should be planted"* (Forest Research, 2023). Figure 5 shows that the amount of grant money paid for woodland expansion and management in the UK as a whole between 2008/09 and 2021/22 has increased during this period. However, grant money paid for England has declined (Forest Research, 2022).

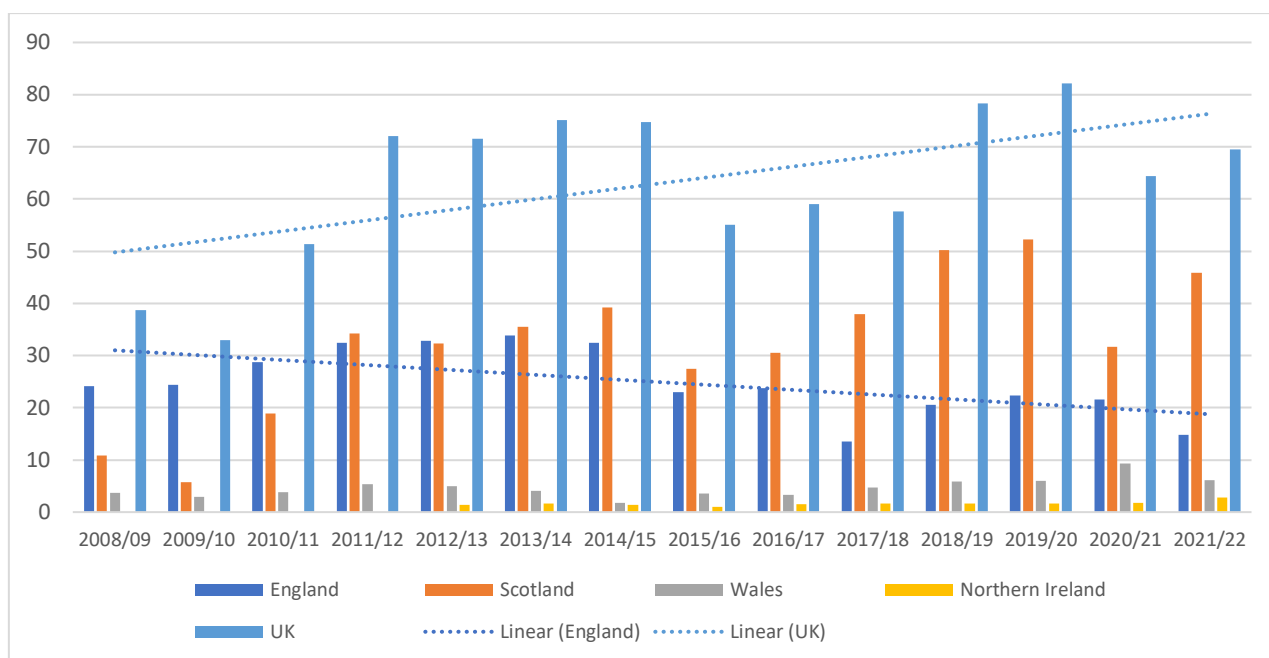


Figure 5. Grant money paid for woodland expansion/management between 2008/09 – 2021/22 (£ million). In the UK, the financial year begins on 5 April and ends on 6 April the following year. Source: Forest Research, 2022; FoE, 2019.

Conifer/Broadleaved Ratio

Conifers accounted for around half (51%) of the entire woodland area in the UK in 2022: around 26% in England and around 73% in Scotland (Table 11) (Forest Research, 2022). The goal was to achieve a 60:40 ratio of broadleaf trees to conifers (CCC, 2018). The highest proportion of broadleaf woodland was found in southern England, while the highest proportion of coniferous woodland was observed in Scotland. Northern England, Northern Ireland, and areas of Scotland had particularly low broadleaved woodland cover. Broadleaf and conifer woodlands both contained non-native species; Scotland had the only native forest-forming conifer, the Scots pine. In contrast, the UK's commonest non-native broadleaves were sweet chestnut and sycamore (Reid et al., 2021).

Table 11: Area of woodland in thousand hectares, UK, March 2022. Source: ONS, 2022.

Forest Type	England	Wales	Scotland	Northern Ireland	UK
Conifers	343	152	1,092	64	1,650
Broadleaves	980	159	395	54	1,587
Total	1,323	310	1,486	118	3,237

UK percentage	41	10	46	4	
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Restoring the quality of woodland

Certification

1.42 million hectares of woodland in the UK were certified at 31 March 2022. This represented 44% of the total UK woodland area, with 24% in England, 47% in Wales, 60% in Scotland, and 56% in Northern Ireland (Table 12) (Forest Research, 2022). It included all woodland managed by Forestry England, Natural Resources Wales, Forestry and Land Scotland, and the Forest Service in Northern Ireland (858,000 hectares), as well as an additional 562,000 hectares of private sector woodland (Forest Research, 2022). Thus, the original goal to certify as many public and private forests as possible (Defra, 2015) has, in part, been achieved. Certified woodland was either certified under the Programme for the Endorsement of Forest Certification (PEFC) scheme or the Forest Stewardship Council (FSC) scheme, with many accredited woodlands under both (Forest Research, 2022). On the Government-owned public forest estates (PFE), all ancient woodland was managed under UKWAS. However, the proportion of certified privately owned ancient woodland was unknown (Reid et al., 2021).

Table 12. Woodland area certified by different owners in the UK, as of 31 March 2022 (thousand hectares). Source: Forest Research, 2022.

Country	FE/FLS/NRW/FS*	Private sector	Total	Percentage of woodland area (%)
England	214	101	315	24
Wales	115	30	145	47
Scotland	467	428	895	60
Northern Ireland	62	3	65	56
UK	858	562	1,420	44

*FE: Forestry England, FLS: Forestry and Land Scotland, NRW: Natural Resources Wales, FS: Forest Service (Northern Ireland). NRW estimates only relate to the Welsh Government Woodland Estate (WGWE).

Condition of woodlands

The National Forest Inventory (Forestry Commission, 2020a) summarised the state of all woodlands (obtained from ecological data/samples from over 15,000 representative woodland sites in Great Britain), including the condition of non-native woodlands, namely plantations and specific woodland

habitat types (Table 13). All woodland types were lacking in trees, deadwood and open space. Just 7% of native woodlands are in good ecological condition (Reid et al., 2021). No comparable information was found for 1990 or the years shortly after that.

Table 13. Compositional and structural state condition indicators of all woodlands in Great Britain - 2010 to 2015 survey cycle. Source: ONS, 2022.

Condition indicator	Unfavourable		Intermediate		Favourable	
	Area (ha)	%	Area (ha)	%	Area (ha)	%
Compositional state						
Tree health – pests and diseases	73,692	2	326,408	11	2,547,733	86
Invasive species	220,949	7	23,855	1	2,703,484	92
Regeneration at component group level	0	0	2,628,638	89	319,196	11
Structural state						
Number of native trees and/or shrub species	1,402,259	48	585,098	20	960,477	33
Deadwood volume (m3 per ha)	2,250,883	76	515,164	17	181,787	6
Vertical structure	633,582	21	1,211,071	41	1,103,182	37
Veteran trees	2,928,501	99	5,645	0	13,688	0
Age distribution of tree species	1,189,376	40	1,421,369	48	337,089	11
Proportion of open space	2,419,080	82	525,399	18	3,354	0

Since 2010, over 27,000 hectares of plantations on ancient woodland sites in England have been restored, improving their ecological condition (Defra et al., 2022). Table 14 presents the latest findings on the condition of designated woodland sites with the strictest protected area designations (SSSIs and SACs) in England in 2022. Conditions have been classified as favourable (best condition) through to destroyed (worst condition). Such legally protected woodlands are regularly measured for their condition (ONS, 2022). No comparable information was found for 1990 or the years shortly after that.

Table 14. Area of protected woodland sites (SSSIs and SACs) in England by condition in 2022. Source: ONS (2022) and Natural England.

Habitat	Condition	2022 hectares	2022 percentage
Broadleaf, mixed and yew woodland – Lowland	Favourable	38,749	49
	Recovering	35,211	45
	Unfavourable	5,077	6
	Destroyed	13	0
Broadleaf, mixed and yew woodland – Upland	Favourable	6,093	40
	Recovering	7,214	47
	Unfavourable	1,905	12
	Destroyed	37	0
Coniferous woodland	Favourable	2,500	11
	Recovering	21,052	89
	Unfavourable	40	0
	Destroyed	0	0

In Wales, the number of protected woodland sites for broadleaf, mixed, and yew woodland, categorised by condition, in 2020 was as follows: 30 sites were favourable, 112 sites were unfavourable, and 169 sites were classified as unknown. Scotland's proportion of protected woodland sites in favourable condition was 63% in 2022 (ONS, 2022). No information was found for Scotland and Northern Ireland.

Challenges

Despite a more than threefold increase in woodland cover since the 1920s to now 13.3%, the UK still has one of the lowest woodland covers in the EU, where the average is 36%. However, it is increasingly difficult to find suitable land for further afforestation (Forest Research, 2019). Moreover, funding for afforestation and forest restoration is limited and can be complicated to obtain. For instance, a recent study by Friends of the Earth (2019) found it challenging to get a detailed breakdown of how much money was explicitly distributed for trees and woodlands under farm subsidies. Moreover, the study found that many of the available grant schemes have similar sounding names or aims, making it difficult to distinguish one from another (FoE, 2019).

In terms of increasing the quality of woodlands, both certification schemes and conservation designations also have their limitations. Protected designation areas often lack sufficient funding, have inadequate enforcement measures, or face weak political commitment (Razzaque & Lester, 2020). As a result, the extent of ASNW sites, for instance, is still declining or being converted into PAWS (Razzaque & Lester, 2020). Progress in restoring plantations on ancient woodland sites (PAWS) to a more 'natural' state on the public forest estate has also been slow across the UK; many ancient woodland sites remain in a critical or threatened condition (Reid et al., 2021). Sixty per cent of PAWS are located on private land (Reid et al., 2021), and 17,399 hectares of these are still threatened (ONS, 2022).

The main reasons for adverse conditions of designated Sites/Areas of Special Scientific Interest SSSI/ASSIs woodland stands varied by country (Table 15). Overgrazing (by wild herbivores and livestock) was one of the top five reasons in England, Northern Ireland, and Scotland. Invasive species (native and non-native) were having severe impacts in Northern Ireland and Scotland. Native species with the potential to become invasive include bracken and other scrubby species; non-native species include rhododendron, Himalayan balsam, Japanese knotweed, and cotoneaster. Inappropriate woodland management was the reason for adverse conditions in 20% of England's woodland SSSIs. Moreover, recreational and agricultural activities continue to create adverse conditions in SSSIs in Northern Ireland and Scotland (Reid et al., 2021).

Table 15. Top 5 reasons for adverse conditions of Sites/Areas of Special Scientific Interest in each country (percentage of all sites affected in brackets). Source: adapted from Reid et al., 2021.

England	Scotland	Northern Ireland
Inappropriate forest management (20%)	Overgrazing (57%)	Alien and problematic species (23%)
Deer grazing/browsing (7%)	Presence/changing extent of non-native invasive species (41%)	Intensive (over) grazing by livestock (15%)
Agriculture – overgrazing (4%)	Recreation/invasive species (9%)	Invasive species, including bracken/scrub (13%)
Other (4%)	Recreation/disturbance (3%)	Overgrazing, incl. deer browsing (10%)
Inappropriate scrub control (3%)	Agricultural operations (3%)	Other (1.3%)

Conclusion

Woodland cover in the UK has more than tripled in the last 100 years, but the country still has one of the lowest woodland coverages in the EU, and much of it consists of non-native coniferous tree species. Native woodlands remain in poor ecological condition, are threatened by development, are isolated, and continue to experience declines in wildlife populations (Reid et al., 2021). Despite the importance of native, especially ancient woodland, for biodiversity and cultural heritage, protection for the small remaining areas is still weak and poorly enforced. No comprehensive legislation exists to protect all ancient woodlands; only those designated as Sites of Special Scientific Interest or Special Areas of Conservation are reasonably well protected (Reid et al., 2021). There is, therefore, still a need for greater protection in national forestry policies and legislation for ancient and native woodlands outside the designated protected site system (Thomas et al., 1997). Although significant problems remain, there is a growing awareness of the need to further increase tree cover and enhance the quality of both existing and newly established forests. Moreover, woodland restoration initiatives have increased in number and, over recent years, have become larger-scale, while experience in forest restoration has also rapidly developed.

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Part 2: Summary table

Indicators	<1990	>1990
Forest area restored file:///nas.ads.mwn.de/ge26qey/TUM-PC/Desktop/EFI_UK_Report/UK_Narrative_Draft_3.docx	Afforested: 2.024 million ha Forest Nature Reserves: 6,060 ha England: 98 ,423 ha new designations Wales: 10,783 ha new designations No information was found for Scotland and Northern Ireland	Afforested: Total: 3.24 million ha Certified: 1.42 million ha Restored: 27,000 ha plantations on ancient woodland sites restored to native/semi-natural since 2010
Number of projects/initiatives	Afforested: 230 new state forests by 1939, no of private initiatives unknown Designations: 11 Forest Nature Reserves; 43 National Nature Reserves with woodland present	Afforestation: hundreds Restorations: hundreds
Geographical distribution	Afforestation: mainly Scotland, but also England Restoration: mainly Scotland, but also England	Afforestation: mainly Central England and Scotland, urban fringes Restoration: mainly Scotland and England
Spatial scale	Large and small scale afforestation, small scale conservation (80% <20ha/project; 2%>100ha/project)	Large and small scale afforestation, small and increasingly large scale restoration Small patch, 1,560 ha/project
Land use/management regime pre	Grassland, bare area / Intensive animal farming	Grassland, bare area / Extensive animal farming

Abiotic conditions	Semi-arid, blanket bog, deep peat, low organic matter, steep terrain	Semi-arid, blanket bog, shallow peat, steep terrain
Forest category and type	Atlantic oak and beech forests, Tilio-Acerion ash dominated woodland, Caledonian pine forest as main types.	Atlantic oak and beech forests, Tilio-Acerion ash dominated woodland, Caledonian pine forest as main types.
Main driver(s) of degradation	Fire, grazing, conversion to non-native conifer plantations	Grazing, fire, invasive species, pests and disease, developmental pressures, climate change
Ecological condition pre (1–5)	1–3	2–4
Restoration goals	Timber production, job creation, landscape aesthetics Habitat restoration	Carbon sequestration, biodiversity, Water quality, reduce disaster risk, timber production, habitat restoration
Approach	Active	Active Passive
Type	Afforestation Protection / conservation	Afforestation, restoration, rewilding, certification
Activities	Afforestation: Planting of mainly non-native saplings, mulching, thinning, individual tree protection, fencing, reduction of livestock and deer Restoration: planting of mainly native saplings, mulching, thinning, individual tree protection, fencing, reduction of	Planting of saplings, mulching, thinning, individual tree protection, fencing, reduction of life stock, pest monitoring Restoration: planting of mainly native saplings, mulching, thinning, individual tree protection, fencing, reduction of livestock and deer, some natural regeneration, reduction of non-native tree species, introduction of wider



	livestock and deer, some natural regeneration	native flora and fauna, including extinct species
Species used	Afforestation: Norway spruce (introduced) Sitka spruce (introduced) Corsican pine Scots pine European larch Japanese larch Douglas fir Oak Beech Alder Aspen Holly Rowan Ash Willow Elm hazel Conservation / Restoration: Scots pine Oak (<i>Quercus petraea</i> and <i>Q. robur</i>) Birch Beech Alder Aspen Holly Rowan Ash Willow Elm hazel	Afforestation: Norway spruce (introduced) Sitka spruce (introduced) Corsican pine Scots pine European larch Japanese larch Douglas fir Oak Beech Alder Aspen Holly Rowan Ash Willow Elm hazel Conservation / Restoration: Scots pine Oak (<i>Quercus petraea</i> and <i>Q. robur</i>) Birch Beech Alder Aspen Holly Rowan Ash Willow Elm hazel



Genetically modified organisms	No	Not in field (some experimental trials)
Management for old-growth forest	Yes	Yes
Land owner/manager	Forestry Commission (public administration), private forest owners, NGO's (Woodland Trust, National Trust, County Wildlife Trusts)	Forestry Commission, Forestry and Land Scotland, Forest England, Natural Resources Wales, Forest Service in Northern Ireland (= all public administration), private forest owners, NGOs (Woodland Trust, National Trust, County Wildlife Trusts)
Sources of funding	Public administration/private funds, small amounts of NGO funds	Public administration, private funds, NGO funds, crowd sourcing
Funding beneficiary	Forestry Commission, private owners, (NGOs)	Forestry Commission, private owners, (NGOs)
Budget /cost	Afforestation: original estimated budget £18,425,000 Restoration: unknown	Afforestation: dedicated governmental funds at least £758 million Restoration: unknown
Socioeconomic benefits	Timber production, job creation, security, landscape amenity, recreation, scientific	Carbon sequestration, timber production, erosion control, water purification, biodiversity, woody biomass, recreation
Stakeholder groups	National government, forestry department, Treasury, private forest owners, NGO's, environmentalists, scientists, recreationalists	National government, forestry department, Treasury, private forest owners, NGO's, environmentalists, scientists, recreationists, farmers
Stakeholder involvement (1–5)	2	Probably now 3, ie.more than before

Level of success (1–5)	3	Better than before probably, 4
Land use/management regime post	Land purchase, land preparation, planting of saplings, clearcut plantations, inventories, surveys, fencing, reduction of livestock and deer	Land purchase, land preparation, planting of saplings, clearcut plantations, inventories, surveys, fencing, reduction of livestock and deer
Ecological condition post (1–5)	3	Probably about the same, improvement in some areas offset by declines elsewhere
Ecological recovery (1–5)	2	Some recovery
Socioeconomic improvement (1–5)	3	Some improvement
Main obstacles	Lack of local stakeholder involvement, conflicting goals	Funding, land availability, lack of interest from land owners particularly farmers
Monitoring (yes/no) – Indicators	Yes. Tree survival rate,	Some monitoring going on
Stakeholder satisfaction (1–5)	3	No idea

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Appendix 1: The principle conservation designations in the UK

Nature conservation

- National Nature Reserves (NNR)
- Local Nature Reserves (LNR)
- Sites of Special Scientific Interest (SSSI)
- Special Protection Areas (SPA)
- Special Areas of Conservation (SAC)

International Nature Conservation Designations

- Biosphere Reserves
- Biogenetic Reserves
- World Heritage Sites
- Council of Europe Diploma Sites
- Ramsar Sites

Landscape conservation

- Areas of Outstanding Natural Beauty (AONB)
- Heritage Coasts
- National Scenic Areas (NSA) (Scotland only)
- Regional and Country Parks (Scotland only)

Natural heritage conservation

- National Parks
- Environmentally Sensitive Areas (ESA)
- Natural Heritage Areas (NHA) (Scotland only, none designated at this time)

(Bishop et al., 1995)

Appendix 2: Specific measures taken under the UKWAS UK Woodland Assurance Standard (2021)

- 1) New woodlands shall be located and designed in ways that will
 - Deliver economic goods and/or ecosystem services,
 - Maintain or enhance the visual, cultural and ecological value and character of the wider landscape, and
 - Ensure the creation of a diverse woodland over time.
- 2) Even-aged woodlands shall be gradually restructured to achieve an appropriately diverse mosaic of species, sizes, ages, spatial scales, and regeneration cycles. This structural diversity shall be maintained or enhanced.
- 3) The range of species selected for new woodlands, and natural or artificial regeneration of existing woodlands, shall be suited to the site and shall take into consideration:
 - Improvement of long-term forest resilience
 - Management objectives
 - Requirements for conservation and enhancement of biodiversity (see section 4)
 - Requirements for enhancement and restoration of habitats (see section 4)
 - Landscape character.
- 4) Regeneration (natural or planted) shall restore stand composition in a timely manner to pre-harvesting or more natural conditions.
- 5) Native species shall be preferred to non-natives. If non-native species are used, it shall be shown that they will clearly outperform native species in meeting the owner's objectives or in achieving long-term forest resilience.
- 6) Non-native tree species shall only be introduced to the WMU when evidence or experience shows that any invasive impacts can be controlled effectively.
- 7) Other non-native plant and animal species shall only be introduced if they are non-invasive and bring environmental benefits.
- 8) All new introductions shall be carefully monitored, and effective mitigation measures shall be implemented to control negative impacts outside the area in which they are established.
- 9) In semi-natural woodland, lower-impact silvicultural systems shall be adopted. All felling shall be in accordance with the specific guidance for that type of woodland in the relevant Forestry Commission Practice Guide.
- 10) 10) In semi-natural woodlands over 10 ha, no more than 10% shall be felled in any five-year period unless justified in terms of biodiversity enhancement or lower impact.

- 11) Management planning shall identify a minimum of 15% of the WMU where management for conservation and enhancement of biodiversity is the primary objective.
- 12) This shall include conservation areas and features identified in the following sections:
 - 13) Statutory designated sites
 - 14) Ancient semi-natural woodland
 - 15) Plantations on ancient woodland sites
 - 16) Other valuable semi-natural habitats
 - 17) Areas and features of critical importance for watershed management or erosion control
 - 18) Natural reserves
 - 19) Long-term retentions and/or areas managed under lower-impact silvicultural systems (LISS)
- 20) 13) Management strategies and actions shall be developed to maintain and, where possible, enhance the areas and features of high conservation value identified in the following sections:
 - 21) Statutory designated sites
 - 22) Ancient semi-natural woodland
 - 23) Plantations on ancient woodland sites
 - 24) Areas and features of critical importance for watershed management or erosion control
 - 25) Management strategies and actions shall be developed in consultation with statutory bodies, interested parties and experts.
 - 26) Management of wild deer shall be based on a strategy that identifies the management objectives and aims to regulate the impact of deer.