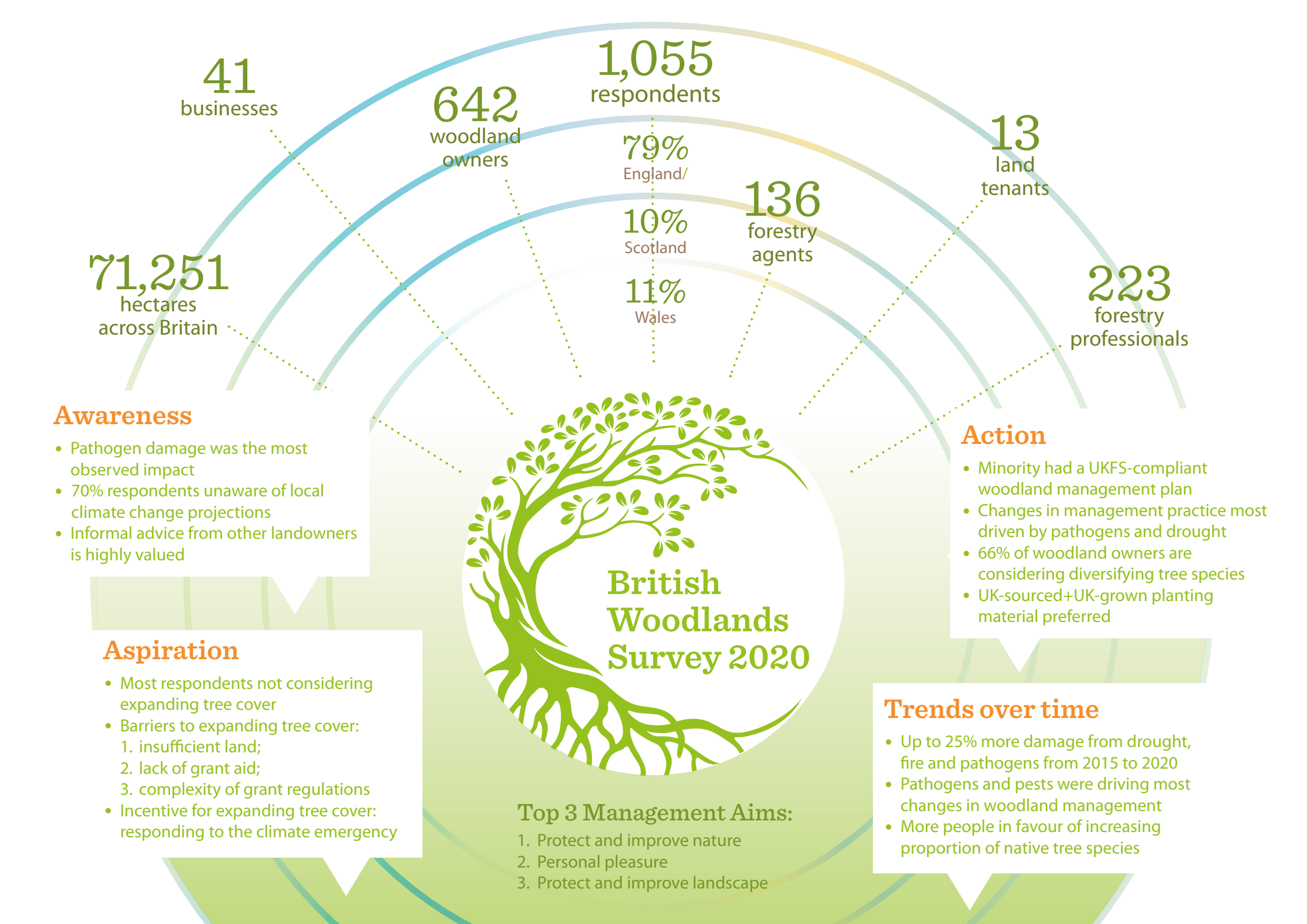
Awareness, action and aspirations in the forestry sector in responding to environmental change:

Report of the British Woodlands Survey 2020

2020 BRITISH WOODLANDS SURVEY


41
businesses
642
woodland
owners
1,055
respondents
79%
England/
10%
Scotland
11%
Wales
136
forestry
agents
13
land
tenants
71,251
hectares
across Britain
223
forestry
professionals
British
Woodlands
Survey 2020
Awareness
• Pathogen damage was the most observed impact
• 70% respondents unaware of local climate change projections
• Informal advice from other landowners is highly valued
Action
• Minority had a UKFS-compliant woodland management plan
• Changes in management practice most driven by pathogens and drought
• 66% of woodland owners are considering diversifying tree species
• UK-sourced+UK-grown planting material preferred
Aspiration
• Most respondents not considering expanding tree cover
• Barriers to expanding tree cover:
1. insufficient land;
2. lack of grant aid;
3. complexity of grant regulations
• Incentive for expanding tree cover: responding to the climate emergency
Top 3 Management Aims:
1. Protect and improve nature
2. Personal pleasure
3. Protect and improve landscape
Trends over time
• Up to 25% more damage from drought, fire and pathogens from 2015 to 2020
• Pathogens and pests were driving most changes in woodland management
• More people in favour of increasing proportion of native tree species

Contents

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We are indebted to the 1,055 respondents for the time taken to respond to the survey and for sharing so readily their awareness, actions and aspirations about environmental change in Britain.

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Executive summary

The British Woodlands Survey 2020 (BWS2020) was a multi-partner project, led by the Sylva Foundation and undertaken with funding from the Forestry Commission to explore awareness, action, and aspiration among the forestry sector to environmental change. The survey was the first repeat of a similar and baseline survey undertaken in 2015, providing an opportunity to explore changes over time. Although Britain-wide in perspective, the outcomes from BWS2020 will be fed directly into the work of the Forestry and Climate Change Working Group which oversees the delivery of an action plan to support climate change adaptation in England.

SURVEY RESPONSE

- 1,055 people responded, 74% of whom were woodland owners or agents.
- The woodland area represented by the survey was 71,251 hectares; equivalent to 3% of privately-owned woodland area in Britain.
- Coverage was not evenly distributed between the three countries, with the majority of respondents being in England (79%), the remainder approximately equally distributed in Scotland and Wales.

AWARENESS

- In 2020, people are more aware than they were in 2015 of environmental change.
- There were significant increases (up to 25%) in observations of threats from drought, fire, and pathogens.
- Country and regional differences were also apparent, with increased observations of fire damage in Scotland, and increases in damage from drought and pests in the east of England.
- 70% of respondents had not reviewed local climate change projections.
- We adopted an approach to profile the respondents' prevailing ecological worldviews, and discovered that there was a significant correlation with a range of actions and aspirations.
- We found that informal advice from other landowners is highly valued, while in 2020 there was a significant decrease in the use of external consultants and government Woodland Officers.

ACTION

- Most respondent woodland owners (69%) did not have a UKFS-compliant management plan in place. Lack of engagement with the UKFS and potentially failure in compliance is a serious impediment to progress towards climate change action policies.
- Respondents indicated that the more significant causes of environmental damage had already led them to alter some management practices.
- Among four important management activities for adaptation, two were being adopted by the majority (reviewing tree species suitability and implementing continuous cover management), two other actions (reviewing climate change projections and gaining understanding of soils) were not, which could undermine good decision making.
- Adaptation deficit is largest where timber production is not a major management objective.
- Levels of future intended activity among woodland owners were highly predictable based on current activity level. While this may be intuitive, it strongly reinforces the value of advocacy in terms of changing attitudes and behaviours, and should provide confidence to policy makers in the efficacy of such programmes.
- Most respondents favoured an increase in native species from the current level as they did in 2015, but this increase had risen by 3% to 65% native species in 2020. Preferences in native *vs.* non-native tree species varied by a respondent's aims for managing their woodland.
- As a management aim, ensuring the resilience of future carbon stocks ranked highly as a motivation, and as an overall aim of management (rank 6 from 16).
- Among those considering creating new woodland, adoption of the Woodland Carbon Code was not seen as a priority while some indicated the need for more information about the scheme.

In 2020, people are more aware than they were in 2015 of environmental change.

BWS2020 Report.

ASPIRATION

- In response to the climate emergency, among four choice options, most respondents said they were likely to alter their management activities, while others said they would increase hedgerows/ shelterbelts, create more new woodlands, and create new agroforestry systems.
- Unlike the response to the climate emergency, which perhaps reflected long-term aspirations, most respondents said that they did not intend to expand tree cover in the next five years, most often due to lack of available land. Lack of grant aid was cited as another cause, where there was evidence of considerable frustration with the complexity of regulations relating to grant aid.
- Most woodland owners were considering diversifying the range of species in their woodlands, with most preferring UK-sourced +UK-grown material. There was not strong support for using improved material (*i.e.* Forest Reproductive Materials) among most respondents.
- There was clear support for natural regeneration to enable site-based adaptation.

STRATEGIC PROGRESS

Evidence from the 2020 survey is used to review progress in meeting the Forestry and Climate Change Action Plan. While most of its actions are underway in some form, it is clear that progress overall is insufficient and that significant barriers remain.
In summary:

– Funding and bureaucracy remain as barriers to woodland creation, even if land were available;
– A minority of all respondents have woodland management plans in place which are UKFS-compliant, with no change from 2015;
– Lack of species diversity in new tree planting;
\+ Awareness and support of planting material sourced and/or grown in the UK is encouraging;
– Lack of contingency planning could be improved by greater effort in advocacy which will yield long-term benefits;
\+ Adoption of continuous cover management forest management is encouraging;
– Low awareness of climate change projections and tree species suitability;
– Lack of clarity on best practice for adaptation measures.

Adaptation deficit is largest where timber production is not a major management objective.

BWS2020 Report.

Summary of progress

Evidence from the BWS2020 survey has been mapped against relevant actions from The Forestry and Climate Change Action Plan (FCCWG 2019) which aims to support the English forestry sector in adapting to climate change.

		ACTIONS	EVIDENCE AND INTERPRETATIONS FROM BWS2020	STATUS
POLICY	1	Integrate forest climate change adaptation policies into the new environmental land management scheme (ELMS), specifically to ensure those managing to the UKFS can access ELM payments.	Most respondent woodland owners did not have a UKFS management plan in place. Lack of engagement with the UKFS and potentially failure in compliance is a serious impediment to progress towards climate change action policies, and concerning given the very broad nature of the likely ELMs which will not be able to provide the same detail of necessary actions. Grant regulations and complexity are significant barriers to those potentially seeking to create new woodlands, which may to lead policy failure. Policy makers should take serious notice of these barriers.	
	2	Consider alternatives to clearfell systems, such as continuous cover forestry, where suitable sites and species combinations allow and management objectives are compatible.	Noting the low levels of UKFS compliance [1] and still significant proportion of respondents without any management plan with no discernible change from 2015, this suggests that there is much still do to encourage more owners to develop woodland management plans. Only when changes to the template are hastened and accompanied by a concerted effort to promote through advocacy and regulation the need for a management plan, will significant and positive change come. Behavioural evidence suggests long-term change follows adoption of resilience actions which should hearten policy makers and encourage them to invest more in advocacy, including advice and support.	
	3	Have appropriate contingency plans in place to deal with risks to the forest, including spillages, pest and disease outbreaks, extreme weather events and fire.	This is urgent and should inform [Item 2].	
	4	Consider projections of changes to rainfall patterns when specifying designs for culverts, drainage systems and roads.	Evidence from BWS2020 could be used alongside the England Tree Strategy (live summer 2020) to help develop forestry policy that supports climate change adaptation and environmental resilience.	
RESEARCH	5	Continue research to identify alternatives species and provenances and better understand the genetic basis of resilience of a range of tree species, including establishing more trial plots.	There are wide-ranging divergent views on tree species and genetic diversity. While some in the sector may wish to see greater uptake of Improved material and/or a wider range of sources (*e.g.* provenances)—noting that both these do not necessarily mean exotic choices— our respondents consistently (and increasingly; 2015-2020) favour an increase in native species. To satisfy this demand, research leaders might want to consider investing more effort into diversifying and improving native tree species. Evidence for benefits remains poor and under-studied.	
	7	Review, develop and integrate decision support systems (DSS) such as ESC and resources such as Silvifuture to increase usability for practitioners and encourage uptake.	Use of many of these tools remain low level, with ESC used by *c.*25% of woodland owners (but 58% of agents), with some tools like Silvifuture having a very low profile. There is scope for them to be more deeply embedded in guidance and regulations.	
PRACTICE	9	Build and promote case studies of successful initiatives and increase effectiveness of knowledge sharing.	Woodland owners are more likely to collaborate for the purposes of sharing knowledge with fellow owners than to engage in other activities. Perhaps more local networks could be encouraged, whether formal or otherwise. Support could be given in different forms to encourage practitioners to share good practice.	
	10	Create a knowledge hub that supports correct species choice, use of mixtures and silvicultural choices.	Magazines remain the top source of trusted advice over web-based sources. We may need to consider additional means to online provision for any 'hub'.	
	12	Provide guidance on the financial impact of silvicultural choices now and in the future.	Many comments received about the Woodland Carbon Code indicate the effort required to support knowledge and understanding about complex issues. More support from specialist advisors may be necessary.	
	13	Incentivise nurseries to grow adequate stocks of adapted planting stock in the UK that meet best biosecurity standards as set by the Plant Healthy Certification Scheme.	Insufficient specific evidence gathered about tree nurseries inBWS2020. The context of the market is important to consider here in terms of desire to use 'adapted' planting stock [see 5 above].	

On target Some progress No progress

Introduction

ABOUT THE BRITISH WOODLANDS SURVEY

The British Woodlands Survey (BWS) gathers evidence about Britain's woodlands and those who care for them. The BWS aims to provide an evidence base on which future policies and practice can be developed.

The British Woodlands Survey is coordinated by Sylva Foundation and run in partnership with a large number of organisations. Summary results are always published in a report and made freely available. Where possible data collected is also used to support peer-reviewed scientific research.

For more information visit: www.sylva.org.uk/bws

HISTORY OF THE BWS

The first British Woodlands Survey was held in 2012 which itself built upon an important series of surveys undertaken by the Department of Land Economy at the University of Cambridge since 1963. The intention was always that a major survey was repeated every five years, while any number of additional surveys on specific themes may be run as required.

To date the surveys completed are:

- BWS2012 – Major Survey
- BWS2014 – Ancient Woodlands
- BWS2015 – Environmental Change
- BWS2017 – Major Survey
- BWS2020 – Environmental Change

BWS2020 is the first repeat survey of the BWS exploring the theme of environmental change, the first having taken place in 2015.

IMPACT OF THE BWS

The intention of the BWS is to provide increasingly valuable data and insights along a longitudinal time series. The BWS has had significant impact since its inception, including:

- BWS2015 (exploring environmental change) used as key evidence for the need to develop a Climate Change Action Plan by the Forestry Climate Change Working Group in 2018, comprising 24 or more organisations: www.rfs.org.uk/media/512806/action-plan-for-climate-change-adaptation.pdf
- BWS2015 cited as evidence in the government's Committee on Climate Change 2017 evidence report, for a low level of understanding and action among stakeholders. Chapter3, p.78: www.theccc.org.uk/tackling-climate-change/preparing-for-climate-change/uk-climate-change-risk-assessment-2017/ccra-chapters/natural-environment-and-natural-assets/
- BWS2017 used by FSC-UK to help revise its standards and develop new provision for small woodlands: www.fsc-uk.org/en-uk/get-involved/small-woods-project-2018-19
- Supported ongoing social research exploring understanding among landowners about payment for ecosystem services led by Forest Research: www.forestresearch.gov.uk/research/exploring-land-manager-views-payments-ecosystem-services-networks-and-learning
- BWS2015/BWS2017 prompted research commissioned by Defra to develop responses to pest and disease outbreaks, and the new Environmental Land Management scheme under development.
- Provided information to support work within Government developing guidance, communication and incentives to target better different kinds of owners, and influential in supporting the need for a 'climate change knowledge hub' (Ambrose-Oji *et al.* 2019).
- 'The insight provided by BWS in recent years has helped the Woodland Trust to understand the motivations and needs of woodland owners and managers. This is critical in allowing us to develop our offers of support to prospective and existing woodland owners. It is also vital as evidence for lobbying and advocacy in support of the woodland sector. The more people participate, the stronger the evidence.'
  Mike Townsend, Principal Advisor, Woodland Trust.

ENVIRONMENTAL CHANGE

Environmental change is having far-reaching impacts on the health and productivity of our trees and woods. Woodland owners and managers have always managed risk and uncertainty, but the pace and scale of environmental change experienced over the past 25 years and anticipated over the next 50 years are unprecedented.

A number of influential reports in the last two years have only reinforced the impending climate crisis, while environmental change in the form of flooding, drought, and damage from new pests and pathogens is omnipresent. The United Nations Intergovernmental Panel on Climate Change (IPCC) recently concluded that society has very limited time to avert a 'climate change catastrophe' (IPCC 2018). The UK's Met Office Hadley Centre most recent climate change projections (UKCP18) reiterated the very significant challenges to the landscape and our way of life in the UK. In July 2019, the Government amended the Climate Change Act (2008) to legislate for net zero emissions by 2050. In 2019, the IPCC published its Special Report on Climate Change on Land, highlighting that climate change was already having a significant impact on land management, the scale of the contribution from land and land management to global greenhouse gas emissions and the nature of sustainable land use change that will be required if society is to meet the emissions reduction goals set out in the Paris Agreement (IPCC 2019).

SURVEY SCOPE AND PURPOSE

The purpose of BWS2020 was to explore adaptation to environmental change (for definitions see Box 1) in British woodlands, and their potential resilience, by assessing awareness, action and aspiration among woodland owners, managers and related professionals. The survey follows a British Woodlands Survey undertaken on the same theme in 2015 (BWS2015) and so potentially offers valuable insights to any changes over time.

BWS2015 was commissioned to provide a baseline of evidence for the 2015 Climate Change Accord, signed by more than 30 organisations within the English forestry sector that coalesced around a call for action to be taken to ensure our trees, woods and forests are more resilient. The Accord states:

> "We believe that it is necessary to act now to provide a secure future for our forests, woods and trees, that significant changes are required to widely-accepted and practiced systems of management to make them resilient, and we are committed to help realise the vision set out in this Accord."

Since then, a group of organisations has come together, first to devise and subsequently to deliver an action plan to support the work of the Accord, known as the *Forestry and Climate Change Working Group* (FCCWG 2018). The FCCWG have been instrumental in supporting the development of BWS2020, and its results are designed to help inform its ongoing work including regular reporting (*e.g.* FCCWG 2019). The action plan also identified 11 critical issues that needed to be addressed (Box 2). While the FCCWG is focussed on forestry in England, its remit is of interest to the UK as a whole.

BOX 1: DEFINITIONS

Environmental Change

We adopt the term 'environmental change', as opposed to 'climate change', so as to include factors not necessarily related to a changing climate. Such examples include, but are not limited to, the arrival of a pest or pathogen due to assisted migration, changes in frequency of flooding due to river management practice, and storm events unrelated to climate change. Nonetheless such factors may be exacerbated by climate change: an example is a pathogen introduced from a warmer country via imported goods gaining a foothold in the UK due to a milder winter climate.

Resilience

The definition of resilience adopted by both the Intergovernmental Panel on Climate Change and the UK Forestry Standard is:

> The ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organisation, and the capacity to adapt to stress and change.

The three themes of BWS2020 – awareness, action and aspiration – were designed to capture important elements among decision makers that would in turn act as indicators of current knowledge about environmental change, an assessment of the current levels of relevant activity relating to woodland management and the wider forestry sector, and a measure of intention and ambition together with exploring any barriers to progress.

POLICY CONTEXT

Like BWS2015, the 2020 survey was framed around the adaptation elements of the United Kingdom Forestry Standard (UKFS), while ensuring that key policy objectives were addressed. The survey was therefore designed to support the UK's international reporting responsibilities and to assist in the development of forestry policies for England, Scotland and Wales, while also meeting specific requirements of funders and policy makers in England. These are described below.

The Intergovernmental Panel on Climate Change (IPCC) identifies three key adaptation measures:

I. autonomous adaptation occurring automatically as a response to climate change;

II. planned adaptation as a result of a deliberate policy, based on an awareness of the impacts of change, and;

III. anticipatory adaptation which takes place before any impacts are observed.

The United Kingdom Forestry Standard (UKFS) has two main adaptation requirements which are specified in the UKFS:

I. forest management should maintain or enhance the resilience of forests and forest ecosystems in order to reduce the risks posed by climate change to their sustainability;

II. forest management should enhance the potential of forests to protect society and the environment from the various effects of climate change.

The UKFS provides legal and best practice guidelines on forests and climate change (Forestry Commission 2017) in which 18 'factors' relating to adaptation are detailed under the themes of forest planning; adaptive management; tree and shrub species selection; landscape ecology, and; environmental protection.

The Welsh Government launched its five-year blueprint to tackle climate change in 2019, including proposals to grow more woodland. In Scotland, the 2018 Climate Change Plan identified several critically important roles for forestry in mitigating climate change, and identified the need to promote sustainable forestry management. Scottish Forestry has published a series of resources to support resilient forests.

Government's policy for a National Adaptation Programme (England) is overseen by Defra and sets out a vision to help make the country resilient to a changing climate (Defra 2018a). It has four main objectives (see below) plus an overarching aim to secure good evidence in which the British Woodlands Survey is referenced as the main metric for reporting progress in the uptake of adaptation measures:

1. woodland resource is expanded and better linked to enhance its resilience at stand and landscape level;

2. existing woodlands are more resilient to the impacts of climate change and pests and diseases;

3. adaptation is embedded within future forestry policy (post-CAP) to contribute to long term reductions of climate change risks; and

4. woodlands are more resilient to natural hazards.

In England, other key policies and strategies include the Government's 25-year environment plan which provides a range of wide-sweeping objectives for forestry and related land management practice (H. M. Government 2018). Another important strategy is Defra's Tree Health Resilience Strategy (Defra 2018b). A joint policy note on tree provenance choice was released in 2019 between Forestry Commission, Natural England, and the Woodland Trust (Forestry Commission *et al.* 2019). In 2020, the Forestry Commission released a guide for woodland owners and professional agents to help with managing woodlands in a climate emergency (Forestry Commission 2020). Resilience features strongly in questions posed top stakeholders in the 2020 England Tree Strategy.

BOX 2: CRITICAL ISSUES IDENTIFIED IN THE FORESTRY AND CLIMATE CHANGE ACTION PLAN:

I. Not enough woodland is being planted to enhance resilience at a landscape scale.

II. Lack of management in many woodlands is hindering implementation of adaptation measures *e.g.* opportunities for natural regeneration (which can assist adaption) are being reduced by deer browsing and the closed canopy structure of many woods.

III. New tree planting is not using sufficient quantities of genetically-diverse and/or appropriate stock, potentially limiting adaptive potential.

IV. Nurseries are not providing a wide enough range of tree species of sufficient and appropriate genetic diversity.

V. The sector is not embracing contingency planning.

VI. Low level of restocking is hindering implementation of adaptation measures.

VII. Limited uptake of continuous cover approaches to management.

VIII. Forest planning and design is not taking account of climate change impacts and projections.

IX. Lack of clarity on what adaptation measures are available and appropriate.

X. Lack of knowledge sharing of adaptation practices.

XI. Continuous Professional Development (CPD) opportunities difficult to identify and access.

Forestry and Climate Change Working Group

Research method

THE SURVEY

An online survey was opened to participants for 13 weeks (April – July 2020). People were invited to participate in a structured online survey, built in LimeSurvey, an open-source survey tool (www.limesurvey.org), version 3.23.0. The survey was presented only in English. It was designed to operate on desktop computers as well as mobile devices such as phones and tablets. It was hosted online by Sylva Foundation at www.sylva.org.uk/bws.

The survey consisted of 96 questions in 13 groups, organised within sections of relevance to four distinct types of respondent: Woodland owners; Agents; forest-related Businesses; and Professionals with an academic or policy interest in forests. Respondents were routed through the survey according to this categorisation.

The survey comprised a range of question types: multiple choice, single-choice array, Likert scale, ranking, numerical input, and free-text comment. Very few of the questions were mandatory. The benefit to those taking part in the survey is that it improves the experience – feedback from previous surveys spoke of some frustration in being required to answer all questions, whether of interest or not to the respondent – and reduces the time taken to complete the survey. However, this clearly has some implications for analysis: numbers responding to each question vary slightly throughout the survey. In the following results section, the number of respondents is shown in brackets (n) to clarify this point. Where data from two questions are compared (for example, exploring differences between respondents in Wales, Scotland and England), data had to be provided on location in addition to data in the question under consideration, and the number of responses available for analysis is therefore slightly lower than the total number who answered each question. Limitations are explained in Box 3.

BOX 3: LIMITATIONS OF THE SURVEY

In conducting this type of survey research, there are a number of considerations to take into account when interpreting the findings. The main considerations are:

1. The data reflects the views only of those who participated in the survey. We recognise that there are always those who do not or cannot engage.

2. The survey was only available to those willing to respond online.

3. Although the survey took on average 29.7 minutes to complete (median 20.4 minutes), many respondents spent considerably longer on it. As with all surveys with non-mandatory questions, there was some evidence of survey attrition (lower response rates towards the end of the survey). Randomising questions, one of the best ways of reducing attrition, was not possible because of the complex routing devised to offer different questions to different types of respondent. Randomisation was however used wherever possible within individual questions with multiple answers.

The results analysed are those received from respondents; with minor exceptions where there were obvious discrepancies, no attempt was made to verify data reported.

STATISTICAL ANALYSIS

All analysis was conducted in R (R Core Team 2018), with data cleaning and manipulation conducted using R package 'dplyr' (Wickham *et al.* 2019b). Data were matched across the 2015 and 2020 surveys.

For data with multiple questions within a data set and ordered response scales (*e.g.* aims, 0-10 scale), data were first tested for proportional odds (to determine ordinal or multinomial response) and appropriately analysed (ordinal data: ordinal logistic regression; multinomial data: log-linear models via neural networks (Venables and Ripley 2002), with an initial model including survey year, woodland role and question (plus two-way interactions) along with a fixed effect to account for individual user (ideally, each user would have been fitted as a random effect in a cumulative link mixed effects model, but computational time and convergence issues prevented this, therefore a median score was calculated across all questions per respondent and included as a covariate nested within survey year to account for any biases driven by respondents who were positive/negative across all questions). Statistical significance of main effects and interactions were determined using analysis of deviance (likelihood ratio Chi square tests; Fox and Weisberg 2011) and non-significant interactions and main effects dropped from the final model (for these tests a conservative p value of 0.01 was used as the significance threshold). Post hoc estimated marginal means and contrasts were calculated for significant effects (Tukey's Honest Significant Difference multiple comparison adjustments; Lenth 2019). Where survey year was significant, post hoc data were displayed graphically (Wickham 2016; Sievert 2018), with all global models significance tests and post hoc tests stored in data tables for future reference.

For data with a single binary response (*e.g.* having a woodland management plan), generalised linear models with binomial errors and logit link functions were used to model the data, with a binary response with survey year and woodland role (plus two-way interactions) as predictors. Similar methods of testing statistical significance and post hoc testing were used as above.

For woodland proportions, where responses were available across multiple woodland types, a linear mixed effects model was used to analyse the data (Bates *et al.* 2015), with arcsin square root-transformed proportions used as the response (to normalise the data), an initial model including a two-way interaction of survey year, woodland role and woodland type used as fixed effects and individual respondent nested within survey year used as a random effect. Statistical significance of fixed effects and interactions were determined using analysis of variance (F tests; Kuznetsova *et al.* 2017) and non-significant interactions and main effects dropped from the final model. Post hoc testing approaches were similar to those above. A similar approach was used for the ideal proportion of native trees question, but using a linear model with no random effect (single question).

Analyses of New Ecological Paradigm (NEP) data were conducted in R with R packages 'plyr' (Wickham 2011), 'Tidyverse' (Wickham *et al.* 2019a), and 'e1071' (Meyer *et al.* 2019). A respondent's NEP Likert answers were converted to numeric (1 to 5) and a mean calculated. A mean >3.0 (where 3.0 is neutral opinion) for three specific questions was required for inclusion in one of five 'facets' (see page 27). Data were checked for outliers and missing data removed. Observations were checked for non-engagement (*i.e.* zeros for every sub-question) and removed accordingly.

Welch t-tests were performed to test if different subsets exhibited significantly different NEP scores. Welch t-tests were chosen as they are more reliable for samples of differing sample sizes or sample variances. When t-testing a subgroup against an overall group, the subgroup was tested against the overall group that did not include the subgroup to ensure that the assumption of independence was satisfied for the t-test. Tests involving subgroups of insufficient size ($n<30$) were omitted. For all tests a significance value of $p<0.05$ was chosen.

Results

GENERAL COMPARISONS BETWEEN 2015 AND 2020

While many questions were repeated from the 2015 survey in 2020, it is important to note that for this report we did not limit analyses to only the same people who completed both surveys. However, comparisons between data from the 2015 and 2020 surveys indicated overall that distributions for location, woodland area, and role were similar (Figure 1) and unlikely to be statistically biased. Further comparisons between the two survey years are detailed in relation to specific questions in the following sections of the results.

Figure 1 *Distributions of data for location (country), woodland area (ha), and respondent types for BWS2015 and BWS2020.*

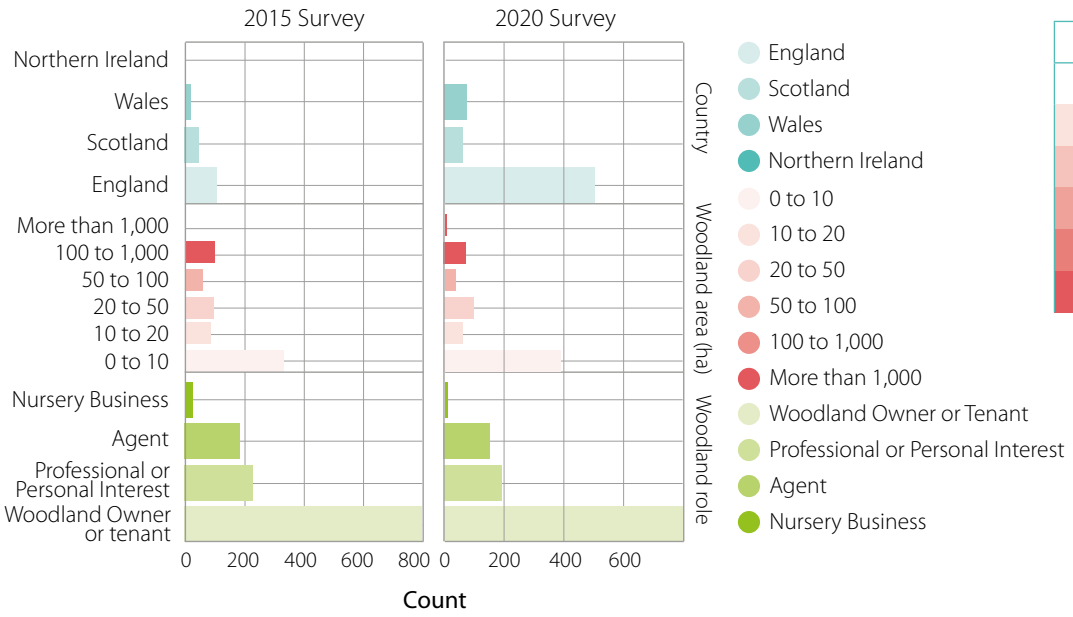
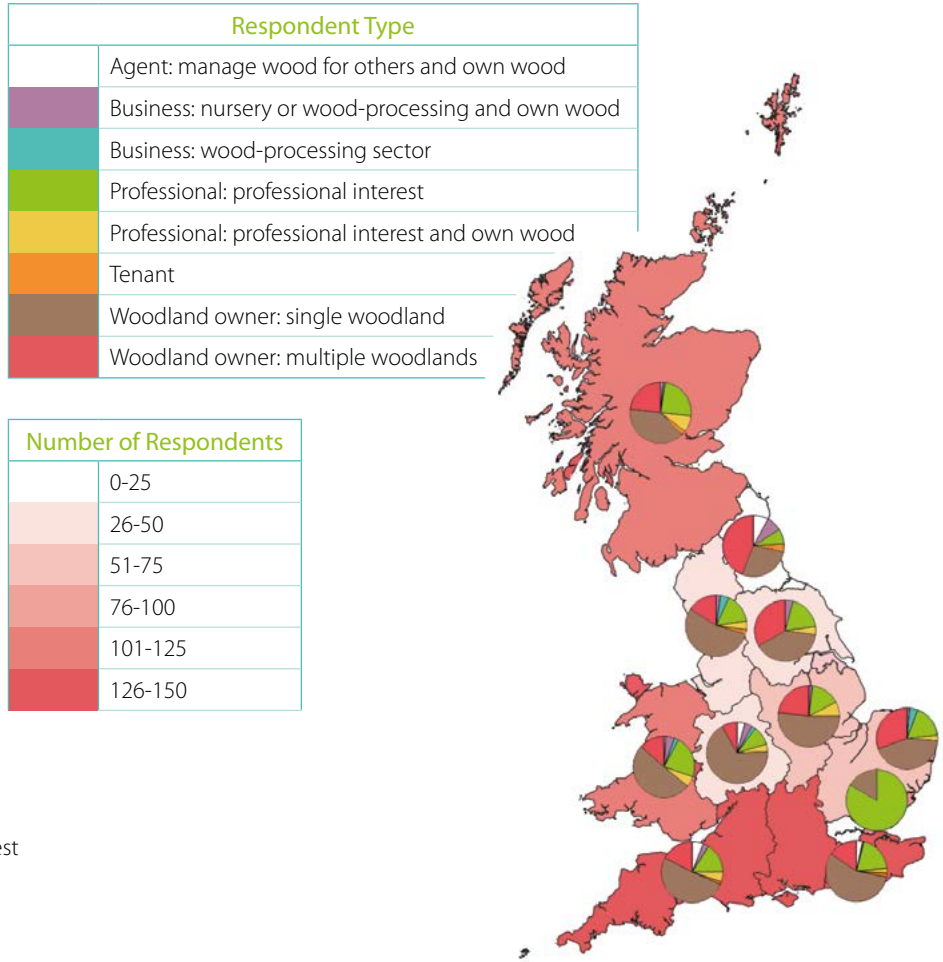


Figure 2 *Distribution and frequency of respondents types by regions and countries.*



SURVEY POPULATION

Characterisation of respondents

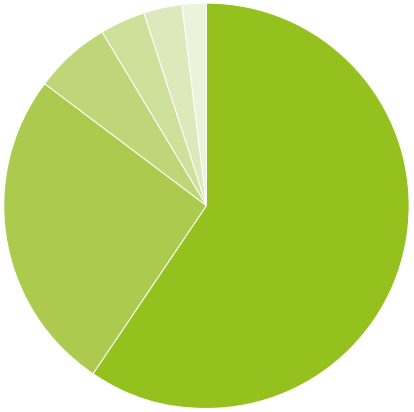
Frequency and distribution

The total number of survey respondents was 1,055 distributed across Great Britain (Figure 2 and Table 1).

The survey software reported an additional 323 'respondents' who did not identify their sector. Their responses are not included in this report, as was made clear at the start of the survey with the inclusion of the following statement: *'Please note that if you leave this at "No answer", you will not be able to scroll through the whole survey. Some sections will not display. We will not count entries without a category in our analysis.'* The most likely reason for this seemingly high number is that it represents people who were browsing the survey before either completing it later or deciding against further engagement. This figure is similar to those recorded in previous BWS.

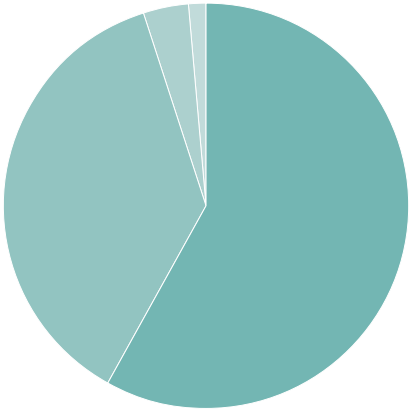
Calculating regional response rate where location data were provided by respondents, the distribution of respondents across the three nations was: England (575, 77%), Scotland (82, 11%), Wales (89, 12%), which is higher representation for Scotland and Wales than the population as a whole (8 and 5%, respectively), although Scotland is under-represented in terms of respondents' woodland area (see below). There was a good response rate across regions of England, though the South West and, to a lesser extent, the South East were over-represented (in terms of population size), while the West Midlands and Yorkshire and the Humber were under-represented, though, again, the responses reflect woodland cover more closely than population size of each region.

Figure 3a *Distribution of typologies among 1,055 respondents, showing distribution among the 752 respondents who met one of six woodland owner typologies.*



- Woodland owner: I own land containing woodland (a single woodland property)
- Woodland owner: I own land containing woodland (multiple woodland properties)
- Professional: I manage my own woodland (owned or leased) and have a professional interest in UK forestry
- Business: I manage my own woodland (owned or leased) and have a forestry business (tree nursery or wood-processing)
- Agent: I manage my own woodland (owned or leased), and I also manage woodland on behalf of other woodland owners
- Tenant: I lease land containing woodland (a single woodland property or multiple woodland properties)

Figure 3b *Distribution of typologies among 1,055 respondents, showing 303 other respondent types.*



- Professional: I have a professional or personal interest in forests and forestry in the UK
- Agent: I am acting on behalf of an owner of woodland (a single woodland property or multiple woodland properties)
- Business: Wood-processing sector (*e.g.* haulier, sawmill, wood user)
- Business: Tree nursery

The majority (778, 74%) of respondents identified themselves in the category *Woodland owner* (single or multiple properties; 642), or *Agent* (136) acting on behalf of woodland owners (see *Woodland Ownership*), while other main respondent typologies were: Business (41) (including *Tree nursery businesses* (4); *Wood processing businesses* (11); *Forestry professionals* (223); and *Tenants leasing land with woodland* (13) (Figure 3b).

Among the Professionals and Business respondents there was representation from the *Forestry industry* (25%); *Public sector – central/devolved government* (16%); *NGO community organisation* (15%); *Public sector – local government* (11%); *Research* (7%); and *Other* (18%). The remaining 8% identified themselves as *No professional involvement in forestry (personal interest)*.

Responses received from *Forestry Businesses* were further categorised as *Sawmiller* (14); *Timber harvesting contractor* (4); *Timber buyer* (3); and *Timber Haulier* (1). Among *Tree Nursery Businesses* (4), two provided information concerning annual turnover, with one exceeding £1.5M, the other less than £0.5M.

Woodland Ownership

Most *Woodland owners* provided location data (600; Table 1). A majority of *Woodland owner* respondents (79%) owned/managed properties in England, with approximately equal representation (10% and 11%) in Scotland and Wales (Table 1). The mean woodland size in Wales was 263ha (median 4ha), indicating that some large woodland areas were represented by relatively few respondents, while in England the mean was 78ha (median 6), and in Scotland the mean was 117ha (median 5).

Table 1 *Geography of responses by number of* Woodland owners, *and woodland properties owned or managed.*

Country	Woodland owners (including tenants)		Woodland	
	n	%	ha	%
England	471	79	36,471	52
Scotland	62	10	9,569	14
Wales	67	11	23,418	34
Locations not provided	152	–	1,793	
Total	**752**		**71,251**	

In a change from previous surveys, in the 2020 survey we permitted respondents who were a *Professional, Business,* and *Agent,* to declare also that they owned woodland. Among 752 of respondents who owned woodland properties, the majority were *Woodland owners* (single property, 448; or multiple properties, 194), while other owners included *Agents* (24); *Businesses* (26); and *Forestry professionals* (47); plus *Tenants* (13) (Figure 3a). In all cases *Woodland owners* refers to all six categories and up to 752 respondents unless otherwise specified.

The majority of woodland properties managed by *Agents* (Table 4) were also in England (2,872; 63%), with a stronger representation in Scotland (1,283; 28%) than in Wales (423; 9%). The greatest number of *Agents'* properties in a single region was, as in 2017, South Scotland (739; 16%); the English region with the greatest number of properties was the South West (411; 9%) (Figure 2). These figures should be interpreted with caution, however, because they may have included cases where respondents recorded their total number of managed properties in the location of their headquarters, rather than distributing them across the regions, as the survey intended.

Of the 146 Business and Professional respondents, 104 were in England, 20 in Scotland, and 22 in Wales.

Ownership typology

Ownership type was classified according to 11 categories following Nicholls *et al.* (2013). These differ from those adopted in the National Inventory of Woodland and Trees (Forestry Commission 2003), and the current National Forest Inventory (Forest Research 2017), but have been used consistently within the British Woodlands Survey series, and their origin can be traced back to work first undertaken in the 1960s.

Personal non-agricultural owners represented the majority (55%) of respondents; the second most frequent (29%) respondent type being *Personal agricultural.* This represented an increase in the proportion of *Personal non-agricultural* respondents compared with 2015 (46%) and a decrease in the proportion of *Personal agricultural* (35% in 2015). The remaining 16% comprised nine other typologies, among them the largest proportions were for *Agricultural business* (3.5%), *Charity* (3.2%) and *Private Trust* (2.7%).

Aims for woodland

Woodland owners were asked to indicate the relative importance of their aims for their woodland, each scored between 0-10. Figure 4 summarises the results, which indicate that *Protecting/improving nature or biological diversity* was ranked as the most important motive, (median 9; mean 8.1), followed by *Personal pleasure* (median 9; mean 7.5). *Wood products (timber, bioenergy, woodfuel, etc.)* scored median 5, while the motivations ranked lowest in importance were *Non-timber forest products* (median1; mean 2.0) and *Hunting/shooting* (median 0; mean 1.8).

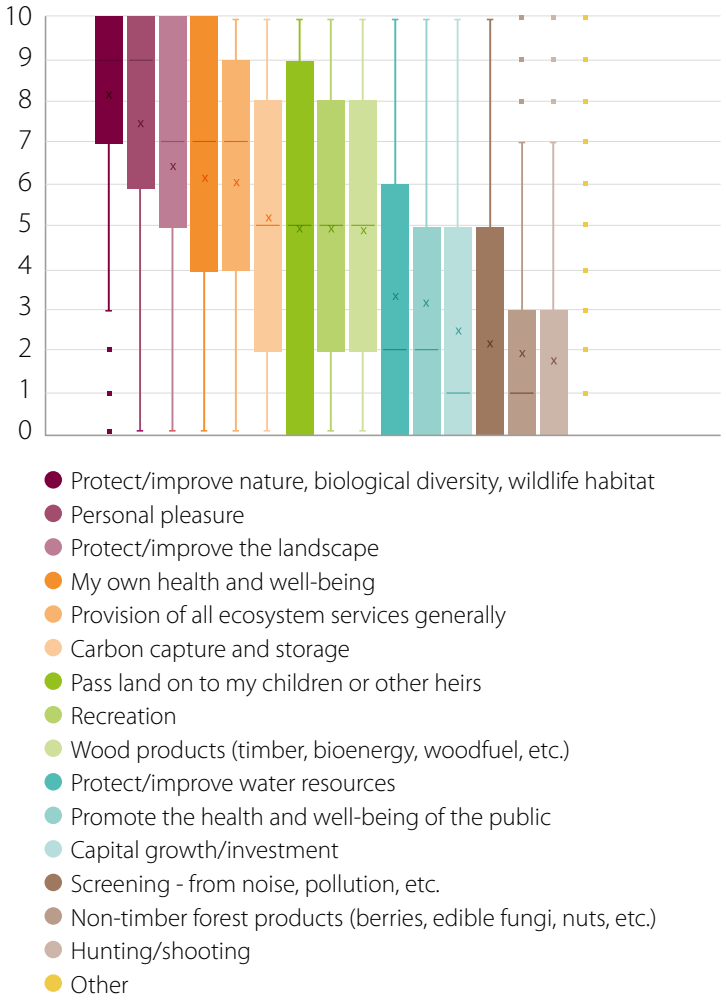
Comparing overall aims for woodland management between the 2015 and 2020 surveys showed increases in zero scores (*i.e.* not an aim for a respondent) across all aims, although these effects were particularly large for non-timber forest products, hunting/shooting and screening. Although shifts between 2015 and 2020 were question-specific, there was a general trend for reduced scores of 6-9 in the 2020 survey. For some aims (*Carbon stocks, Landscape, Nature, Personal pleasure* and *Water resources*) this was somewhat offset by an increase in scores of 10 in 2020 versus 2015. As a general rule, 2020 scores tended to be more extreme (more 0 and 10 scores) than 2015 scores.

Characterisation of woodlands

Woodland area

The sampling of BWS2020 represented an area of woodland, owned or managed by owners or their agents, totalling 71,251ha (Table 1) which represents 3.1% of the area of privately-owned woodland in the UK (Forestry Commission 2019). Among these, 612 woodlands were owned by individuals totalling 33,074ha, ranging in size from 0.1ha to 3,200ha (mean 54ha). Eighty-four *Agents* managing woodlands for others declared that they were responsible for managing 38,177ha, ranging in size from 0.16ha to 20,000ha (mean 460ha). However, the median size was 6.9ha indicating that a small number of very large properties constituted a large part of the overall woodland area.

Figure 4 *Management aims for woodlands among* Woodland owners *(n=634) from not important (0) to important (10). The coloured boxes indicate 1st and 3rd quartiles, the line within the median value, and × shows the mean. The whiskers indicate minimum and maximum values, and dots, any outliers.*



Woodland type

In contrast with results from previous recent BWS surveys, woodland type was more evenly divided among respondents between those with *Mainly broadleaved trees* (15,252ha, 48%) and those with *Mainly conifers* (12,391ha, 39%); those reporting *A mixture of broadleaved and conifer* (where at least 20% of one type was present) comprised 4,132ha (13%) (Figure 5). The most recent national statistics for England, Scotland, and Wales (Forestry Commission 2019), describe private woodlands as comprising 61% broadleaves and 39% conifers (there is no mixed category), indicating that our survey response was broadly representative.

Woodland owners were asked to categorise the proportion of their woodlands by five main woodland types (Table 2). *Ancient semi-natural woodlands* comprising mostly native trees and shrubs derived mostly from natural regeneration were the most frequent (340), although *Secondary semi-natural woods* covered a larger area (14,861ha, 50%). PAWS woodlands (either Plantations or Restored) were reported by 201 respondents, with a total area of 5,165ha.

Table 2 *Distribution of woodland types among respondents. Note that the number (n) of responses is for those who answered this question and who also provided information on forest area.*

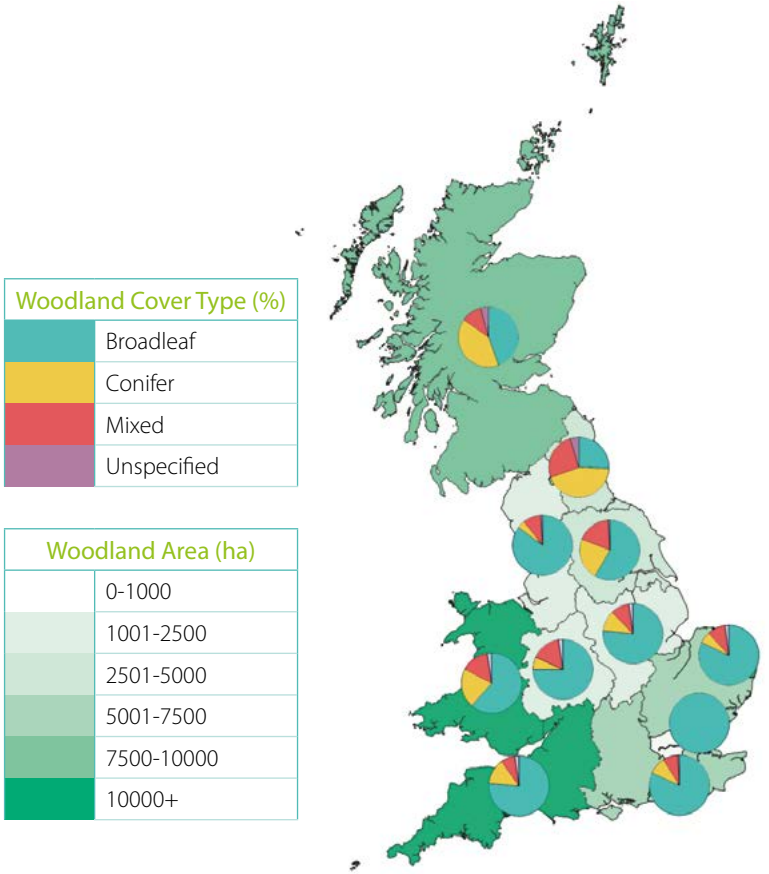
Woodland type	n	ha
Ancient woodland – Semi-natural	340	7,232
Ancient woodland – Plantations (PAWS)	165	3,988
Ancient woodland – Restored PAWS	83	1,177
Secondary woods – Semi-natural	219	2,588
Secondary woods – Plantations	314	14,861

Woodland owners were asked whether the woodlands they owned or managed were mainly monocultures (defined as 50% or more of the woodland consisting of a single species). The top five species indicated for these monocultures were oak spp. (73), ash (38), sweet chestnut (38), Douglas-fir (35), and Sitka spruce (34). Dominant species within woodlands varied according to woodland size, with Douglas-fir more prevalent in larger properties, and oak, ash, and birch more common in smaller woodlands (Table 3).

Table 3 *Top three ranked tree species present for different woodland sizes. Species are ordered in descending order.*

ha	0.1-10	>10-100	>100-1,000	>1,000
n	130	70	30	10
Top three species	Oak spp. Ash Birch	Sitka spruce Oak Beech	Sitka spruce Scots pine Larch spp.	Douglas-fir Scots pine Sitka spruce

Figure 5 *Woodland area (ha) owned or managed by respondents with woodland type per region.*



Woodland Management Standards

Among *Woodland owners* who answered questions about management plans (612), 34% of respondents did not have a woodland management plan in place, while 7% were unsure. Among those who did have a plan in place (59%), 52% were UKFS-compliant, 21% were not, and 27% were unsure. Overall, this means that most respondents (69% of 612 respondents) did not have a UKFS-compliant woodland management plan in place. Between 2015 and 2020 there were no significant differences, either for the presence of a management plan or UKFS compliance.

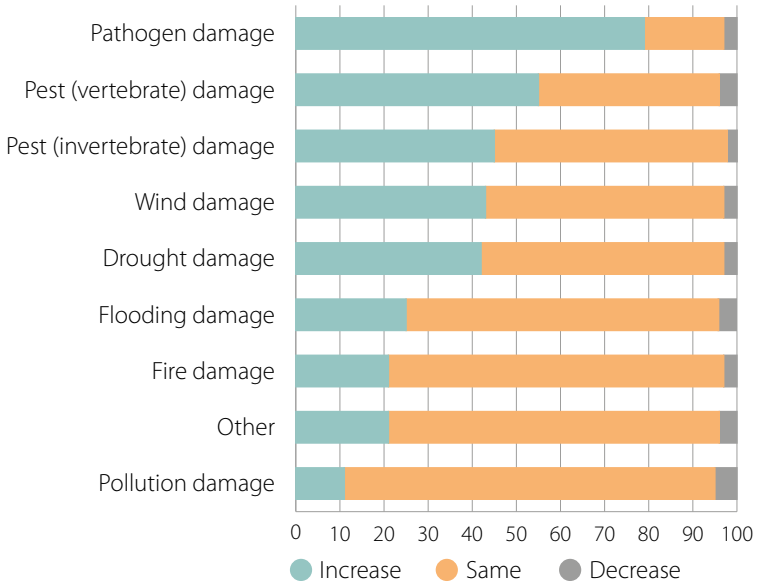
The majority (538; 91%) of *Woodland owners* did not have independent certification for the woodland management, for example under the UK Woodland Assurance Scheme. For those who did (9%; 51), 14 were registered with the FSC, 4 with PEFC, and 10 with the Grown in Britain standard.

OBSERVATIONS AND EXPERIENCE OF ENVIRONMENTAL CHANGE

Woodland owners were asked about their own observations of environmental damage in woodlands in the last five years in the UK, and whether they believed there had been an increase, decrease or no change. The greatest factor observed (*n=773 max.*) as increasing by 611 respondents (79%) was an increase in *Pathogen damage,* followed by *Pests (vertebrate) damage* (55%; 423), *Pests (invertebrates)* (45%; 338), and *Wind damage* (43%; 329) (Figure 6). *Pollution damage* was the factor most thought to have stayed the same (84%; 621) or decreased (5%; 40).

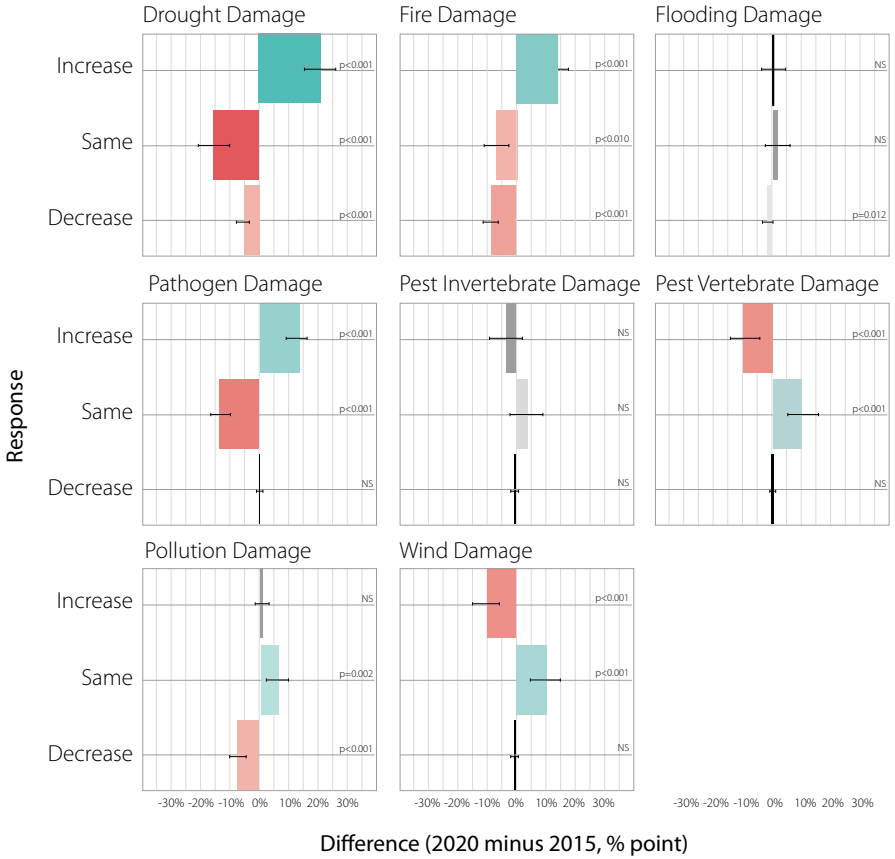
Comparisons between 2015 and 2020 survey data reveal a similar ranking of observations between the two surveys, although there were significant ($p<0.001$) differences in their magnitude and between different respondent type. In terms of specific threats, 2020 individuals were more likely to score the threat of *Drought* with an increase over 25% from 2015 (Figure 7). Similarly, *Fire* and *Pathogens* also increased since 2015, with the threat of *Vertebrate* and *Wind* damage more likely to be the same, and the threat of *Pollution* having declined. In terms of woodland role, woodland owners or tenants were more likely than all other groups to score threats as being the same, with all other roles more likely to state that threats had increased.

Figure 6 *Observations by* Woodland owners *across Britain of changes in environmental damage.*



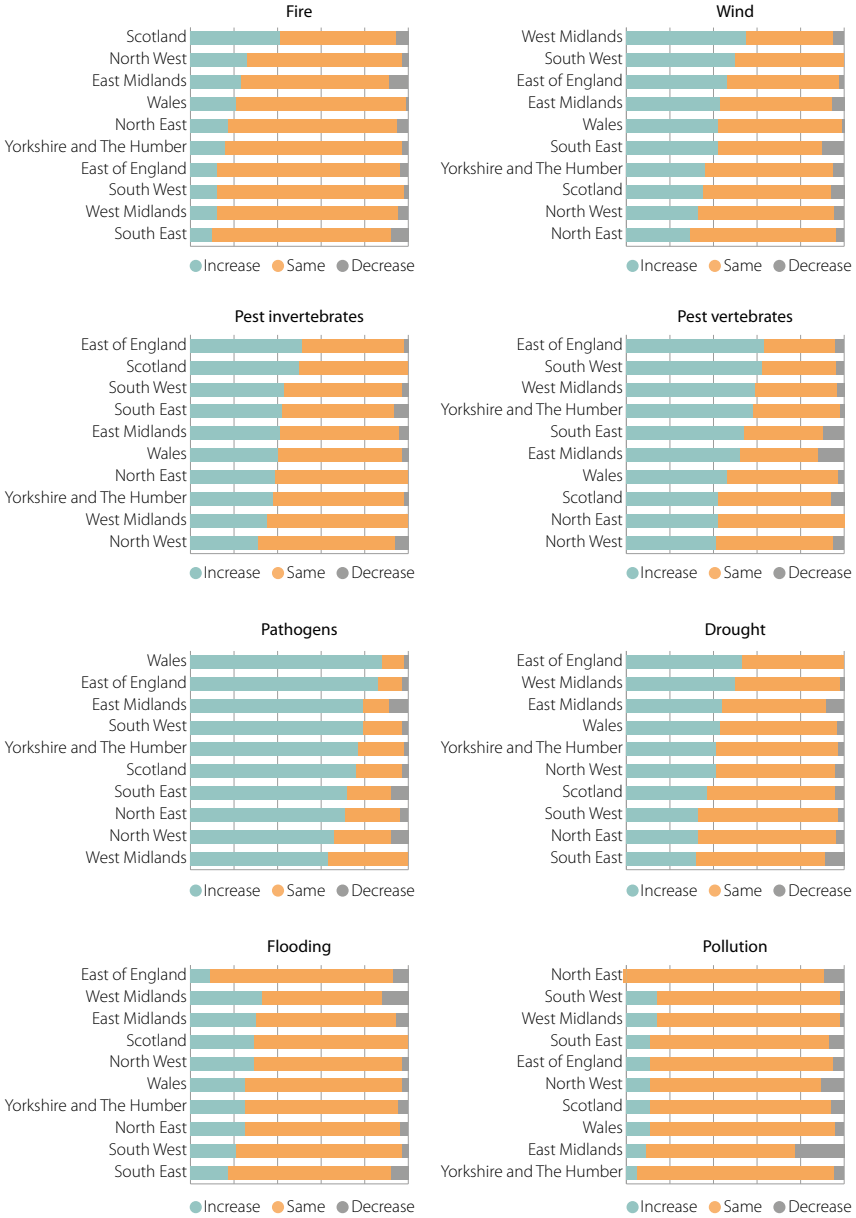
Agents (103 max.) were asked a similar question, but phrased as whether they had observed environmental change which had caused them to alter their advice or business practices. The results were similar to those of woodland owners, with *Pathogen damage* (64) being most impactful, the next nearest being *Pests (invertebrates)* (20).

Figure 7 *Changes in observations of specific threats between 2015 and 2020 showing increases in Drought, Fire, and Pathogen damage, and decreases in Pollution.*



We further explored how these observations of environmental damage may have varied by country and region (Figure 8), noting that London was excluded due to its small number of responses. The East of England reported the highest increases in *Drought*, and both *Invertebrate* and *Vertebrate pests*. The West Midlands ranked highest for observed damage from *Wind* and *Flooding*. Respondents reported marked increases in damage from *Fire* in Scotland. Woodlands in Wales were reported to have the highest observed increase in *Pathogen* damage.

Figure 8 *Observations by* Woodland owners *of changes in environmental damage in the last five years for eight English regions (London excluded), and in Scotland and Wales.*



In addition to rating these eight factors, respondents provided free-text responses detailing other sources of damage. As in previous years, human damage featured heavily, including damage caused by both authorised and unauthorised access, but this year fly tipping, antisocial behaviour and vandalism were noted by a large number of respondents. This accords with recognition of the impact of COVID-19 on waste disposal behaviour throughout the UK and a 'Welsh Government Duty of care campaign to encourage people to help tackle fly-tipping' launched in June 2020.

Comparisons of data between 2015 and 2020 revealed significant ($p<0.001$) differences between years, and by respondent role. In terms of specific threats, individuals in 2020 were more likely to score pathogens and pests as having driven changes in advice and management, whereas pollution had not changed advice or management. In terms of woodland role, agents were more likely to respond with no change in advice versus individuals with professional/personal interest. Results in the 2020 survey showed a significant ($p<0.001$) increase in changes driven by the perceived threat of *Fire,* but a decrease in changes driven by perceived threat of *Pests, Pollution,* and *Wind.*

MANAGING FOR RESILIENCE

Woodland owners under all categories were asked about four management activities we judged to be indicators of actions that support forest resilience: *Undertaking a survey of soil types in their woodland; Managing some of their woodland under a continuous cover system; Reviewing climate change projections for their region, and; Reviewing tree species suitability for their region.* We asked respondents about which of these activities they had currently undertaken, and those that they planned to undertake in future (Table 4). 70% of respondents were unaware of climate change projections for their region, although most (57%) said that they would explore them in the future.

Table 4 *Counts of* Woodland owners *and* Agents *who currently undertook a range of four management activities and/or planned to in future.*

		Survey of soil types	Continuous cover management	Climate change projections	Tree species suitability
Current	Yes	157	306	164	339
	No	410	252	382	225
	Total	567	558	546	564
Future	Yes	153	309	291	388
	No	323	176	221	120
	Total	**476**	**485**	**512**	**508**

Across all four management activities for *Woodland owners* (excluding business, professional, and agents who also owned woodland), we investigated all 'instances' when there were paired data (*i.e.* within any one management activity type there were data for both current and planned activity) using a chi square test. This revealed a highly significant ($p<0.001$) relationship between current action and planned future activities across 1,448 instances (Table 5). Among instances where activities were planned in future (751), 463 were currently active, and 288 were not. Among instances where no activities were planned in future (697), 49 were currently active, and 648 not. Therefore, levels of intended future activity among *Woodland owners* were highly predictable based on current activity level. A similar relationship was found for responses to environmental threats (page 21).

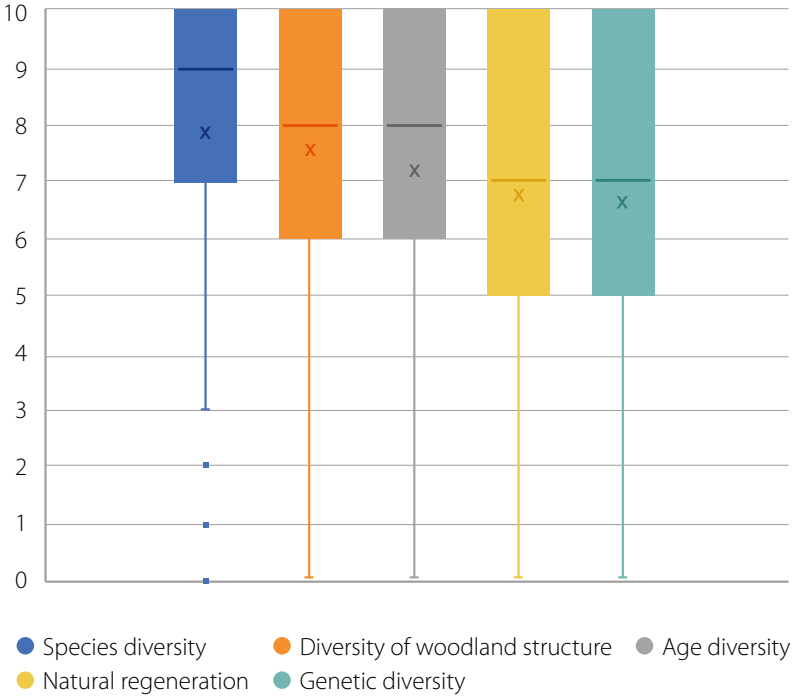
We tested a hypothesis that those who were production-orientated for their main management aims were more likely to be actively implementing the four resilience management actions (soil survey, continuous cover management, climate change projections, and tree species suitability). To do this we created two groups of respondents: those who on average scored high importance (mean score ≥8 from 0 to 10, where 10 is high importance) for two production-orientated aims (*Wood products*, and *Carbon Capture and Storage*), and those who scored low importance (mean score ≤3) for these two aims. We used two t-tests to test for significant differences in the number of 'Yes' answers between the two groups, for both Current and Future intended actions. Differences between the two groups were highly significant ($p<0.001$: *Woodland owners* with strong production-orientated aims were more active currently (2.09 *cf.* 1.05) and likely to be more active in future (2.83 *cf.* 1.30) across the four activities.

Table 5 *Counts of paired instances of current and future resilience management activities among* Woodland owners. *A paired instance means that within any one management activity type, a respondent must have answered both current and future questions.*

	Current YES	Current NO	Total
Future YES	463	288	751
Future NO	49	648	697
Total	**512**	**936**	**1,448**

When asked to score the importance of five forest management practices for woodland resilience, *Woodland owners* (single or multiple properties owners only) and *Agents* combined ranked *Species diversity* highest (median score 9 out of 10; mean 7.9), followed by *Diversity of woodland structure* and *Age diversity* (medians 8) (Figure 9). Lowest scores were for *Natural regeneration* and *Genetic diversity (e.g. varying sources of material, provenances, improved varieties)* (respectively, medians 7 and 7; means 6.8 and 6.7). There were some differences in ranking between *Woodland owners* and *Agents*, with the latter ranking *Natural regeneration* below all other options.

Figure 9 *Mean ranks (0-10; where 10 highest) for five forest management practices considered important for resilience among* Woodland owners *and* Agents. *The coloured boxes indicate 1st and 3rd quartiles, the line within the median value, and × shows the mean. The whiskers indicate minimum and maximum values, and dots, any outliers.*



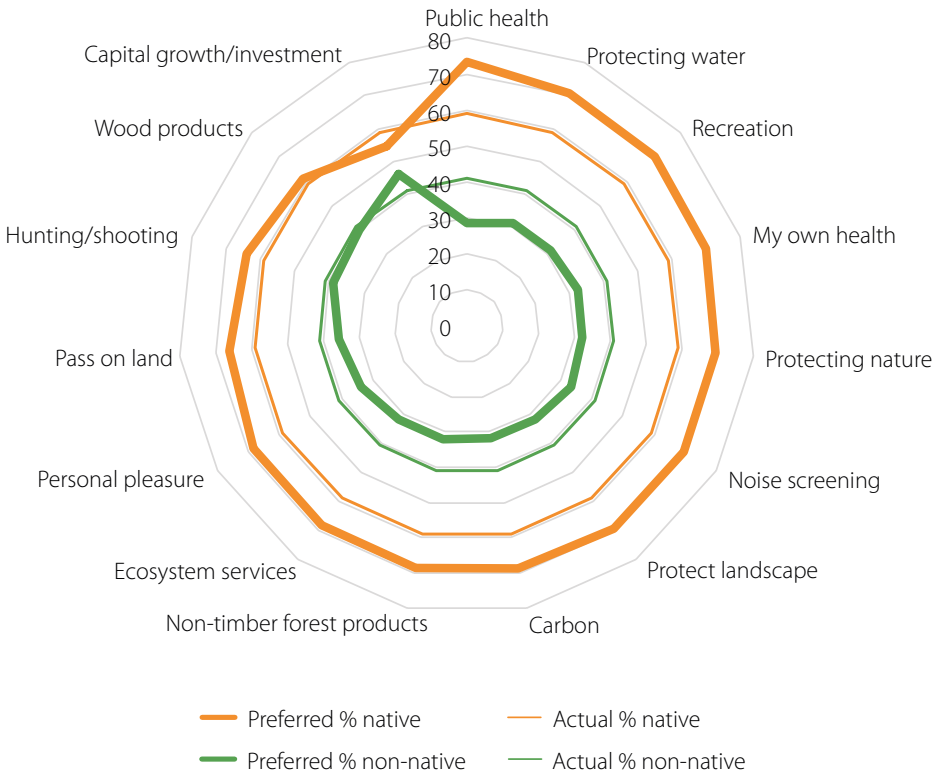
Results were similar across the three countries, although *Natural regeneration* was considered the least important practice in Scotland (mean 6.1), while in Wales, *Age diversity* was ranked in second place, very slightly higher than *Diversity of woodland structure*.

We analysed differences between 2015 and 2020 data for four of these management objectives (*Natural generation* was not offered as an option in 2015). Results in the 2020 survey tended to be more negative or extremely positive than the 2015 survey, with scores of 10 being significantly higher in this survey, along with the majority of scores of 5 and below (with a particular increase in mid-point scores of 5). Scores of 7-8 were significantly greater in the 2015 survey than the 2020 survey.

Currently, approximately 41% of the UK's forest cover is comprised of non-native tree species and 59% is native (Forestry Commission 2019). We asked respondents what they consider might be the ideal balance between native and non-native species to improve future resilience of UK forests. Among 755 respondents, the mean ideal proportion of native trees was 65%, *i.e.* an increase of 6% in native species. *Woodland owners* showed a preference for a higher proportion of native species (mean 69%), compared with *Agents* (mean 57%). Figures for non-native species were 32% and 43%, respectively.

We explored whether the ideal proportion of native species for Britain might vary according to a respondent's main management aims. Those with strong (8-10) aims for *Capital growth/investment, Wood products,* and *Hunting/shooting* preferred an increase in non-native species, whilst all other types preferred an increase in native species (Figure 10). Note the views of respondents to this question varied significantly by their ecological worldview; see page 27.

Figure 10 *Plot of preferred proportion (%) of native and non-native trees compared to actual proportions (59 vs. 41% respectively) among 14 ('Other' aim excluded) different woodland management aims.*



We explored further any difference in attitudes to native versus non-native trees between 2015 and 2020 survey data. There were significant (p<0.001) effects of survey year and woodland role on the ideal proportion of native trees, with a 3% increase between 2015 and 2020 (Figure 11).

We asked respondents to what extent threats from environmental change had caused them to alter woodland management with respect to a number of management outcomes. In terms of major changes in management, the threat with the smallest impact was *Fire Management*, while the greatest alterations arose from *Pathogen control* and *Drought tolerance* (Figure 12). Comparing combined figures for major and minor actions, the ranking was similar though *Wind* ranked above *Invertebrate pest* control and *Flooding* (Figure 12).

A follow-up question asked how likely it was that respondents would alter future management because of the same range of environmental threats. Respondents were most likely to alter approaches to respond to *Pathogen control* (250), followed by *Vertebrate pests* (233), *Invertebrate pests* (161), and *Drought tolerance* (158) (Figure 13).

We explored whether the extent to which woodland owners have already made management alterations in response to a variety of environmental changes might affect any future planned response. We found a positive correlation (Figure 14), with a Pearson's correlation coefficient of 0.575, and a multiple R-squared of 0.33. The p-value of the correlation is <0.0001, and (0.542, 0.675) is the 95% confidence interval around the Pearson coefficient. If a management alteration has been established in response to an environmental change, 69% of respondents (379/549) reported that management is likely to continue in the future in response to this environmental change. However, if management alteration has not already been implemented in response to an environmental change, then there is only an 8% (137/1650) chance that management alteration is likely to be introduced in response to this environmental change. Meaning those owners and managers who have already accepted there are actions they can take to increase the resilience of their woodland have instituted change and will continue to do so, whereas others experience inertia that is unlikely to change.

Figure 11 *Ideal proportion of native trees among all respondents in the 2015 and 2020 surveys.*

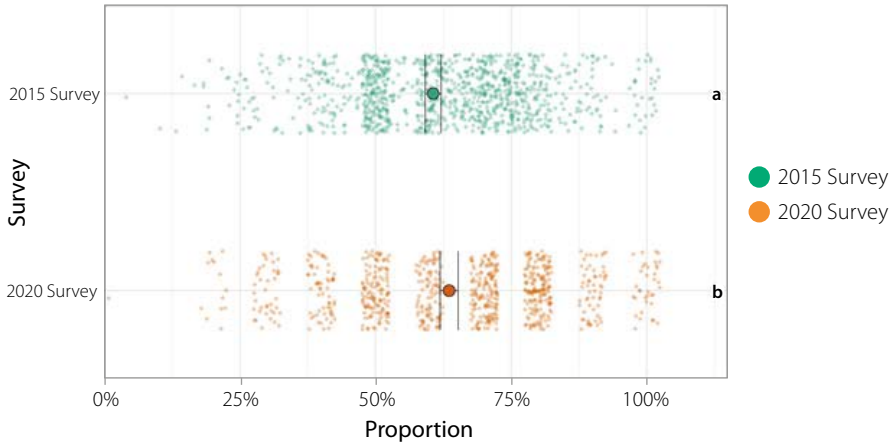


Figure 12 *Counts of threats which had caused respondents to alter woodland management to a major or minor extent, or not at all.*

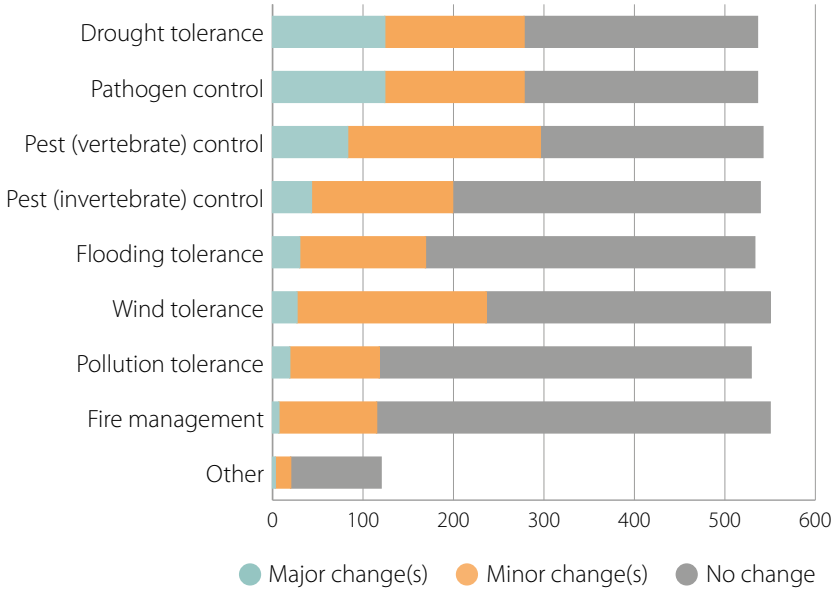
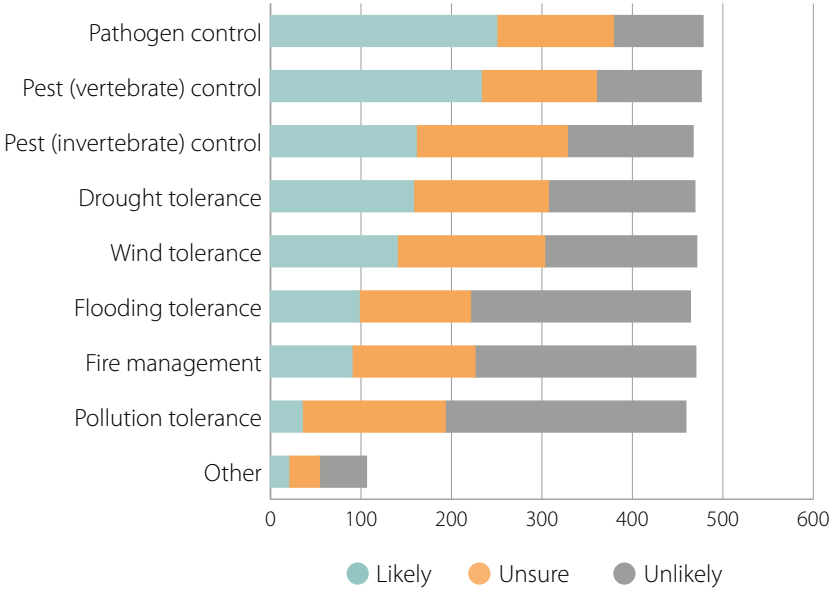
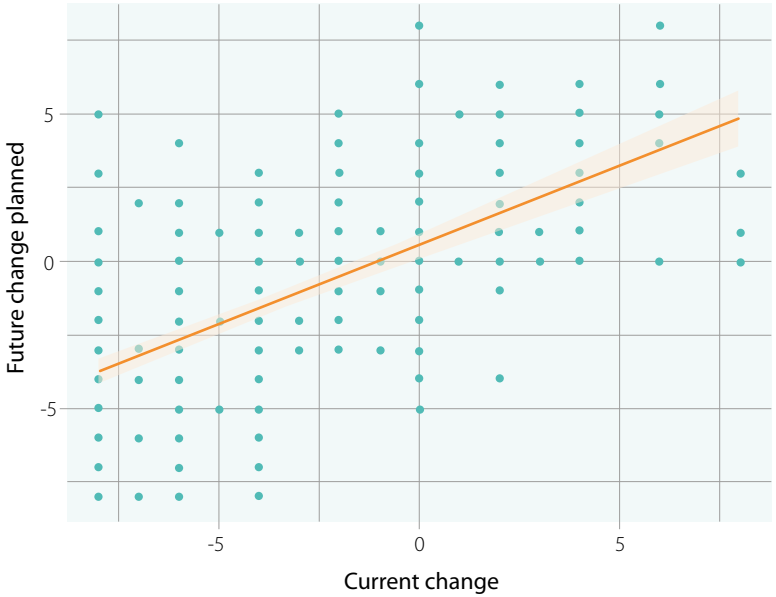


Figure 13 *Likelihood of altering future approaches in response to a range of environmental threats (counts).*



Woodland owners and *Agents* were asked how likely they were to implement a range of responses to the climate emergency. For *Agents*, responses were limited in number and evenly distributed. Among *Woodland owners*, 455 indicated they were likely to *Alter approaches to woodland management*, while 381 said they would *Increase hedgerows/shelterbelts*, 379 would *Create more new woodlands*, and 276 would *Create new agroforestry systems*. The high proportion of Woodland owners indicating willingness to increase tree cover is at odds with responses to other tree expansion questions (see page 23), although in this case it most likely reflects a longer-term response to the existential threat of climate change, whereas the other questions explored likely action within the next five years.

Figure 14 *The relationship between current and future planned responses to environmental change. The X axis gives each respondent a score between -8 and +8 based on the number of changes that they have implemented in their woodland in response to environmental change. The Y axis gives each respondent a score between -8 and +8 based on the number of plans each respondent expects to implement in response to environmental change. The shaded area either side of the line indicates 95% confidence limits.*



Businesses were asked about steps they took for biosecurity. There were a low number of respondents but 10 businesses considered risks when *Acquiring planting stock* and 8 when *Moving woody materials* (*e.g.* bark mulch), 5 respondents *Provided cleaning and disinfecting facilities for staff* and 5 *Considered risks when moving planting stock*. No respondents *Provided cleaning and disinfecting facilities for customers.*

Carbon

For the first time in the BWS series we asked respondents a range of questions related to carbon. As reported above, carbon capture and storage ranked 6 out of 16 aims for woodland management (page 14).

For those *Woodland owners* who said they intended to create new woodland in the next five years (*n*=536), the largest proportion (47%) said that they were *Unsure* or *No* (33%) that they would not consider registering it with the Woodland Carbon Code.

Among the free-text responses noting what measure would encourage registering new woodland with the Woodland Carbon Code, the most frequently cited was a requirement to have more information about the scheme. Other suggestions included increasing flexibility:

> '...for future management, (I) would be reluctant to bind the choices of future generations with an agreement which may restrict their management options.'
>
> Woodland owner, multiple properties.

Among a range of considerations that had influenced a decision to diversify the range of species in their woodland, *Woodland owners* ranked carbon capture and storage fourth out of five choices (with 38% indicating that it did influence them); timber yield ranked lower (33%), while forest health and biodiversity considerations both ranked considerably higher (79% and 85%).

We asked respondents how important it was to help to ensure the future resilience of carbon stocks and carbon sequestration as a woodland management objective. Among the 558 respondents, the mean rank was 7.3 (0-10, where 10 was most important).

Among 361 *Woodland owners* who responded to a question about whether their management plan included actions that help to minimise carbon/greenhouse gas emissions, 40% (144) said *Yes*, while 26% (93) answered *No* and 34% (124) were *unsure*.

Agents were asked whether they encouraged their clients to include forest management actions that help to minimise carbon/greenhouse gas emissions. Among 103 responses, most respondents indicated *Sometimes* (45) or *Always* (40), while a small proportion replied *Rarely* (12), and *Never* (6).

INCREASING TREE COVER

Among 518 *Woodland owners*, 46% (237) had expanded (*i.e.* not including restocking) their tree cover in the previous five years. Of these, the mean increase in area was 12.5ha (median 1ha; max. 500ha). We noted that the mean expansion for those who chose to report data in acres (150) rather than in hectares (81) was equivalent to an increase of 3.5ha (8.67 acres) as opposed to 28.9ha for the latter.

Woodland owners were asked if they were considering expanding tree cover in the next five years, by how much, and by what method. As reported above (page 22), many respondents had indicated that they would consider planting more trees as a response to the climate emergency which perhaps indicates a longer-term aspiration than the five-year period explored in our detailed questioning. *Tree planting* was most favoured (192) with a mean expansion of 28.7ha (median 2ha) (Table 6). *Natural regeneration* was next most popular (130, mean expansion of 5.8ha, median 1.0ha). Although expansion through *Agroforestry* was reported by only 73 respondents (mean 5.2ha), the median (2.0ha) was equal highest.

Table 6 *Popularity of different approaches to tree expansion among* Woodland owners *(n=count) and by mean area (ha).*

	n	Area ha
Tree planting	192	5,338
Natural regeneration	130	675
Agroforestry	73	2,372
Hedgerow expansion	129	180

Among 536 *Woodland owners*, the largest proportion (42%; 224) said they were not likely to expand tree cover in the next five years, while 38% (204) told us that they were, and 20% (108) were unsure. Those respondents who were considering expanding tree cover were most incentivised by *Grant aid* (264), followed by *A viable income source (e.g. Woodland Carbon Guarantee)* (241), and *Free or low-cost advice from trusted sources* (170).

We asked *Woodland owners* which of a number of factors had discouraged or prevented them from expanding tree cover. Among the 281 respondents, other than in instances where *All existing land was already planted* or *They have enough woodland,* the factors most discouraging woodland creation were *Lack of grant aid* (43), *Complexities of regulations relating to grant aid* (38), and the fact that *Expenditure comes from taxed income* (37) (Figure 15). We also asked *Agents* to rank factors significant in discouraging or preventing their clients from expanding tree cover: *Complexities of regulations related to grant aid* ranked first (58), followed by *Regulations (e.g. Environmental Impact Assessment)* (42), and *Lack of grant aid* (34) (Figure 15).

There were also a number of free text responses providing a range of views concerning barriers to expanding tree cover:

> "Better processes and procedures from Government agencies. Being paid on time. Less complicated rules and application processes."
>
> Woodland owner (multiple woodland properties).

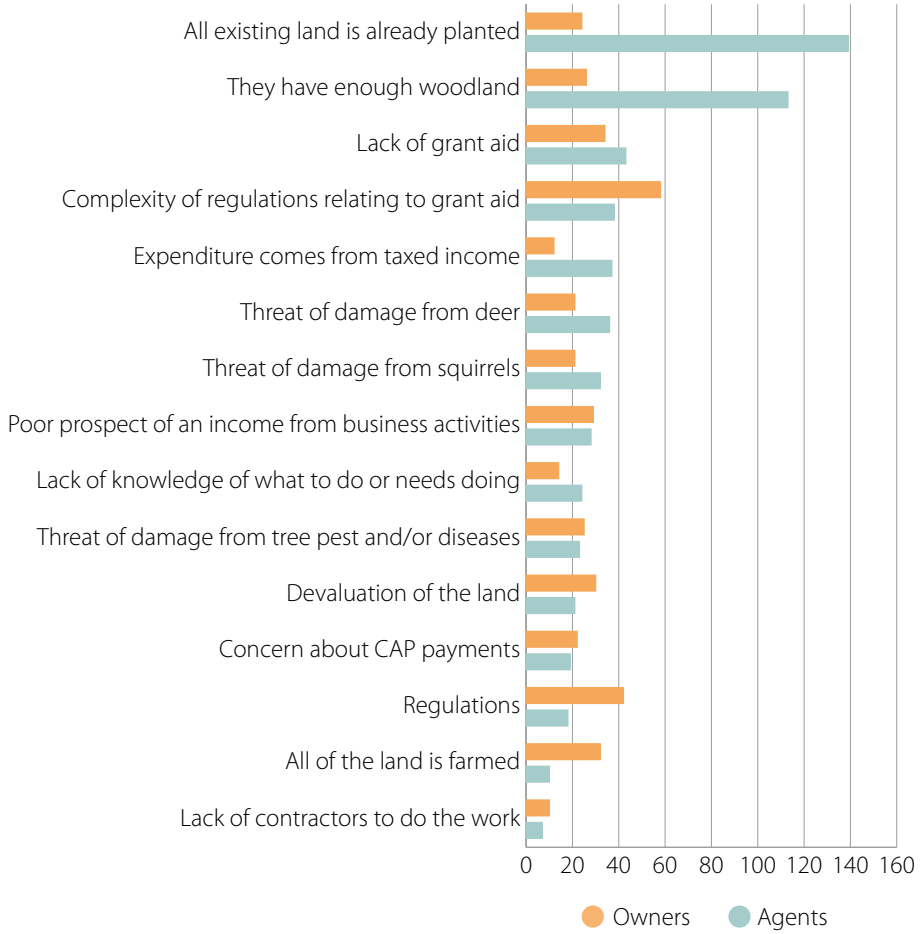
> "Favourable tax treatment. Assistance from recovering land from secure agricultural tenancies."
>
> Agent (who also manages own woodland).

> "I have always avoided grant-aided schemes as they imposed limitations and ideas about woodland composition and care which went against my own knowledge of trees and woods and were inappropriate for what I wanted to achieve and my geographical situation."
>
> Woodland owner (multiple woodland properties).

> "Income replacement is necessary if I give up my arable farming to convert to trees."
>
> Woodland owner (multiple woodland properties, recently expanded by 10 acres and willing to expand a further 500 acres).

In response to a question to *Agents* as to whether they had helped clients expand tree cover in the last five years, including natural regeneration, agroforestry, hedgerow expansion, and new planting, 89% said that they had. *Agents* (102) told us that on average 50% (median 40%) of their client base might be considering expanding tree cover in the next five years.

Figure 15 *Factors which discouraged or prevented expansion of tree cover among* Woodland owners *and* Agents.



We asked *Agents* to rank three different incentives that they thought would be most likely to encourage clients to increase tree cover. *Grant Aid* was ranked first, followed by *A viable source of income* (*e.g.* Woodland Carbon Guarantee) and *Free or low-cost advice from trusted sources.*

Agents believed that among a range of approaches to expanding tree cover that might be most popular among their clients, *Planting* ranked first, followed by *Hedgerow expansion, Agroforestry*, and *Natural regeneration.*

Tree Species and Genetics Diversity

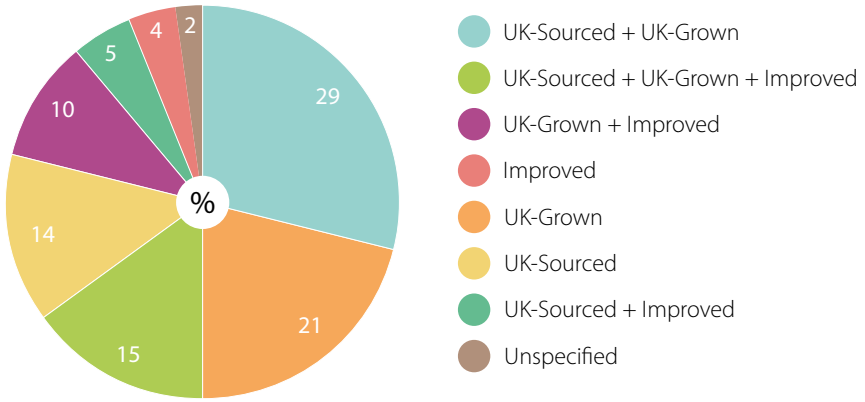
Among 234 *Woodland owners* who had restocked an existing woodland or created a new woodland within the last five years, 69% (161) had specified the provenance of their planting material, while 11% (26) were *Unsure*, and 20% (47) said they had not.

Most *Woodland owners* (417, 79%) said that they knew what species were suitable for their land, while only 3% (15) said *No* and 18% (98) were *Unsure*. About one quarter of respondents (108) had accessed the Ecological Site Classification (ESC) online tool for information on species suitability, and 88 had used the Royal Forestry Society's (RFS) Species Profile Project. Other information sources included the Right Trees for Changing Climate database (44) and Silvifuture (25). Among 106 *Agents*, 58% had accessed the ESC tool, and 26% the RFS tool.

A majority (358, 66%) of *Woodland owners* stated that they were considering diversifying the range of species in their woodland, compared to 24% (128) answering *No,* and 10% (54) being *Unsure*.

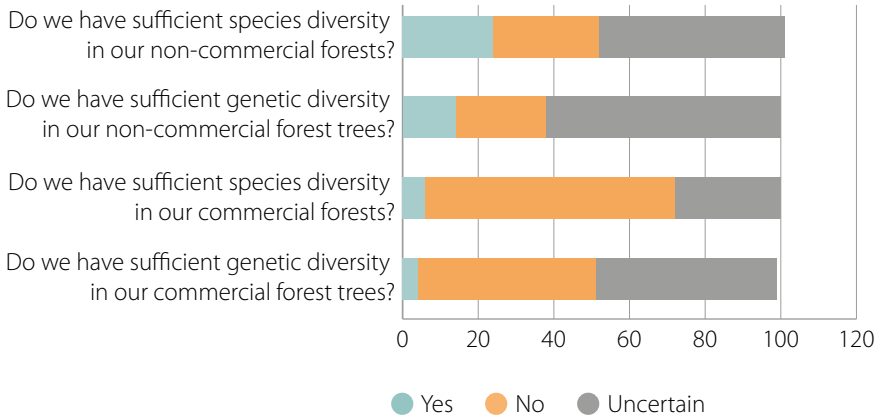
We asked *Woodland owners* how likely they were to specify different categories of tree planting material, the choices offered including all combinations of *UK-sourced material, UK-grown material,* and *Improved material. UK-grown* refers to material (from any source) grown only in the UK, while *UK-sourced* refers to material from seed or cuttings sourced from the UK but potentially grown anywhere. *Improved* refers to four FRM categories which are source-identified not necessarily from the UK but selected for better characteristics: source-identified; selected; qualified; tested. Among 558 responses, the largest proportion (29%; 281) would specify *UK-sourced+UK-grown. UK-grown* material only was second most-popular at 21% (205), followed by *UK-sourced* material only at 14% (150) (Figure 16). *Improved* material only was least popular at 4% (44) (Figure 16). In response to a question about which of these options they considered most important, 41% (185) stated *UK-sourced+UK-grown,* 21% (97) *UK-grown,* and 16% (71) *UK-grown+UK-sourced+Improved,* and 11% (50) *UK-sourced.* All other options were represented by 5% or less among respondents.

Figure 16 *Preference for specifying different categories of tree planting material among* Woodland owners*, including UK-sourced, UK-grown, and Improved (which referred to various subcategories of FRM material).*



All respondents were asked their views concerning tree species diversity and genetic diversity in UK forests. From 771 responses, the largest proportion believed that in commercial forests there was insufficient diversity both for tree species (506, 66%) and genetics (336, 47%) (Figure 17). Differences in opinion were less marked in non-commercial forests, but notably 62% (474) were uncertain about genetic diversity. This set of questions was further explored in terms of how responses corresponded to ecological worldviews; see page 27.

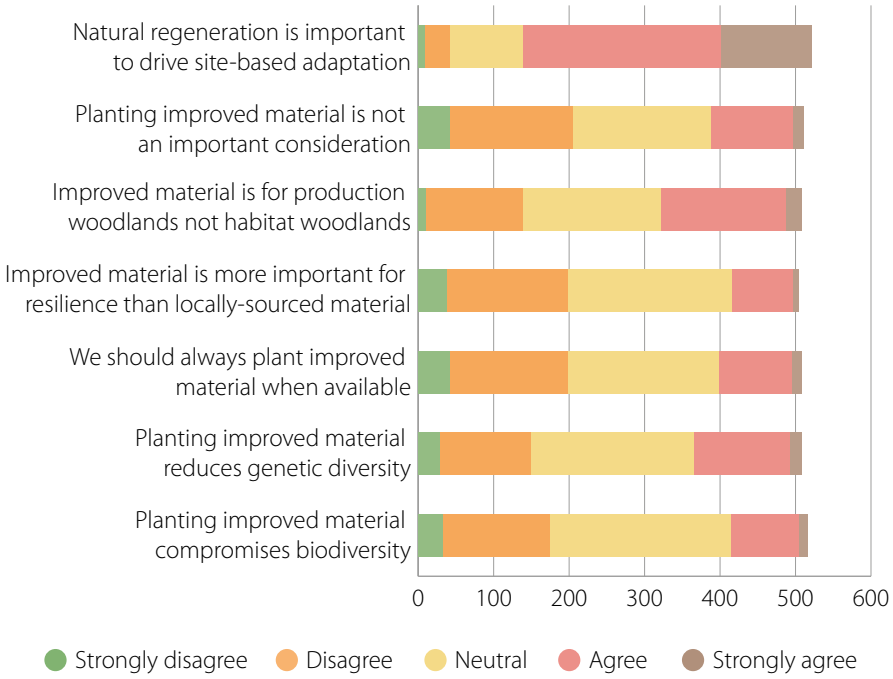
Figure 17 *Opinions among all respondents about levels of species and genetic diversities in commercial and non-commercial forests.*



All respondents were asked their opinion concerning the use of improved material for a range of statements. The strongest views (from here on meaning combined agreed/strongly-agreed and disagreed/strongly-disagreed) emerged around the idea that *Planting improved material is not an important consideration* where 40% of respondents disagreed and 24% agreed. Concerning the suggestion that *Improved material should always be planted when available,* 39% of respondents disagreed and 22% agreed. Similarly, 39% disagreed that *Improved material is more important for resilience than locally-sourced material* compared to 18% who agreed. Very clear support came for the concept that *Natural regeneration is important to drive site-based adaptation,* with 74% agreeing with this statement. Full results are presented in Figure 18.

We explored further whether a strong preference for *Improved* material over *Locally-sourced* material might be explained by respondents' main management aim for woodland (16 choices; page 14). The top-ranking aim among those who thought improved material was more important than locally-sourced material was *Personal pleasure* (62), followed by *Protecting nature* (53). Aims linked to profitability and production did not rank highly with *Wood products* (39; rank 3), *Carbon* (28; rank 8), and *Capital investment* (16; rank 10). This indicates that management aim was not a good predictor for those likely to select improved planting material.

Figure 18 *Opinions among all respondents about levels of species and genetic diversities in commercial and non-commercial forests.*



Respondents provided a rich source of free-text reasons for not increasing tree cover. In addition to the reasons stated above, other reasons included concentrating on increasing management, not just tree cover. One respondent noted that they believed:

> "...the pressure to maintain other environmental features with heritage and wildlife value, is more important than increasing cover, so I focus on delivering more form our critically undermanaged and underutilised historic woodlands". Agent.

ECOLOGICAL WORLDVIEWS

Respondents were asked whether they agreed/disagreed with a series of statements based on the New Ecological Paradigm (NEP) scale developed by Dunlap *et al.* (2000). This is a well-established scale used by researchers to assess people's underlying ecological worldviews. It provides 15 statements (also termed 'items') eight of which are pro-ecological and seven anti-ecological, distributed across five discernible, but interrelated, 'facets': *Anti-anthropocentrism* (rejecting the idea that humanity has the right to rule over nature; Anti-anthro); the *Fragility of nature's balance* (Balance); the *Rejection of exemptionalism* (rejecting the idea that humans are exempt from the constraints of nature; Anti-exempt); the *Possibility of an ecocrisis* (Ecocrisis); and, the reality of *Limits to growth* (Limits) (Table 7).

Figure 19 *A histogram of NEP scores for the total population of observations who answered all NEP questions. The line indicates the density curve of a normal distribution with the same sample mean and sample standard deviation (3.95229 and 0.5328084 respectively). The histogram follows the density curve quite closely, except it is negatively skewed.*

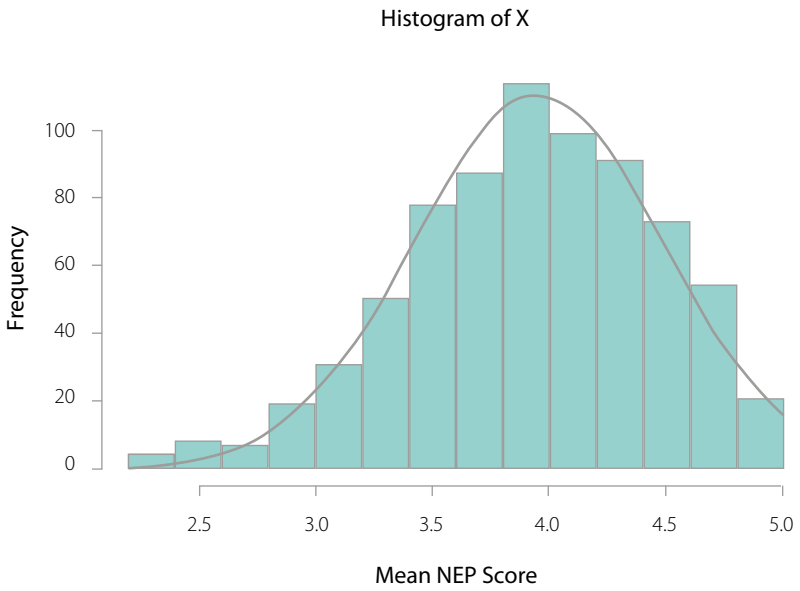


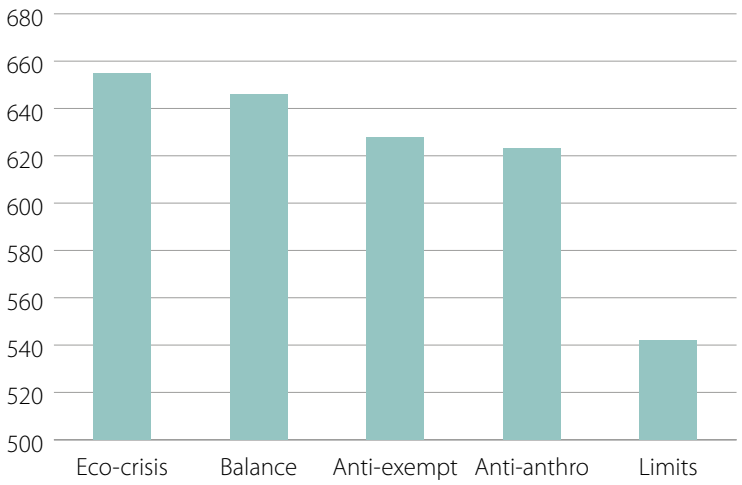
Table 7 *The 15 statements or items of the New Ecological Paradigm (NEP) and their attribution to a pro-or anti-ecological worldview, and to five facets from Dunlap et al. (2000). NEP scores ranged from 1-5, where 5 was strongly-agree. Note that scores for even-numbered statements (i.e. anti-ecological) were reversed to allow their combination with pro-ecological scores to arrive at a meaningful score*

NEP code	Statement or Items	Worldview	Facet
1	We are approaching the limit of the number of people the Earth can support	PRO	Limits
2	Humans have the right to modify the natural environment to suit their needs	ANTI	Anti-anthro
3	When humans interfere with nature it often produces disastrous consequences	PRO	Balance
4	Human ingenuity will ensure that we do not make the Earth unlivable	ANTI	Anti-exempt
5	Humans are seriously abusing the environment	PRO	Ecocrisis
6	The Earth has plenty of natural resources if we just learn how to develop them	ANTI	Limits
7	Plants and animals have as much right as humans to exist	PRO	Anti-anthro
8	The balance of nature is strong enough to cope with the impacts of modern industrial nations	ANTI	Balance
9	Despite our special abilities, humans are still subject to the laws of nature	PRO	Anti-exempt
10	The so-called "ecological crisis" facing humankind has been greatly exaggerated	ANTI	Ecocrisis
11	The Earth is like a spaceship with very limited room and resources	PRO	Limits
12	Humans were meant to rule over the rest of nature	ANTI	Anti-anthro
13	The balance of nature is very delicate and easily upset	PRO	Balance
14	Humans will eventually learn enough about how nature works to be able to control it	ANTI	Anti-exempt
15	If things continue on their present course, we will soon experience a major ecological catastrophe	PRO	Ecocrisis

A total of 735 respondents (including 449 *Woodland owners* and 98 *Agents*) completed this section in the survey, which required all 15 questions to be answered. NEP scores could range from 1 to 5, where 5 is strongly pro-ecological. The mean NEP score was 3.95 (min. 2.2; max. 5.0) among all respondents, meaning that on average respondents held strong pro-ecological worldviews (*i.e.* >3.0) (Figure 19). Responses followed a negatively skewed distribution (-0.403) with a median score of 4.0.

The largest proportion of respondents were categorised as conforming to the *Ecocrisis* facets (655), and, the least to *Limits to growth* (542) (Figure 20). There were no significant differences in overall NEP score or facet scores between *Woodland owners* and *Agents*.

Figure 20 ***Distribution of 735 responses across the five facets of the New Ecological Paradigm.***



A number of tests were conducted among *Woodland owners* (two main sub-types only: single and multiple property owners) to assess whether there was any relationship between NEP score or facet characterisation, and other data. For the composition of woodlands (broadleaved or conifer) there were no significant differences, however among broadleaved woodland owners (≥95% broadleaves), their mean NEP score (4.02; *n*=221) was significantly greater (p=0.009) than among other owners (3.88; *n*=228).

Among *Woodland owners* whose management plan included actions to help minimise carbon greenhouse emissions, NEP scores (mean 4.01; *n*=92) were significantly greater (p=0.027) than for those who did not (mean 3.84; *n*=69).

Tests also revealed that *Woodland owners* who reported noticing increases in some environmental changes, specifically wind, flooding or pollution damage, were likely to score more highly on the NEP scale (p=0.016-0.025).

We reported above (page 21) that alterations to management in response to an observed environmental change is more likely to lead to future similar action. We also explored how respondents might implement a variety of changes within their woodlands as a response to the climate emergency (pages 18-19), and we subsequently tested how such responses may fit with NEP facet characterisation using two-sided t-tests. We found that *Woodland owners* in the *Limits to growth* facet were significantly more likely to *Plant new woodland* (p≤0.001), *Increase hedgerows/shelterbelts* (p=0.005), and *Alter future woodland management* (p=0.008). Owners in the *Anti-Anthropocentric* facet were significantly (p=0.04) more likely to *Create new agroforestry schemes*.

We divided *Woodland owners* into two groups, those who scored greater than the median NEP score, and those who scored less than or equal to the median. Those in the upper-half were more likely to rate all five offered factors of *Age diversity* (p≤0.001), *Diversity of woodland structure* (p≤0.001), *Species diversity* (p≤0.001), *Genetic diversity* (p=0.003), and *Natural regeneration* (p≤0.001) as more important.

Woodland owners in the upper-half of the NEP score were significantly (p≤0.001) more likely to consider the future resilience of carbon stocks and carbon sequestration as more important.

When considering the ideal balance between native and non-native trees in UK forests (pages 20-21), those who would prefer a higher proportion of non-native species had a lower mean score (3.73; *n*=50) compared with those who preferred a higher proportion of native species (mean 3.99; *n*=321).

Those who believed that in non-commercial woodland there was insufficient species diversity (p=0.003), and insufficient genetic diversity (p=0.04), were more likely to have high NEP scores, but views about genetic and species diversity in commercial woodlands were non-significant for NEP score.

We also explored how woodland owners might consider diversifying the range of species in their woodland (page 25) according to each facet, and found that those in *Limits to growth* were more likely (p=0.04) to diversify than those in *Anti-Anthropogenic* facet.

Among *Agents* who undertook the NEP questions we explored how their business practices or advice had changed in respect to environmental changes. Among the many options offered (page 21), the only significant differences were for agents with pro-ecological views who were more likely to have changed practices for *Fire* (p=0.013) and *Flooding* (p=0.002). *Agents* who encourage their clients to include management actions to help minimise greenhouse gas emissions were significantly (p=0.02) more likely to have higher NEP scores.

KNOWLEDGE AND NETWORKS

We asked a range of questions about knowledge and networks, some of which were less directly relevant to the theme of resilience than others, but are nonetheless considered worthwhile to report here, given the interest in communicating information and knowledge in designing new land management policies following the UK's departure from the EU.

We asked *Woodland owners* to indicate the usefulness (scored 1-5, where 5 was most useful) of different advisor types for managing their woodlands. Among 531 respondents, the most useful were considered to be *Other woodland owners* (mean 2.6; median 3), followed by *FC Woodland Officers* (mean 2.1; median 2), *Private agents* (mean 1.8; median 1) and *Other (non-FC) government officers* (mean 1.0, median 0). *Agents* were more likely to use the full range of sources of advice than *Woodland owners*.

Results in the 2020 survey showed a significant decrease in use of external consultants and government Woodland Officers compared to results from 2015.

In terms of how any such support was most preferred among *Woodland owners*, *Online information and guidance* was considered most useful (mean 2.9; median 3), followed by *Printed material* (mean 2.7; median 3), and *Local workshop events* (mean 2.1; median 2).

For sources of advice and/or information on forest management, among 535 responses most (315) favoured *Magazines*, followed by *Web-based sources* (274), *Trade associations* (156), and *External consultants* (142).

> "Collaboration is king."
> Woodland owner.

The majority (59%; 512) of *Woodland owners* indicated that they currently collaborated with other *Woodland owners* to *Share knowledge and information,* but otherwise a minority collaborated to achieve a range of outcomes, including *Control pests and diseases* (21%), to *Achieve economies of scale* (17%), *Increase landscape (e.g. catchment scale) tree planting* (12%), and to *Share profits* (1%), In terms of the likelihood of collaborating in future, *Woodland owners* responded similarly to current levels of activity, with only *Control pests and diseases* being an activity showing notable change with 45% likely to collaborate in future compared to 21% currently not doing so.

Respondents provided a wide range of free-text comments on their experiences of collaborating and networking. These ranged from those strongly in favour of collaboration and already active:

> "Adjacent woodland owners have been very cooperative and we are all mutually interested in each other's activities. Pest control is done collaboratively. We have found local courses on woodland management and species diversity, for example the LOST project in Cumbria, a great source of information and contact with other local woodland owners and foresters. We have been exploring cooperative use of the woodland with local schools through the RFS."
> Woodland owner.

> "I just chat casually to woodland neighbours and share good practice."
> Woodland owner.

Many others noted that collaboration happens sporadically and would welcome more encouragement and development of opportunities:

> "Collaboration has been piecemeal and mainly with immediate neighbours on relatively small projects – *e.g.* riparian planting *etc.*"
> Woodland owner.

> "Farmer clusters have been shown to be extremely effective in increasing biodiversity in England and I would like to see more thought and resource given to this in Scotland – *e.g.* making sure that forestry expansion plans are prevented from re-creating the horrors of the past such as wiping out heather moorland and the accompanying suite of native wildlife such as waders, black grouse, mountain hares *etc.*"
> Woodland owner.

Discussion

The 2020 British Woodlands Survey has provided the first opportunity to explore changes in awareness, action, and aspiration over time, and it was encouraging that we were able to do so with confidence as indicated by most statistical tests. In our analysis this year, we were also able to explore further the 'ecological worldview' of respondents – in essence a form of environmental profiling – which yielded a number of thought-provoking results. These should be of considerable interest to a diverse range of stakeholders, including policy makers practitioners and researchers, especially concerning likely action or inaction among different stakeholders to policy, regulations, or incentives. We intend to follow-up on this work by exploring the data received in the survey more deeply.

In terms of overall response to the 2020 survey, we were pleased that interest in participation is still high: we received more than 1,000 responses, and while numbers from Scotland were down compared with 2015, those from Wales increased. A sample size representing 3% of privately-owned woodland area across Britain is an important source of evidence. Allowing respondents to acknowledge their role as the owner of a woodland in addition to another role – for example *Professional – I manage my own woodland and have a professional interest in UK forestry* – was a helpful step in the way that we were able to categorise responses to multiple roles. Lastly, the 2020 survey was launched when Britain was subject to an unprecedented societal lockdown in response to the global Covid-19 pandemic. The impacts of this on the survey are difficult to ascertain, but may explain some of the differences in responses compared with 2015. Were people less confident about the future? Has consideration of wider benefits of the environment affected responses? Future social research may shed light on the impact of the pandemic and lockdown.

AWARENESS

Awareness of damage from pathogens was strongly evident in this survey, and indeed this has increased significantly since 2015. This finding is unsurprising with the continuing impact of ash dieback across the country, and perhaps the increase in awareness in acute oak decline and other pathogens. Enhanced awareness of drought and fire in the last five-year period appear to mirror anecdotal reports, but national fire statistics for the whole of the same period are not yet available to permit a more thorough investigation. Vertebrate damage, mainly by grey squirrels and deer, remain a significant problem in our woodlands.

ACTION

We decided upon four management activities that might best indicate actions to support forest resilience. It was disappointing to discover that a minority of woodland owners and agents had neither reviewed climate change projections for their specific location nor completed a survey of soils, although most were practicing continuous cover management in some form and had reviewed tree species suitability. When asked about future intention, a majority indicated that they intended to review tree species suitability. It was reassuring to note that thinking and action was most advanced where production was an important objective, and where it is likely to require the most urgent attention. However, the analysis also raises concerns that woodlands managed for other objectives may not be resilient and therefore that the delivery of their goods and services may be compromised. This set of questions allowed us to analyse whether there was a relationship between current action and future intention, and the results confirmed a very significant relationship.

A similar result was found for predicting responses to environmental threats. Essentially, current levels of action are a very good predictor for future intentions. This should interest policy makers who will understand that investment in raising awareness, providing support and advice, and promoting action among an audience is likely to lead to long-term positive changes in behaviour. Conversely, failing to address inaction or unawareness, is likely to lead to continued failure to support actions essential for resilience. Ultimately, our focus in future should be on those who are not acting to manage their woodlands and to support them in implementing anticipatory not reactive adaptation measures.

Questions remain concerning how levels of woodland management can be qualified. Government and others have used the presence of a woodland management plan compliant with the UK Forestry Standard (UKFS) as an important indicator. It is widely accepted that there are cases where exemplary forest management may be active, regardless of a woodland management plan being in place (and whether it is UKFS-compliant) or not. That said, in the absence of any simple alternative, the presence of a management plan remains an important indicator that a woodland owner, manager, or agent has thought carefully about their responsibilities and the sustainable development opportunities available. Compliance with the UK Forestry Standard ensures that activities are balanced and proportionate, and that they meet both legal requirements and meet defined best practice. While some questions may exist concerning the need to update the UKFS to meet the urgent challenges of the climate emergency, nonetheless it provides a sound and unprejudiced foundation to support sustainable development in our land management practices. Now, more than ever, as new major new grant schemes are under development following Brexit and through devolved governments, there are significant and crucially important advantages from continuing to promote the benefits of an independent and unbiased standard to promote sustainable forestry.

The choice of tree species in relation to environmental factors, including site and local climate, has attracted renewed interest in recent years . For some forest managers, the silvicultural characteristics of a wider palette is believed to help diversify forests and reduce the risks of climate change and pests and diseases.
Other practitioners believe that there is sufficient diversity and therefore resilience among existing tree populations. While this debate continues in the face of insufficient data and uncertainty among practitioners as to best practice, in BWS2020 we explored each respondent's ideal proportion of native *vs.* non-native species. It was interesting to discover that respondents overall would like to see a 6% increase in area under native trees, although *Agents* sought a smaller increase than *Woodland owners* and other groups. Interestingly, between 2015 and 2020, there was a 3% increase in the ideal proportion of native tree species. The respondent's management aim for their woodland also had a strong impact on this question, with those aiming for capital growth, wood production, and game management preferring an increase in non-native species. A person's ecological worldview is also a good predictor of likely views about tree species diversity.

ASPIRATION

Questions in the 2020 survey concerning carbon management revealed that most respondents considered it to be a moderately important aim overall, and rated the resilience of carbon stocks quite highly as a management objective. However, carbon did not rate highly as a motivation for diversifying tree species. Those with pro-ecological worldviews are more likely to consider minimising greenhouse gas emissions in their management actions, and indeed to consider the future resilience of carbon stocks. A minority of those who said they were likely to expand tree cover in the next five years were likely to register with the Woodland Carbon Code.

With the current high interest in creating new woodland, BWS2020 asked many questions about increasing tree cover. We discovered that almost half of our respondents had increased tree cover in the last five years, and a similar proportion intended to increase woodland cover in future. Many respondents however did indicate that they would consider expanding tree cover as a response to the climate emergency, perhaps indicating a longer-term aim.
Tree planting would be the popular method of woodland creation with a mean expansion of 29ha, although natural regeneration was the next most popular even though the mean area was much smaller at 6ha. Agroforestry schemes were likely to represent less than 13% of the area to be created by woodland tree planting. The biggest barriers to expanding tree cover were lack of available land, although lack of grant aid and complexity of regulations were also significant. This supports the findings of a members' survey undertaken by the Royal Forestry Society earlier in 2020. Professional agents, by contrast, thought that grant aid would be the incentive most likely to encourage an expansion in tree cover, while other sources of income (*e.g.* Woodland Carbon Code) and free or low-cost advice were also likely to provide significant motivations.
Again, a person's ecological worldview is also significant in terms of willingness to respond to a range of resilience actions, including creating new woodland.

Most *Woodland owners* were keen to diversify the range of tree species in their woodland, although there was more interest in the source of the material grown and in using British nurseries, than there was in adopting improved stock (*i.e.* under Forest Reproductive Materials categories). There was strong support among respondents in adopting natural regeneration to support adaptation.

In the 2020 we offered four choices to respondents for actions that could be taken to respond to the climate emergency. Altering woodland management practice scored highly, with a significant proportion indicating that they would consider increasing hedgerows or creating new woodland.

There was a clear appetite for woodland management support from online sources, and increased knowledge sharing through networks and informal contacts. This may well be a direct result of the significant decrease in use of external consultants and government Woodland Officers. The role of magazines as a source of practical information on woodland management remains surprisingly high and should not be ignored in the general move towards online dissemination of information.

Conclusions

Near the front of this report (page 4) we provide a summary of how the evidence from BWS2020 can be used to inform the progress of the FCCWG's action plan. We also highlighted 11 critical issues identified by Forestry and Climate Change working group (see Box 2, page 8), and these are worth reflecting upon here as a framework for our conclusions. Of chief concern and where the results of BWS2020 provide some context and evidence, these can be summarised as follows:

I. **Not enough woodland creation** – respondents are clear that barriers exist even if land was available, chiefly funding and bureaucracy.

II. **Lack of woodland management** – concerns about vertebrate pests highlights the damage that deer and squirrels have on actions which can assist adaptation, including natural regeneration. The minority of respondents (31%) having a UKFS-compliant management plan in place is unsatisfactory.

III. **Lack of diversity in new tree planting** – our respondents show a general trend towards desiring more native species. This will please some while frustrating others, given polemic views on native and non-native tree species and merits for adaptation.

IV. **Nurseries are providing a limited range of stock** – we had a low response for BWS2020 among tree nurseries. However, among practitioners, UK-grown planting material is favoured which mostly likely reflects increasing concerns about biosecurity, which is encouraging. Low interest in Improved stock might indicate limitations for enhancing genetic diversity, or at least for supporting productivity.

V. **Lack of contingency planning** – BWS2020 results very clearly indicate a close relationship between current activities and future intentions. More advocacy and support for practitioners will reap long-term benefits.

VI. **Low level of restocking** – not addressed in BWS2020.

VII. **Continuous cover management** – the majority of respondents were applying this forest management technique and intend to in future, which is very encouraging.

VIII. **Forest planning and design** – low awareness of climate change projections, tree species suitability and influence of soils, all point to poor preparedness in planning and implementing resilience woodlands in future.

IX. **Clarity on adaptation measures** – the range of awareness and action reflects the current lack of clarity on best practice, and points further to the importance in updating the UKFS as a priority.

X. **Lack of knowledge sharing practice** – most respondents did not collaborate other than to share knowledge and information with wide divergence on current levels of activity. There was however interest expressed in future collaboration, particularly to manage pests and diseases. Support for cooperation and collaboration could have potential for driving landscape-scale change.

XI. **CPD opportunities** – not addressed in BWS2020.

BWS2020 provides an important data-set for informing forestry policy; while understanding of and interest remains high, there continues to be little evidence of widespread implementation of actions to enhance resilience. The analysis presented here highlights that this adaptation deficit is largest where timber production is not a major management objective and reveals motivations behind implementing resilience actions that can be harnessed in future policy development.

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