

2015 | BRITISH
WOODLANDS
SURVEY

**Awareness, action and
aspiration among Britain's
forestry community relating
to environmental change:**

Report of the British Woodlands
Survey 2015



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Foreword

I am very pleased to see the results published from the British Woodlands Survey on resilience, having been present at its launch alongside the forestry sector's Climate Change Accord in July. For the first time, we have on record the 'voice' of more than one and a half thousand woodland owners and managers. This is critical as, if we want to make real change on the ground, this will have to be done by landowners and managers themselves. The results tell us that there is much work to do, with little progress seen on implementing adaptation to date. It is, however, pleasing to see that thought is being given to climate change and resilience. This adds weight to the clarion call that arose from the Climate Change Accord, for woodland owners and managers to embrace climate change adaptation through practical action.

Our ancient semi-natural woodlands have some proven resilience and many may have the capacity to adapt to a changing climate over future centuries. Nonetheless, we know that our environment is changing more rapidly than ever before. Within our farm woodlands and productive forests there is a priority for action so that they continue to help meet our growing timber and wood fibre needs over the rest of this century. It is clear that there are different actions and approaches for different woodland types and management objectives – but all need careful thought, now, as to how to ensure their future resilience.

Building on the evidence presented in this survey, the Climate Change Accord provides a framework upon which the sector can build, being proactive and visionary in planning to adapt to climate change. But it is not just about planning; there is an urgency for adaptation measures to be implemented now. These will ensure that the woods that so define our British landscape and provide so many complex benefits, continue to meet the needs of future generations.

Sir Harry Studholme
Chairman, Forestry Commission

Acknowledgements

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For funding and support we thank Forestry Commission England, Sylva Foundation, University of Oxford, and Woodland Trust.



We are indebted to all respondents for the time taken to respond to the survey and for sharing so readily their awareness, action and aspiration relating to environmental change.

About the British Woodlands Survey

The British Woodlands Survey (BWS) gathers evidence about the UK's woodlands and those who care for them. It aims to provide an evidence base on which future policies and practice can be developed. BWS2015 is the third survey in the series. The British Woodlands Survey is co-ordinated by the Sylva Foundation within its think-tank Forestry Horizons. For more information visit: www.sylva.org.uk/forestryhorizons/bws

Citation

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Executive summary

Almost three quarters of the UK's woodlands (2,283,000 ha; Forestry Commission 2015) are in private ownership, yet little is known about the awareness of woodland owners and managers, and forestry professionals, concerning the importance of woodland resilience to environmental change. Many key questions concerning adaptation to environmental change were unasked and unanswered, meaning that accordance with the guidelines of the United Kingdom Forestry Standard (UKFS) has been difficult to measure, both in terms of current actions and future aspirations.

During 2015 a group of forestry and woodland stakeholders agreed to gather evidence to inform policy and practice by running a national survey, under the British Woodlands Survey series, to explore awareness, action and aspiration relating to environmental change among private woodland owners and managers. The survey, which was framed around the adaptation elements of the UKFS, ran from July until September 2015. The survey represents the first comprehensive evaluation of the level of understanding of the need to adapt to climate change across the forestry sector and the rate at which adaptation measures are being implemented. As such, it provides important evidence for the UK's second Climate Change Risk assessment and for the second National Adaptation Programme (England) that will present Government's response to the priority risks identified.

Forestry in the UK represents a broad range of management objectives, from nature conservation, through recreation provision to commercial plantations. This report respects that wide spectrum of objectives but, as a central theme, considers what is necessary to maintain productive potential and economic sustainability alongside the social and environmental pillars of sustainable forest management and the complex array of ecosystem services emanating from forests.

SURVEY RESPONDENTS

1509 people responded to the survey including: 827 private woodland owners; 182 forestry agents; 235 other tree and forestry professionals (e.g. NGO staff, forestry contractors); and 19 tree nursery businesses. Responses were received from across the whole of the UK: most private woodland owners were located in England, while agents proportionally

represented more properties than owners in Scotland and Wales. The respondents represented an area of woodland, managed by owners or their agents, covering 247,891 ha; equal to 11% of all privately-owned woodlands in the UK.

AWARENESS

Among all respondents 52% believed that the climate is changing to such an extent that it will affect UK forests in the future. There was a high degree of uncertainty (34%) among all respondents, whilst only 14% believed that climate change would not affect UK forests. There was more uncertainty among woodland owners than professionals: 45% of owners believed that climate change will affect forests and 55% of owners were uncertain or disagreed with this statement.

Ninety percent of respondents reported observing at least one form of environmental change in the last ten years, with impacts from vertebrate pests such as deer and squirrels most cited by woodland owners, and pathogens and pests most commonly reported by forestry professionals. Among those reporting an increase in environmental impacts over recent years there was a clear relationship between the number of impacts observed and the proportion of those who believed that climate change will impact the UK's forests in future.

ACTION

A minority of woodland owners reported implementing key adaptation measures from the UKFS, including reviewing climate change projections for their region (15%). A small majority of owners expressed an intention to have some woodland area under continuous cover management (53%) and to review in future tree species suitability (62%). A minority of owners currently make provision for environmental change, the greatest provision (41%) being made for pest (vertebrate or invertebrate) control.

Management of both pathogens and pests (vertebrate and invertebrate) were singled out as issues of highest priority among all respondents. Among forest management practices highlighted in the UKFS, species diversity was identified by owners and professionals alike as the top priority for resilience, over age diversity, forest structure or genetic diversity.

Only 16% of owners knew the origin, provenance or genetic variation of their three most frequently-occurring species. 50% of owners believed that locally-sourced planting material was more important for maintaining or enhancing resilience than improved material, although 31% were unsure. Among those responding to this survey, owners stated a preference for an increase in woodland area under native tree species, from 59% of woodland area currently to 65% in future, whilst agents and professionals appeared more content with the current balance between native and non-native species. Such conservatism among woodland owners may be a barrier to the implementation of adaptation measures.

A majority (69%) of owners stated a preference for specifying UK-grown material for future planting. Among the nursery trade, 71% of businesses reported knowledge of the provenance of all of their stock, with provenance/origin information routinely provided, when available, to customers by 92% of businesses.

Among agents providing advice to clients, perceived threats from pathogens and pests have led to the largest changes in practice. The majority reported no change in relation to advice given for fire management, pollution or flooding.

A minority of woodland owners confirmed having any of five key biosecurity practices in place. Only 7% of woodland owners provide cleaning and disinfecting facilities for visitors whilst, surprisingly, 33% of agents confirmed that they advise their clients to do this. A small minority (14%) of owners reported providing any site information on biosecurity for visitors.

Lack of information was cited as a major barrier to managing for resilience in the context of pathogen control among owners and agents. Financial costs only featured strongly as a barrier to the control of pests (vertebrate and invertebrate).

ASPIRATION

The outlook among owners and agents for the resilience of woodlands under their stewardship was mostly positive (67% of respondents), although this was generally based on the assumption that 'nature would cope'. Such faith in the ability of nature to adapt to the likely rate and magnitude of environmental change indicates significant resistance to the implementation of adaptation measures and raises concerns over the future of our woodland resource. Specifically, it indicates that woodland owners and managers may not be aware of the magnitude of change that is predicted. Among comments received expressing concern for the future, pests and diseases, in particular ash dieback, were most commonly cited. Again, this indicates that current pest and disease outbreaks are dominating the resilience agenda, with less thought given to the longer term, incipient, effects of climate and environmental change, which will require equal attention.

IMPLICATIONS FOR PRACTICAL ACTION

Responses from the 2015 British Woodlands Survey indicate that the resilience of the UK's forests is currently poor although there are a number of positive aspects relating to current action and aspiration that can be built upon. Such actions will require collaboration across the sector, with responsibilities shared between the many and diverse actors. The 2015 Climate Change Accord provides a promising platform for consensus and co-operation that will support these actions.

However, the survey also identifies a number of barriers to the implementation of practical action, not least the conservatism of woodland owners and the assumption by a majority that 'nature will cope'. The responses also clearly identify that practical action will not be embraced until risks are more clearly communicated and firmer, tailored, guidance is provided on how to address those risks.

Summary	
1	Overall, accordance with guidelines for adaptation within the UK Forestry Standard is currently low.
2	High awareness among woodland stewards of environmental change impacts may provide new opportunities to engage with woodland managers, particularly if focussed around issues of direct and local relevance.
3	Professionals and agents were generally more aware and active in implementing adaptation measures than owners, indicating that existing sources of information and outreach activities among these groups are effective.
4	Lack of information and advice available to woodland owners and managers to help them respond to existing and emerging threats surfaced as a key issue. A number of owners expressed a view that subjects covered by the survey were too technical. Existing assumptions concerning comprehension and knowledge of adaptation and resilience may be unrealistic.
5	A dearth of contingency plans among owners and managers to deal with major events such as fire, pest and disease outbreaks, and extreme weather, is of considerable concern.
6	Low awareness of climate projections for their locality, together with lack of knowledge of soils, means that most woodland stewards are unaware of the potential impacts of environmental change. Most owners have not reviewed future species suitability and are therefore unaware of the potential for creating more resilient forests.
7	Uncertainty around the concept of provenance, improved material and genetic diversity points to a requirement for improvements in education.
8	Low levels of awareness and action in relation to biosecurity among owners, which was only marginally better among professional foresters, could involve a review of the feasibility of recommended approaches, an assessment of risks, and feed into predictive modelling.
9	Targeted funding to support actions which might benefit the resilience of woodlands, in particular pest management and control, would be highly beneficial.
10	Many of the actions for increasing resilience will flow from good management planning and levels of understanding of the issues, both of which appear to be insufficient. The high number of woodlands without a management plan will undermine attempts to improve resilience.

Introduction

SURVEY SCOPE AND PURPOSE

The purpose of BWS2015 was to explore adaptation to environmental change in British woodlands, and their potential resilience, by assessing awareness, action and aspiration among woodland owners, managers and related professionals. The intention was to create a baseline of evidence against which change can be measured in future. There are various policy contexts for this evidence, and these are outlined below.

The survey was also designed to accompany the 2015 Climate Change Accord¹, signed by more than 30 organisations within the 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.”

Organisations involved in the Accord also produced ‘Adaptation in Action’ statements, to explain their distinct views on issues and the actions that they are taking to improve resilience. Hence this survey provided a platform for the voice of the individual to be heard, alongside those of organisations.

The three themes of the survey – 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.

¹ www.sylva.org.uk/forestryhorizons/downloads/Climate_Change_Accord_2015.pdf

The survey targeted four groups representing woodland owners, agents, tree and forestry professionals, and tree nursery owners/managers.

DEFINITIONS

Environmental Change

The term ‘environmental change’, as opposed to ‘climate change’, was adopted 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 would be 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.

A common accessible definition of resilience is an ability to ‘bounce back’, or even ‘bounce back better’ (e.g. Brussels Briefings 2013). The latter definition was adopted for one of the survey questions (page 26).

BACKGROUND

In November 2015 the UK's Meteorological Office reported that global temperatures had risen to more than one degree centigrade above pre-industrial levels. The world is half way towards 2°C; the gateway to dangerous climate warming (World Meteorological Organization 2015).

The forests, woodlands and trees of the UK have been exposed to considerable changes in the climate over the last five decades, and these are predicted to become much larger in future decades, largely because of our use, globally, of fossil fuels (Forest Research 2015).

The Climate Change 'element' of the UK Forestry Standard is divided into mitigation and adaptation measures, the two main anthropogenic responses to climate change. Mitigation addresses the causes of climate change. Good woodland management, involving activities such as regular thinning and protection from pests and disease threats, will in turn encourage tree growth. The better the tree growth, the better the woodland will be at absorbing carbon dioxide, which it will lock up ('sequester') in the wood and help reduce atmospheric carbon dioxide concentration in the process.

Adaptation focuses on meeting the impacts of climate change. For the forestry sector it means reducing the vulnerability of forests, as well as using forests to reduce the vulnerability of society to climate change.

In theory these two measures are inter-related. Good woodland condition through the adoption of adaptive actions will promote the ability of forests to mitigate climate change. The ability of forests to mitigate (mainly through carbon sequestration) should slow the rate of climate change enabling forests to adapt, at a manageable rate of change, to novel climatic conditions.

The Read Report (Read *et al.* 2009) noted that impacts of climate change are becoming apparent in the UK's woodlands, including effects on productivity, tree condition, woodland soil function, woodland fauna and flora and forest hydrology. A key finding from that report was that there is increasing concern over the number of outbreaks of novel pests and diseases in forestry and arboriculture. The report stated that forest pests and diseases could compromise the ability of woodlands to adapt and contribute to meeting the challenge of climate change.

Defra's action plan for tree health and plant biosecurity (Defra 2011) corroborated that there has been a clear increase in the number of novel pests and pathogens affecting the trees and forests of Britain, which is most likely accelerated by the combined effects of, *inter alia*, globalised trade, a changing climate and the planting of exotic species (Cavers 2015). This highlights a key concept, namely that not all environmental change is a result of a changing climate, however there is strong inter-play between climatic and other environmental changes. For example, climate change may have a major effect on the severity of the impact of some existing pests and diseases, and may facilitate the establishment or expansion of organisms that may become new problems.

The Read Report emphasised the need for the wise management of our forest resources. Forest scientists have developed this notion further by suggesting that a more sustainable long-term strategy for managing tree health must be to develop resilient populations, capable of internal responses, by building evolutionary processes into forest and tree management at multiple spatial scales (Lefevre *et al.* 2013).

As highlighted in the 2012 British Woodlands Survey (Nicholls *et al.* 2013) it is clear that in order to address and act upon such recommendations, there is a strong requirement to build a dynamic relationship with those who own and manage the vast majority of the UK's woodlands. Policy makers and foresters alike should seek to understand the views and opinions of landowners and tenants regarding the opportunities and challenges in adaptive management for climate change and how these fit with the broader objectives of sustainable forest management.

POLICY CONTEXT

The 2015 survey was framed around the adaptation elements of the United Kingdom Forestry Standard (UKFS), while ensuring that key objectives of the National Adaptation Programme for the forestry sector in England 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.

Intergovernmental Panel on Climate Change (IPCC)

The 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.

United Kingdom Forestry Standard (UKFS)

Two main adaptation requirements are specified in the UKFS:

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

The UKFS provides guidelines on forests and climate change (Forestry Commission 2011) 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.

National Adaptation Programme (England)

Government's department responsible for rural affairs in England, Defra, set out a vision to help make the country resilient to a changing climate under a 'National Adaptation Programme' or NAP (Defra 2013). Specifically it suggested that "Profitable and productive agriculture and forestry sectors that take the opportunities from climate change, are resilient to its threats and contribute to the resilience of the natural environment by helping to maintain ecosystem services and protect and enhance biodiversity." In the context of forestry the NAP identified: "Our woodlands will need to be increasingly resilient to cope with the potential changes in climate and more frequent weather extremes. Actively managing more sites, preserving and enhancing species diversity and embedding adaptation skills and knowledge will help to ensure that our woodlands continue to deliver a wide range of benefits. Taking climate change into consideration in woodland creation and restocking will be particularly important given the long time-scales involved." The NAP for England set out two objectives that relate to forestry:

- Objective 16:** To increase the resilience of the forestry sector by increasing the level of management in England's woodlands and the uptake of adaptation good practice in woodland creation and restocking.
- Objective 17:** To increase resilience to pests and disease to help protect biodiversity, maintain agricultural and forestry productivity and protect the UK's ability to export products.

A report to Parliament by the Committee on Climate Change highlighted progress in meeting these objectives (Committee on Climate Change 2015). This report accepted that there was less evidence available in respect to private estates.

The BWS2015 survey was developed and designed to provide a baseline of evidence against which progress towards meeting the objectives of the NAP could be measured in future.

Survey method

The survey was open to participants from 31st July until 30th September 2015. People were invited to participate in a structured online survey, built in LimeSurvey, an open-source survey tool (www.limesurvey.org). It was designed to operate on desktop computers as well as mobile devices such as phones and tablets. It was hosted online within the Sylva Foundation's think-tank Forestry Horizons at www.sylva.org.uk/bws.

A wide variety of communication channels were used to attract participants. Printed fliers were disseminated at the CLA Game Fair and Confor Woodland Show. All participating partner organisations with memberships promoted the survey directly to their members via enews and direct appeals, and a large number of organisations used social media to build interest and encourage participation. The Sylva Foundation contacted previous participants of British Woodlands Surveys (2012 and 2014).

The survey targeted four groups, representing:

GROUP I woodland owners, or agents responding on behalf of a specific woodland from their client base;

GROUP II agents answering more generally without reference to a specific woodland;

GROUP III tree and forestry professionals (excluding agents);

GROUP IV tree nursery businesses, represented by owners/managers.

Woodland owners/agents under Group I were asked to respond to several questions that dealt in some detail with the specific woodland property, including its physical characteristics and silvicultural management. Agents not responding on behalf of a specific woodland (Group II) answered a shorter range of questions than those agents in Group I; essentially a very similar survey to tree and forestry professionals in Group III. Nonetheless, agents were maintained as a separate group so that responses from those providing advice to woodland owners, as opposed to general forestry professionals, could be analysed separately as necessary.

The survey comprised a varying number of questions, dependent on the route taken by the four target groups: owners had a maximum of 45 questions to answer, agents responding professionally and for an individual owner had 50, agents responding professionally had 19, other respondents with a professional interest in forestry and those owning or managing nurseries both were offered 20. Questions were presented as variables that could be selected by participants through the use of multiple choice options or 10-point Likert scales (de Vaus 2002); a psychometric scale commonly used in questionnaires in which respondents express their strength of agreement with each of several statements that assess the extent of agreement/disagreement. A small number of 'free-text' questions invited participants to provide more detailed responses. Most questions were optional; mandatory questions were used only to route participants through relevant questions that were not applicable to everyone. The complete set of questions is available at www.sylva.org.uk/bws2015.

Results for all questions posed in the survey are reported. Where relevant, results are analysed by category of respondent (owner, agent, other professional, nursery owner or manager), and for some questions sub-analyses

are presented based on size of woodlands or location of the woodlands or clients of agents. A small number of questions are analysed with respect to responses received for another question. More such sub-analyses and correlations will be the subject of subsequent research. The authors are aware that the responses reported reflect only the views of those who participated in the survey. Some attempt has been made to put into context the profile of these respondents, by reflecting on previous work with private woodland owners and national statistics, but care has been taken not to extrapolate from the current survey data to make broad statements about all private woodland owners and managers in the UK. As with all surveys, individual interpretation of questions can vary among respondents, as can strength of agreement with statements offered using Likert scales (de Vaus 2002). The analysis is careful not to make assumptions about these two points.

Limitations of the survey:

1. The data reflects the views only of those who participated in the survey. Analysis of responses has been used to test how representative the respondents are of the wider community of private woodland owners and managers, but it is recognised that there are always those who do not or cannot engage.
2. The survey was only available to those willing to work online (desktop computers or mobile devices).
3. Although the survey took on average 18 minutes (median 15), many respondents spent considerably longer on it. Survey attrition (lower response rates towards the end of the survey) was inevitable. Randomising questions was not possible because of the complex routing devised to offer different questions to different types of respondent.

Results

RESPONDENTS

“This is one of the more thoughtful and comprehensive surveys I have completed.” *Woodland Owner*

“The survey appears pointless and seems to be a way to leverage money to do some work on the matter.” *Forestry Professional*

“A good survey and may well prompt managers and owners to take the changing climate seriously.” *Professional Agent*

“As a private woodland owner I feel many of the question asked, are for the highly competent in woodland knowhow. Yet many consultants know little more than I but they do know how to apply for the grants. Better trained personal are needed for management.” *Woodland Owner*

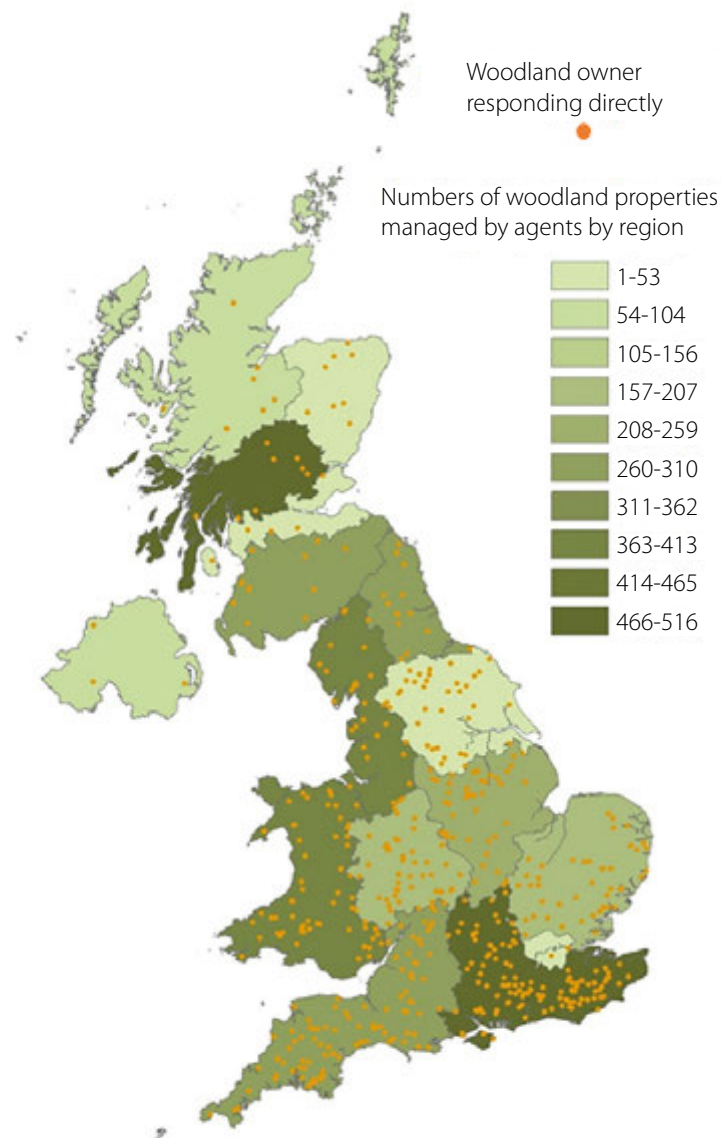
The total number of survey respondents was 1509, distributed across the UK (Table 1; Figure 1).

827 respondents were private woodland owners (55% of those that specified their status). The most strongly represented region was the south east of England (135 properties), followed by the south west (108). Yorkshire was least well represented (23 private woodland properties).

Table 1 Geography of responses based on number of woodland properties owned or managed.

Country	Agents		Owners	
	n	%	n	%
England	2079	59.6	519	84.4
Scotland	938	26.9	49	8.0
Wales	389	11.2	43	7.0
Northern Ireland	81	2.3	4	0.6
Total	3487		615	

Figure 1 Distribution of responses to the survey among woodland owners and agents



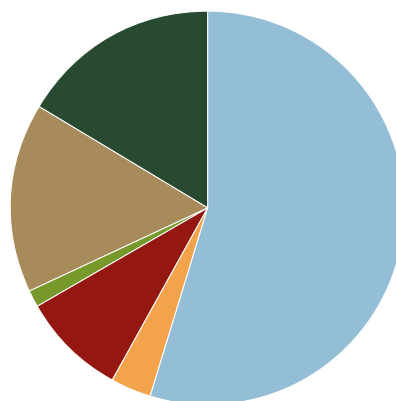
A total of 182 agents, responsible for managing 3487 woodlands, responded to the survey (Figure 2). Agents were proportionally more strongly represented than owners in Scotland and Wales (Table 1). In some cases where responses from woodland owners was low, agents in contrast were very strongly represented. One example is Perth and Argyll where only nine owners responded (Figure 1) yet agents who took part managed 497 woodland properties covering 19,538 ha in this region.

The sampling represented an area of woodland, managed by owners or their agents, equalling 247,891 ha, which equals 10.8% of the area of all privately-owned woodlands in the UK (Forestry Commission 2015).

235 tree and forestry professionals responded to the survey, categorised as follows: forestry industry (28%); NGO community organisation (22%); public sector – central/devolved government (12%); public sector – local government (7%); research institute (7%); university research (5%); other (12%). The remaining 7% was 'No professional involvement in forestry (personal interest)'.

Responses were received from 19 tree nursery businesses that represented a combined annual turnover in excess of £9.5M.

Figure 2 Survey participants by main typology (number and %). For sub-categories among Forestry Professionals see main text.



- Unspecified **246 (16%)**
- Forestry Professional **235 (16%)**
- Nursery **19 (1%)**
- Agents providing generic information **130 (9%)**
- Agents providing single-owner data **52 (3%)**
- Owner **827 (55%)**

16% of respondents selected not to define their typology. Such respondents were provided with only three sections to complete in the survey: Observations and Attitudes (n = 17), Information and Advice (n = 15), and Further contact (n = 13). Their responses were included only in analyses that were not subdivided by category.

The number of answers received varied due to a number of factors, including options provided within the routing of the survey, the fact that questions were optional, and due to 'survey fatigue' (i.e. respondents not completing the entire survey). Detail concerning the number of responses attributed to data analysed are provided where necessary.

WOODLAND AREAS

Owners participating in the survey reported caring for a total area of woodland equalling 86,201 ha (Table 2); the median woodland size was 8.1 ha (range 0.02-25,000 ha).

Those participants responsible for managing woodlands on behalf of other owners reported being responsible for 154,480 ha.

Table 2 Area of woodland owned or managed by participants

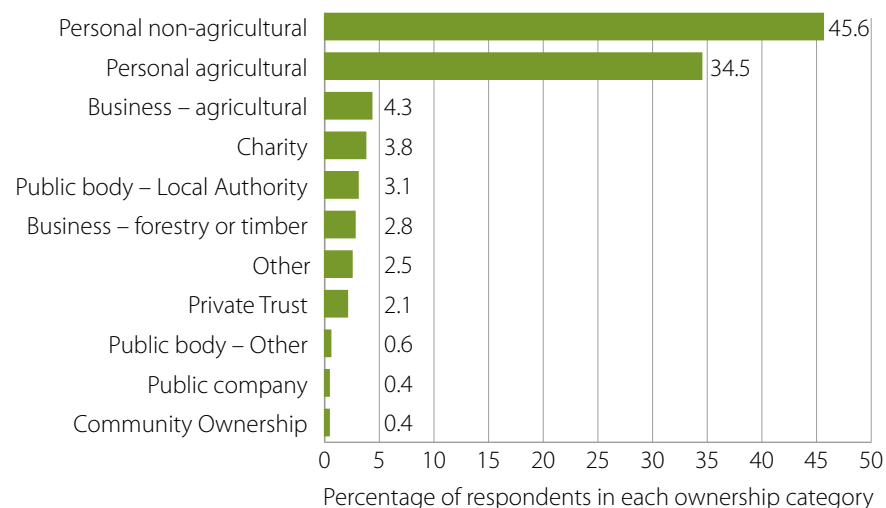
Area of woodland represented by participants (ha)					
	Own woodlands		Manage on behalf of other owners		TOTAL
	median	total	median	total	
Owner	8.1	86,201	20.2	50,689	136,891
Agent	60.0	7,209	540.0	103,790	111,000
All		93,410		154,480	247,891

OWNERSHIP TYPE

Ownership type was classified according to 11 typologies following Nicholls *et al.* (2013). These differ from those adopted in the National Inventory of Woodland and Trees (Forestry Commission 2003), 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 (46%) of respondents; the second most frequent (34%) respondent type being Personal agricultural (Figure 3).

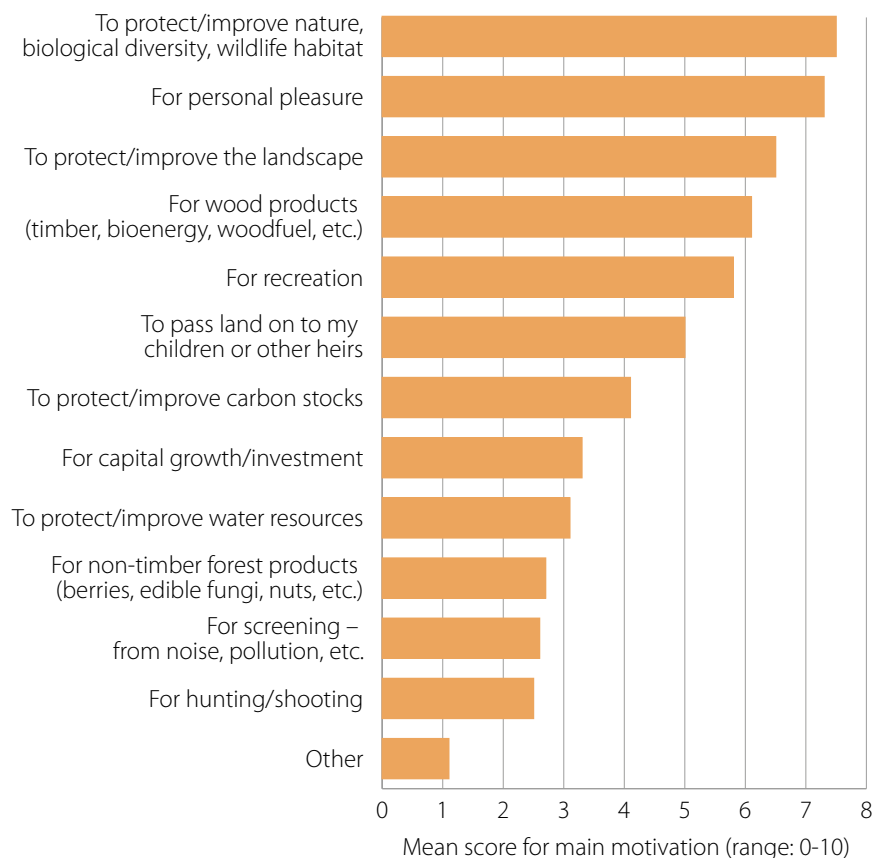
Figure 3 Type of owner (% of total, n=719). Categories follow Nicholls *et al.* (2013)



MOTIVATIONS FOR OWNING A WOODLAND

Woodland owners were asked to indicate their motives for owning woodland, each scored between 0-10. Figure 4 summarises the results, which are shown as mean scores for each motive. Protecting/improving nature or biological diversity ranked among the most important motives alongside personal pleasure, protecting/improving landscape, wood production and recreation.

Figure 4 Motives for owning woodland (n=719), showing mean score (range: 0-10)



Motivations for owning a woodland property (categories described in Figure 4) contrasted between different ownership types, as shown in Table 3. For instance, timber production ranked highest only among forestry/timber businesses. Personal pleasure ranked highest among personal non-agricultural, personal agricultural and business-agricultural. Protecting nature ranked highest for six ownership types, none of which were personal.

Table 3 Motivations for owning woodland by ownership type.

Ownership Type	n	%	Highest-ranking motivation	Lowest-ranking motivation
Personal non-agricultural (i.e. a privately-owned woodland)	328	45.6	Personal pleasure	Hunting/shooting
Personal agricultural (i.e. part of a privately-owned farm or rural estate)	248	34.5	Personal pleasure	Non-timber forest products
Business – agricultural (i.e. part of a farm or rural estate run as a Private Limited Company)	31	4.3	Personal pleasure	Non-timber forest products
Charity	27	3.8	Protect nature	Hunting/shooting
Public body – Local Authority	22	3.1	Protect nature	Hunting/shooting
Business – forestry or timber (i.e. woodland owned by a Private Limited Forestry Company)	20	2.8	Timber production	Non-timber forest products
Other	18	2.5	Protect nature	Hunting/shooting
Private Trust	15	2.1	Protect nature	Hunting/shooting
Public body – Other	4	0.6	Protect nature	Capital growth
Community Ownership	3	0.4	Protect nature	Hunting/shooting
Public company	3	0.4	Protect/improve landscape	Pass land on to heirs/children
	719	100		

CHARACTERISTICS OF BWS2015 SAMPLE POPULATION

Questions will always be asked about how representative a survey is of a 'true' population. While accepting the limitations of the survey (see SURVEY METHOD) two approaches were taken in attempting to answer this question for BWS2015: overall description of typologies and woodland properties to demonstrate the range of responses received; and comparisons to existing evidence.

As described above a wide range of woodland sizes, ownership types and owner motivations were captured in BWS2015. In addition, further evidence reported later in this report suggests that a broad range of responses were attracted. One example is the first position ranking of Sitka spruce among large woodland properties, providing confidence that commercial forestry interests were captured by the survey. The majority of responses – note not by area – were from those owning or managing woodlands in England, suggesting under representation in Scotland, Wales and Northern Ireland.

The typologies of respondents to this survey, and the type of woodland properties that they represented, can be compared with existing evidence to provide an indication of any divergence in the data captured within BWS2015. Key evidence is the National Inventory of Woodland and Trees or NIWT (Forestry Commission 2003) and Forestry Facts and Figures (Forestry Commission 2015). It should be noted that the NIWT included data from the Forestry Commission estate, and that its data are twelve years old. Evidence compared is owner typology and woodland type.

Owner typology: Comparisons between the BWS2015 survey and NIWT, based on typology by land area, are shown in (Table 4). In summary BWS2015 attracted fewer personal and business owners than those in NIWT, but more charities, timber businesses and various public bodies and private trusts.

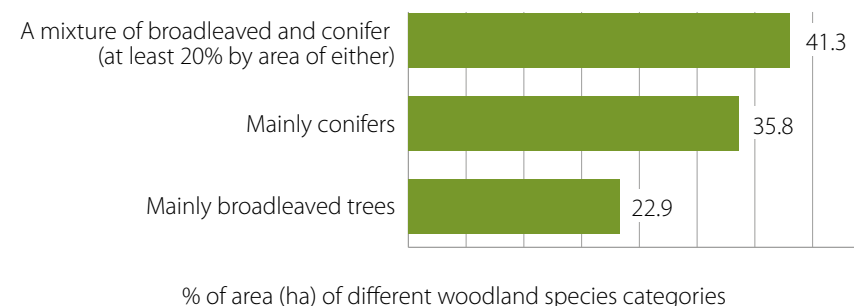
Table 4 Comparison of typologies in respondents to BWS2015 and NIWT (Forestry Commission 2003) with land owned or managed by the Forestry Commission removed.

BWS2015 typology	% of area	NIWT typology	% of area
Personal non-agricultural (8.7%)	30.2	personal	66.8
Personal agricultural (21.5%)			
Business agricultural	8.3	business	16.4
Charity	17.0	charity	5.5
Public body – Local Authority	4.0	local authority	4.7
Business timber/forestry	11.7	forestry or timber business	2.5
Other (15.5%)	18.7	Unidentified	1.1
Private trust (3.1%)			
Public body – other (9.7%)	10.1	Other public	2.8
Public company (0.4%)			
Community	0.0	Community	0.3

Broadleaved, conifer and mixed woodland: An analysis of the area of woodland species category across all responses indicated that respondents were responsible for managing woodlands that mainly consisted of mixed broadleaves and conifers (41%; Figure 5). Areas consisting mainly of conifers were represented in 36% of respondent’s woodland area, and 23% were mainly broadleaved.

The latest forestry statistics (Forestry Commission 2015) indicate that among private woodland owners, 38% of area is with conifers and 62% broadleaved. Note that these data do not include a ‘mixed’ category. In conclusion the woodlands of participants in BWS2015 can be judged to be quite representative.

Figure 5 Woodland species category by area (n=716).



In summary it is clear that the sample of responses to BWS2015 was largely representative of forestry in the UK, being inclusive of both small mixed species woodland properties than dominate English forestry, as well as capturing the views of timber businesses and owners/managers of commercial conifer plantations that dominate in Scotland and Wales. Notwithstanding the limitations of surveys in general and the present survey (discussed above), the number of the responses (1509), and area sampled (11% of all privately-owned woodland in the UK) provides further confidence in the significance of the survey’s findings.

Awareness

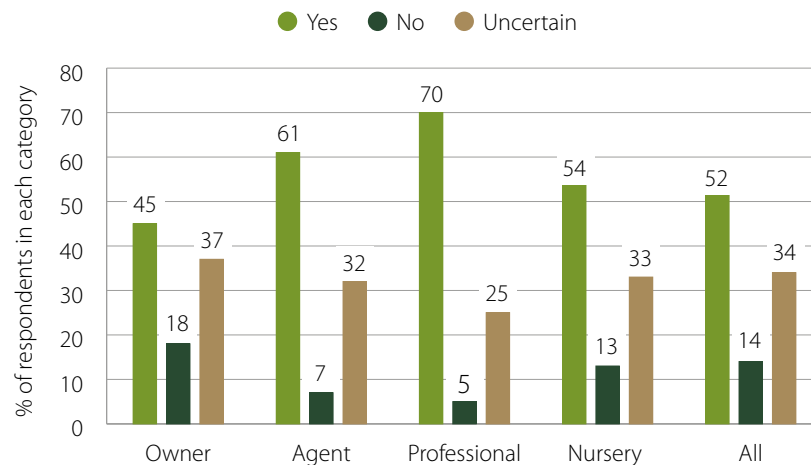
BELIEF IN THE EFFECTS OF CLIMATE CHANGE

Respondents were asked:

Do you believe that the climate is changing to such an extent that it will substantially affect forests in the UK?

52% of all those who responded to this question (n=1102) believed that the climate is changing to such an extent that it will affect UK forests in future (Figure 6). A substantial proportion (34%) of respondents were uncertain. There was more uncertainty among woodland owners than professionals with 45% of owners believing that climate change will affect our forests whilst 55% were uncertain or disagreed.

Figure 6 Responses to the question: *Do you believe that the climate is changing to such an extent that it will substantially affect forests in the UK?*



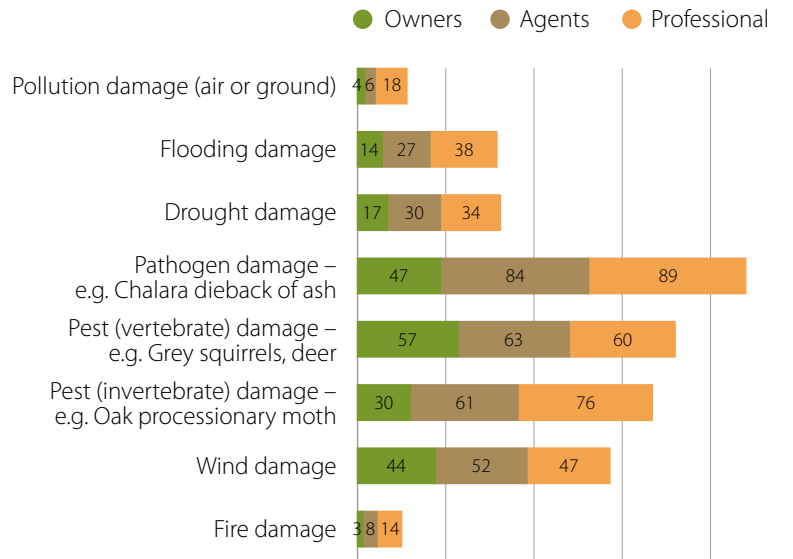
“I have never considered resilience, so have few thoughts about it.” Woodland Owner

“I do not rate resilience high on my agenda. I manage for wildlife and that changes but I do not get too upset about deer damage, squirrel damage, aspen or bracken obtruding etc. It’s all part of the rich pattern. I cannot turn the tide. It’s pointless to try.” Woodland Owner

OBSERVATIONS OF ENVIRONMENTAL CHANGE

Respondents were asked whether from their own observations they had witnessed changes in certain environmental factors in the last ten years, these being: drought; fire; flooding; invertebrates; pathogens; vertebrates; pollution; and wind. Across all groups, a mean of 89% respondents reported that they had observed at least one form of environmental change, whilst among agents and professionals it averaged 97%. Among woodland owners 83% reported observing change, with increases in vertebrate pests such as deer and squirrels most cited, whilst among professionals, pathogens and pests were the most commonly-reported impact on the woodlands that they own or manage (Figure 7).

Figure 7 Observations of environmental change among respondent categories (percentage within each category observing increased occurrence of factors)



Percentage within each group observing increase in factor

Asked about priorities for making our woodlands more resilient in the future, management of pathogens and pests were singled out as the most important issues by woodland owners, agents and professionals. Also recognised was managing or planning for wind damage. Fire, drought and flooding were ranked as less important by most groups, although given a higher priority by professionals.

EXPLORING LINKS BETWEEN AWARENESS AND BELIEF

The possible relationship between experience of environmental change, as indicated by observations made in the last 10 years, and a belief that climate change will impact UK forests in future was explored in the analysis. No linkage was made between the survey questions themselves.

Among all those responding to the ‘Belief’ question – i.e. whether they believed that climate change will impact the UK’s forests in future (n=1102) – the proportions between ‘Yes’, ‘No’ and ‘Uncertain’ varied very little (less than one percentage point) according to how many impacts of environmental change had been observed.

Overall, those who did not believe that climate change would impact forests in future had observed fewer instances of environmental change compared to those that did believe in a future impact.

Among those reporting an increase in environmental impacts there was a clear relationship between the number of impacts observed and the proportion of those who believed that climate change will impact the UK’s forests in future (Figure 8).

Exploring the data within specific environmental impacts, among those reporting an increase in an impact there were some noticeable differences between different ‘beliefs’ (Table 5). Only for the observed impacts of fire, drought, flooding and pollution did those who believed that climate change would affect the UK’s forests exceed those who answered ‘Uncertain’ and ‘No’ to this question. It is notable that all four of these impacts are perhaps more closely-affiliated with climate change than impacts from wind, pests and pathogens.

Figure 8 Relationship between observations of environmental impact (for those reporting an increase) and belief in future impact of climate change on UK forests.

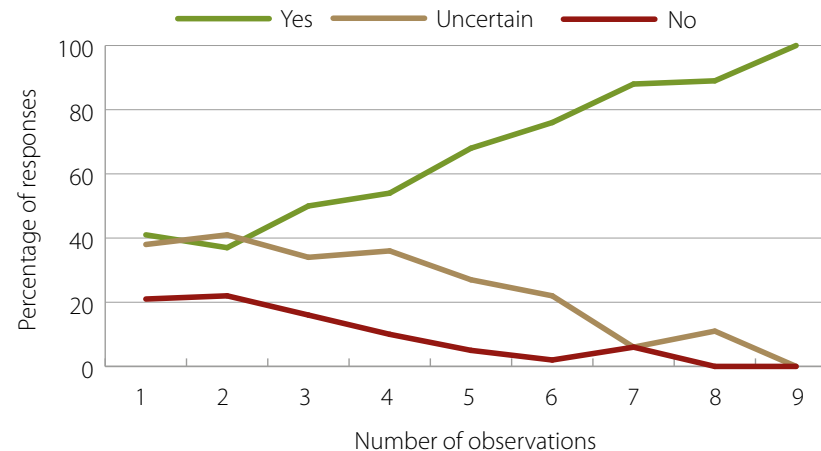


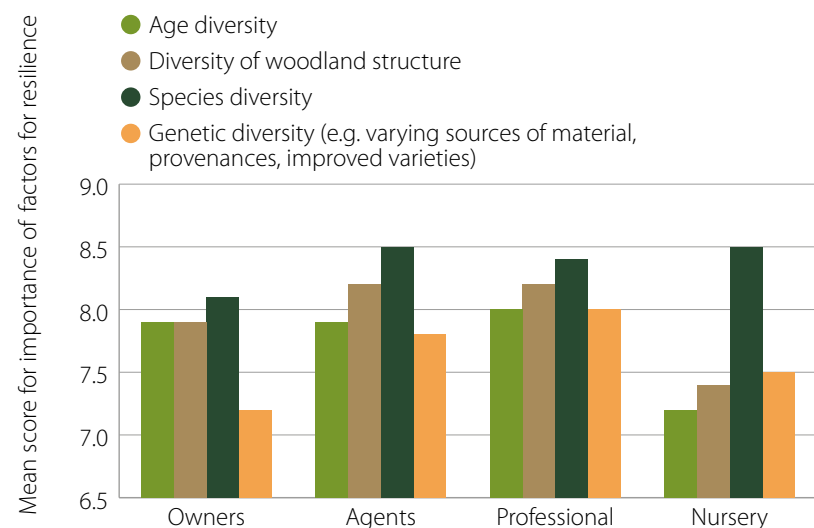
Table 5 Percentages among 'Belief' groups of those observing an increase in eight separate environmental change impacts.

Observation	Yes n = 568 (52%)	Uncertain n = 379 (34%)	No n = 155 (14%)
Fire	7	3	1
Wind	45	41	25
Pest – invertebrate	38	29	24
Pest – vertebrate	54	52	54
Pathogen	56	44	34
Drought	22	14	7
Flooding	24	9	4
Pollution	6	3	1

RATING OF FACTORS IN WOODLAND MANAGEMENT IMPORTANT FOR IMPROVING RESILIENCE

In managing woodlands for resilience, respondents (owners, agents and professionals) were asked to score four factors highlighted as important in the UKFS. Species diversity was identified as a priority, over age diversity, forest structure or genetic diversity (Figure 9).

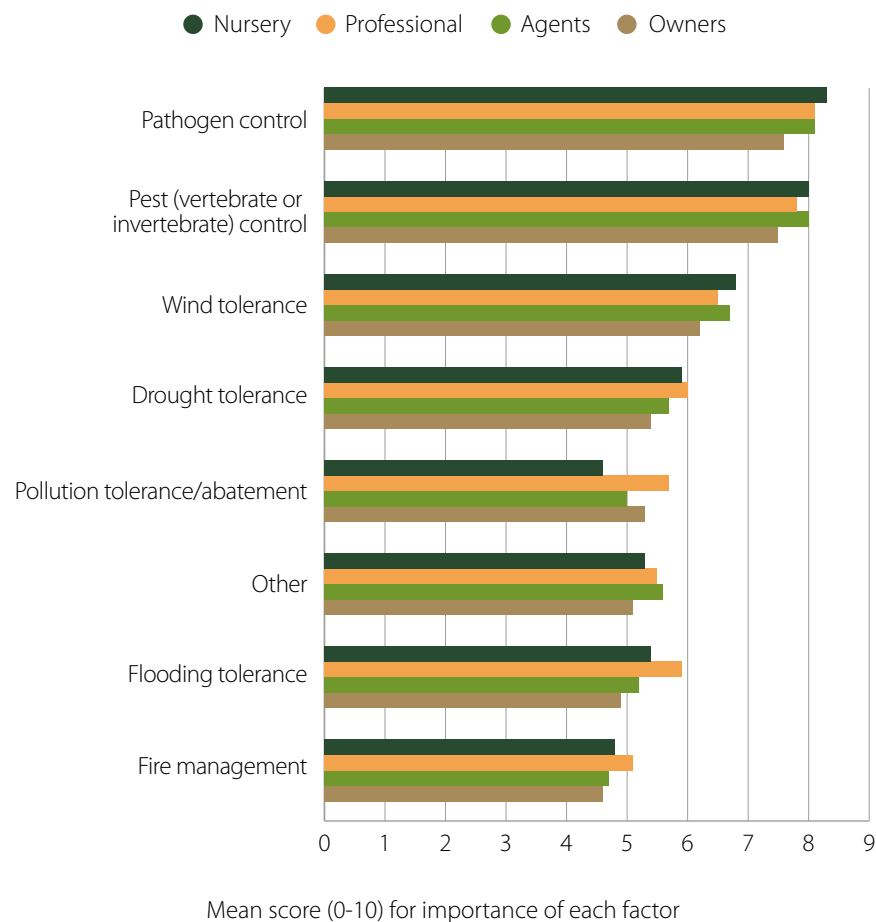
Figure 9 Importance of four factors in woodland management practice for woodland resilience in the UK



RATING OF ISSUES IMPORTANT FOR IMPROVING RESILIENCE

Linked to the question concerning observations of environmental change, respondents were asked to score the importance of the same issues in relation to resilience of UK woodlands. Control of pathogens and pests (both vertebrates and invertebrates) were seen as most important (Figure 10). Fire management was given lowest priority.

Figure 10 Importance of issues for improving resilience in UK woodlands



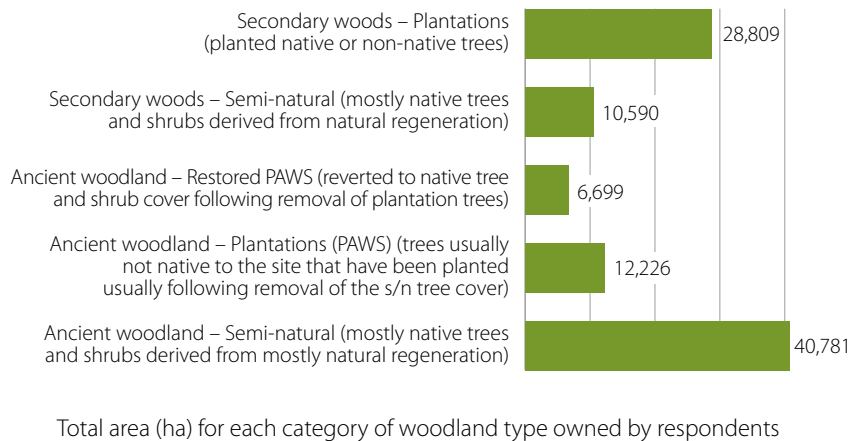
Action

Trees and Species Diversity

WOODLAND DIVERSITY

Secondary plantation woodland (planted or non-native trees) was the most frequent (58%) woodland type reported with ancient semi-natural woodland also well represented (44%). Ancient woodland was reported by 18% of respondents. In terms of the sampled woodland area, however, ancient semi-natural woodland accounted for almost 41,000 ha (Figure 11), and secondary plantation woodland for 29,000 ha.

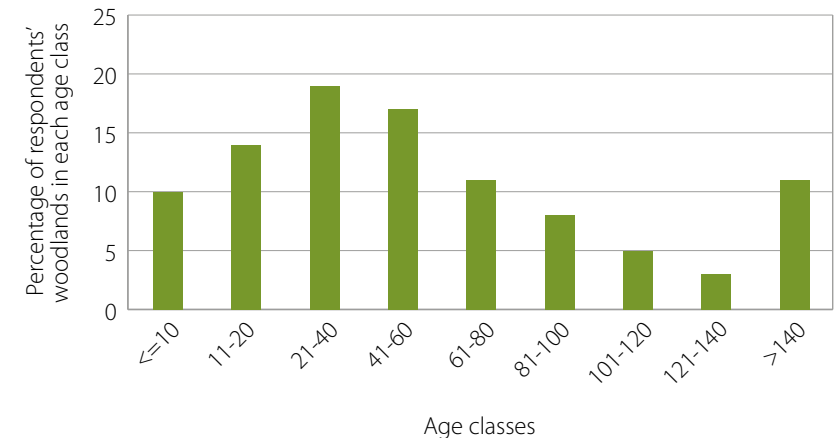
Figure 11 Woodland type, showing number of hectares owned by respondents (n=716).



STRUCTURAL DIVERSITY OF WOODLANDS

Owners and agents were asked to specify how much of their woodland was under even-aged or uneven-aged silvicultural regimes. Even-aged woodland was represented in 60% of the sampled woodland area. The diversity of age classes in the sampled woodlands followed a near-normal distribution, with trees between 21-40 years old being most frequent (Figure 12).

Figure 12 Age classes (years), showing overall proportion for each class (n=716).



TREE SPECIES DIVERSITY

Owners and agents were asked to estimate the number of species in the woodland under their care. Between 6-10 species was the most frequent estimate (Figure 13), with a mean of 16 species and a range from 2-137.

Figure 13 Number of species in woodlands, showing frequency in each range.

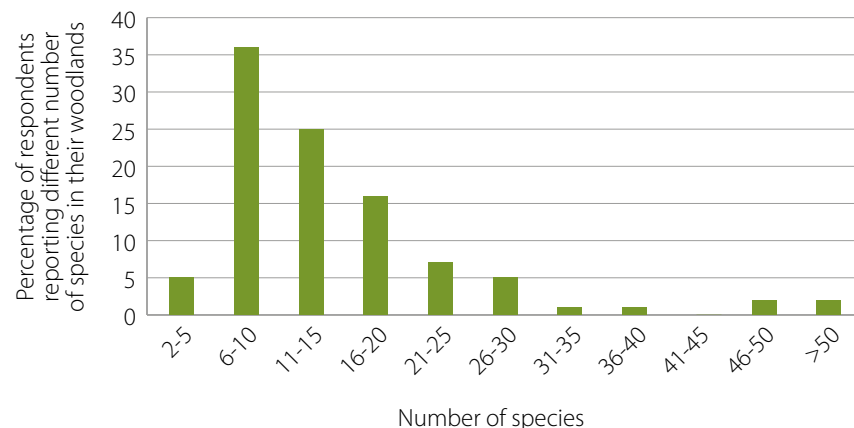


Table 6 Percentage of owners who reported a tree species (spp) within their top three tree species, and top ten species among different respondent groups.

Species	%	Order	Order of spp for respondents owning and/or managing >200 ha	Order of spp for respondents owning and/or managing <10ha	Top selling spp by nurseries
Oaks (pedunculate and sessile)	21.5	1	Spruce (Sitka)	Oaks	Oaks
Ash	17.7	2	Oaks	Ash	Birch (Downy)
Birch (Silver)	7.8	3	Pine (Scots)	Birch (Silver)	Spruce (Sitka)
Beech	6.6	4	Ash	Beech	Alder (Common)
Sycamore	5.1	5	Birch (Silver)	Sycamore	Beech
Spruce (Sitka)	4.7	6	Beech	Chestnut (Sweet)	Birch (Silver)
Pine (Scots)	4.6	7	Sycamore	Alder (Common)	Rowan
Chestnut (Sweet)	3.6	8	Douglas fir	Pine (Scots)	Douglas fir
Alder (Common)	3.6	9	Spruce (Norway)	Cherry (Wild)	Spruce (Norway)
Douglas fir	3.0	10	Larch (Hybrid)	Larch (European)	Hornbeam

According to national statistics on woodland area by species among the private sector (Forestry Commission 2015) Sitka spruce accounts for 17% of the area followed by birch (11%), oak (10.1% two species combined), Scots pine (7.8%), and ash (7.7%). Although not directly comparable to the frequency of owners reporting the top three most frequently occurring species it appears that those containing ash were possibly over-represented among small woodlands. Appropriately the first position ranking of Sitka spruce among large woodlands provides confidence that commercial forestry interests were captured by the survey. Further analysis of the survey data will need to be done to correlate species occurrence with total area of woodlands. Basic analysis of the largest and smallest properties (Table 6) shows clear differences in the top three most frequently occurring tree species.

GENETIC DIVERSITY

A minority of owners (19%) and agents (23%) knew the variety of sources of the material (provenances, genetic variation, etc.) of their three most frequently-occurring species. These findings should be considered in context of the fact that a minority of woodlands were plantations (35%) in this survey, given that knowledge of material sources among other woodland types – existing semi-natural woodlands for example – may be unrealistic under current levels of genetic knowledge. This was explored further by analysing those woodland owners and agents who had reported more than 50% woodland area as either ancient semi-natural woodland or mainly broadleaved: 66% and 62% respectively did not know the provenance of their three most frequently occurring species. Among those reporting more than 50% area with conifer species, only 31% did not have provenance information.

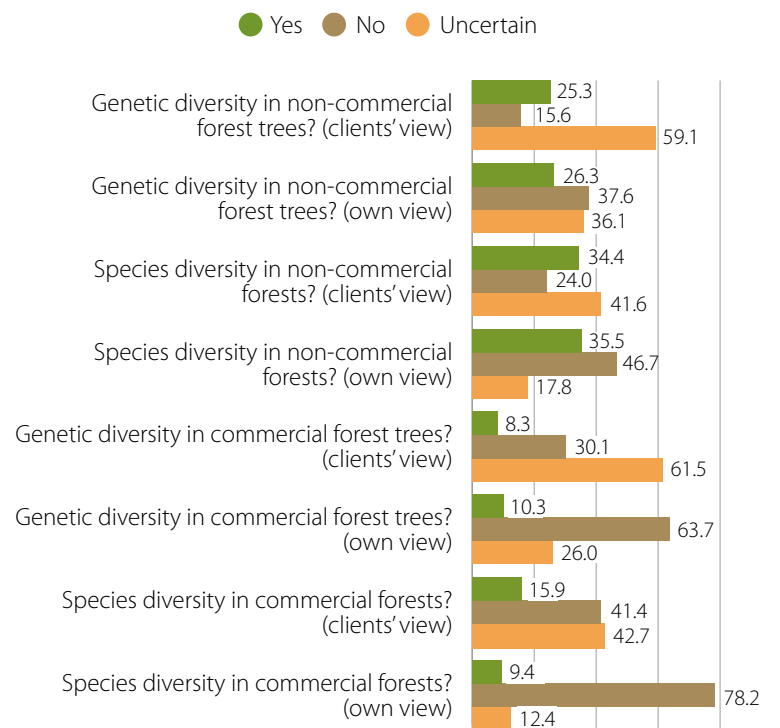
The average number of provenances known for the three most common species was four, with a range 1-30 (N.B. six respondents reported having more than 50 provenances and these were excluded from the analysis).

Most (71%) of nurseries knew the provenance of all their stock (range 60-100%), and all but one provided provenance information to customers.

Owners and agents were asked their views on whether there was currently sufficient species and genetic diversity in both commercial and non-commercial forests. Agents were, in addition, asked to say what they thought their clients thought about these questions. Results are shown in Figure 14. Woodland owners believed that there was insufficient species diversity in commercial forests by a large majority (78%), as did professionals

representing the views of clients although by a lesser degree (41%) with high uncertainty (43%). Concerning genetic diversity in commercial forests, again a large majority (64%) of woodland owners believed there to be insufficient diversity, while professionals were mostly unsure (62%).

Figure 14 Views (%) about adequacy of species and genetic diversity in commercial and non-commercial woods among owners and professionals (Agents, Professionals and Nursery owners/managers) representing perceived views of clients.



Percentage of respondents' views and their clients' views

Within UK non-commercial woodlands the majority of woodland owners believed there to be insufficient species (47%) and genetic diversity (38%), while the majority of professionals were unsure about species (42%) and genetic (59%) diversity (Figure 14).

Woodland owners were asked if, when re-planting or creating new woodland within the last 10 years, they specified the provenance (genetic origin) of their planting material. A small majority (54%) reported specifying provenance. Perversely, fewer owners (44%) reported that they would consider specifying provenance in future.

A substantial majority (69%) of owners stated a preference for specifying UK-grown material for future planting. Among the nursery trade, 71% of respondents reported that they knew the provenance of all of their stock, with provenance information routinely provided to customers among 92% of businesses.

Owners and agents were asked whether they agreed with a series of statements on the use of 'improved material', which was defined to mean 'planting material sourced from tree improvement breeding programmes that have selected parental material for desired traits'. Agents were also asked to respond on behalf of their perceived clients' views. There was a high percentage of 'Unsure' responses for this question, possibly owing to lack of understanding about the term 'improved material' (a few free-text comments made this point); however, some 60% of respondents indicated that planting improved material was important (Table 7). There was a resounding rejection of the idea that improved material was more important than locally-sourced material for planting (only 19% of owners believed this; Table 7).

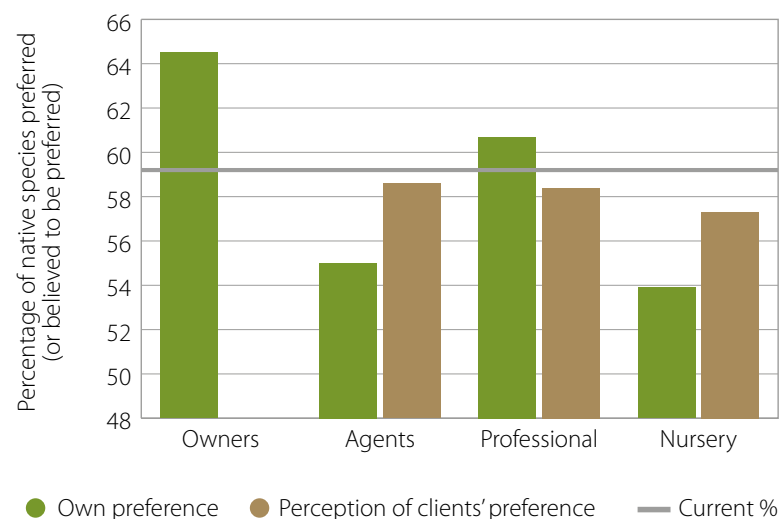
Table 7 Agreement with statements relating to the use of improve material among woodland owners, and agents responding on behalf of perceived clients' views

Statement	Individuals (%)			Clients (%)		
	yes	no	unsure	yes	no	unsure
Planting improved material compromises biodiversity	18	49	33	11	28	61
Planting improved material reduces genetic diversity within the planted tree species	41	28	32	21	41	65
We should always plant improved material when available	25	43	33	30	30	40
Improved material is more important than locally-sourced material	19	50	31	16	32	53
Improved material is for production woodlands not habitat woodlands	45	31	24	48	16	36
Planting improved material is not an important consideration	13	60	27	11	42	47

NATIVE AND NON-NATIVE TREE SPECIES

Currently approximately 41% of UK forest area is with non-native tree species and 59% is native (Forestry Commission 2015). Respondents in all groups were asked their view on the ideal balance between native and non-native species in relation to forest resilience (Figure 15). On average owners stated a preference for an increase in native trees to 65%, whilst agents and professionals appeared more content with the current balance (55% and 61% respectively). When asked what these latter professional groups believed their clients wanted, the average thought it was 59% native species, indicating a perception of no change from the current balance between non-native and native.

Figure 15 Currently approximately 59% of UK forest area is with native tree species. Results show the ideal percentage cover of native species to improve future resilience of UK forests according to different respondent groups.



Forest planning & management

WOODLAND MANAGEMENT PLAN

The creation of a woodland management plan is commonly viewed as a critically important step in supporting woodland management.

Preparing a management plan that is compliant with the UK Forestry Standard (UKFS) is a practical basis for implementing sustainable forest management principles on individual forest management units.

67% of owners stated that they had a management plan (n=545 for this question). Of these, 73% were UKFS-compliant plans. Presence of management plans in place varied among different ownership types (Table 8): all community groups, public companies and public companies reported having a management plan in place, while the lowest proportion of ownership types without a management plan in place were personal agricultural (62%) and personal non-agricultural (63%).

Table 8 Percentage of respondents with a management plan by ownership type.

Ownership type	n	No %	Yes %
Business – agricultural (i.e. part of a farm or rural estate run as a Private Limited Company)	40	23	78
Charity	17	6	94
Community Ownership	3	0	100
Other	13	15	85
Personal agricultural (i.e. part of a privately-owned farm or rural estate)	186	38	62
Personal non-agricultural (i.e. a privately-owned woodland)	260	37	63
Private Trust	11	18	82
Public body – Local Authority	12	25	75
Public body – Other	1	0	100
Public company	2	0	100

MANAGEMENT PRACTICES

As expected a wide range of forest management practices were reported by owners and agents. Among the common practices such as thinning, restocking or coppicing, certain practises widely considered relevant to managing for resilience were also reported:

- 57% practiced selective felling while 19% practiced clear felling (13% practised both);
- 43% practiced invasive species control;
- 23% practiced continuous cover management;
- 37% practiced minimum intervention for ecological reasons.

UKFS RESILIENCE MANAGEMENT ACTIONS

Owners and agents were asked to indicate whether they had undertaken any of four key adaptation actions selected from the UKFS (Table 12; page 29): awareness of soil properties; where possible adopting continuous cover forestry (CCF), reviewing the possible impact of projected climate change on the forest, and; reviewing tree species suitability. Respondents were also asked whether they were likely to undertake any of these actions within the next ten years.

Among owners a minority had undertaken a soil survey, adopted CCF practices, or reviewed climate change projections, while a small majority had reviewed species suitability (Table 9). In future more than twice as

many owners reported an intention to review climate change projections for their region, with smaller increases in those intending to have some woodland under CCF and to review species suitability. On the whole agents were more likely than owners to be fulfilling the four management actions currently (Table 9), while 81% reported an intention to review species suitability in future.

Table 9 Percentage of owners and agents indicating current and future likelihood of woodland management actions

Management action	Owners (n=531)		Agents (n=38)	
	current	future	current	future
Carrying out a survey of soil types in your woodland	29	21	54	36
Having at least some of your woodland under continuous cover management	31	53	59	74
Reviewing the climate change projections for your region	15	41	44	70
Reviewing tree species suitability for your woodland	55	62	63	81

Owners and agents both reported moderate to strong likelihood (score >5; range 1-10) of managing woodlands specifically in ways that would support adaptation. These included among owners and agents: species diversity (76% and 87%); age diversity (71% and 89%) and; structural diversity (69% and 86%). There was lower likelihood of managing genetic diversity (49% and 62%).

CURRENT PROVISION FOR ENVIRONMENTAL CHANGE

Only a small minority of owners made provision in their management actions for fire, wind tolerance, pathogen control, drought tolerance, flooding tolerance, or pollution tolerance/abatement (Table 10). Less than 25% of respondents reported moderate or strong provision (scores >5; range 0-10), although 41% made provision for pest (vertebrate or invertebrate) control. Agents reported making greater provision, with pest control (57%), wind tolerance (46%) and pathogen control (30%) scoring highest.

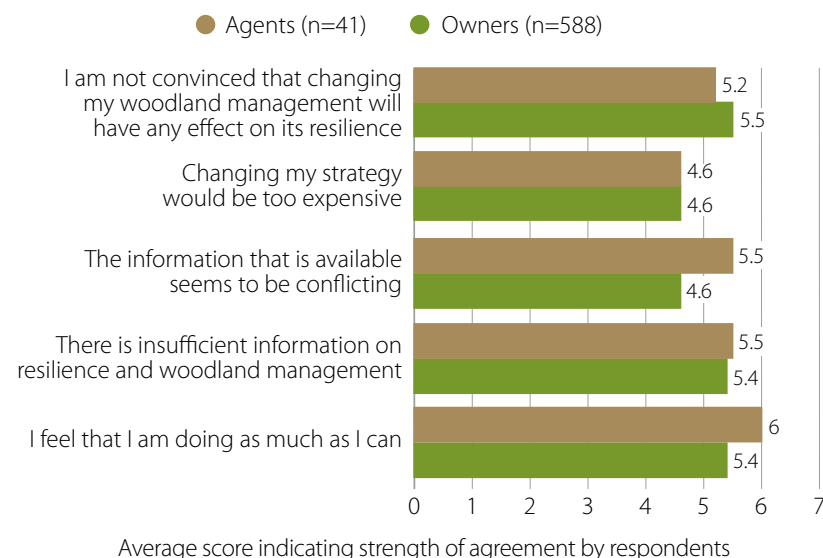
Table 10 Provision among owners and agents for environmental change factors

Environmental change factors	owners %	agents %
Fire management	9	14
Wind tolerance	24	46
Pest (vertebrate or invertebrate) control	41	57
Pathogen control	12	30
Drought tolerance	6	11
Flooding tolerance	7	11
Pollution tolerance/abatement	3	8

BARRIERS TO MANAGING WOODLANDS FOR RESILIENCE

Woodland owners and agents were asked about any issues that presented difficulties in managing woodlands in ways that would support adaptation. As Figure 16 indicates, there was neither strong agreement nor disagreement with any of the questions posed.

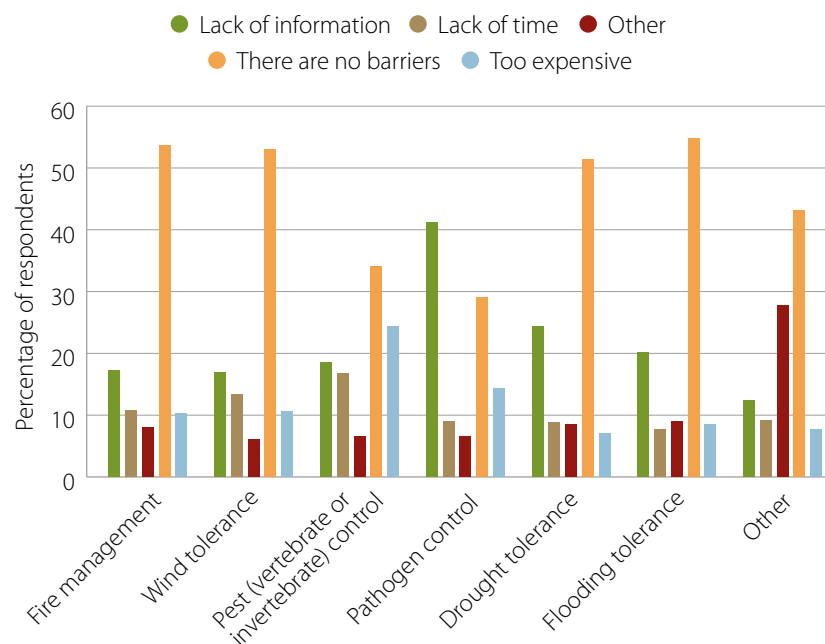
Figure 16 Extent of agreement with statements relating to managing for resilience. Showing average scores (range 0-10) where 0 is strongly disagree, and 10 strongly agree.



Owners and agents were asked to highlight any barriers to managing woodlands to support adaptation. For six out of seven key environmental factors, no barriers were reported (Figure 17). For one factor – pathogen control – lack of information was a main barrier (42% within the factor). Financial costs only featured strongly (24% within the factor) for control of pests.

“Sorry to say but it is a lack of time and resources. The woodland generates no income. There are only two of us on the farm, when we can we do some coppicing and re planting if needed and halo thinning around oaks. I enjoy the woodland and feel ash die back is a terrible threat.” *Woodland Owner*

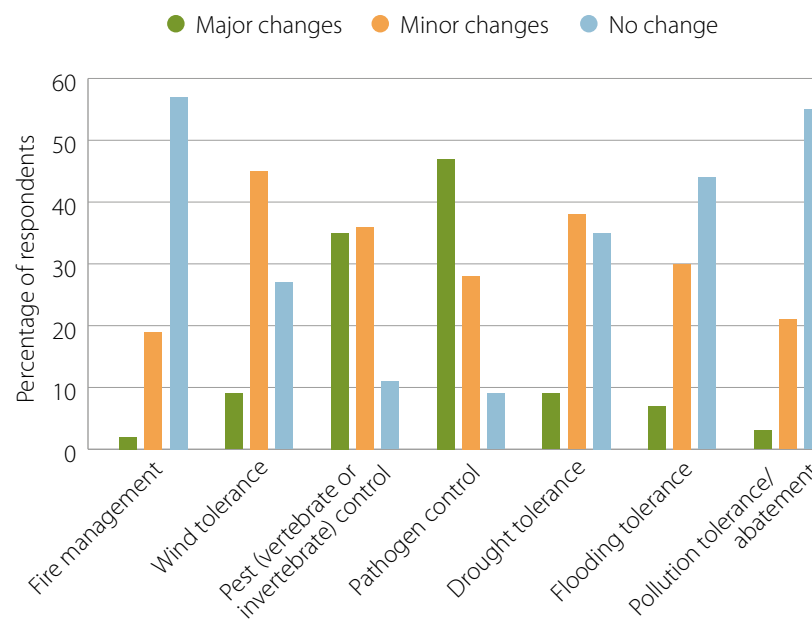
Figure 17 Barriers that prevent owners/agents making provision for resilience in relation to seven factors



RELATIONSHIP BETWEEN AWARENESS OF THREATS AND ADVICE PROVIDED OR BUSINESS PRACTICE AMONG AGENTS

Among agents providing advice to clients, perceived threats from pathogens and pests has led to largest changes in practice. The majority reported no change in relation to advice given for fire management, pollution and flooding (Figure 18).

Figure 18 Extent to which perceived threats of seven factors have caused a change in advice given by agents to clients (% of responses, n=286)

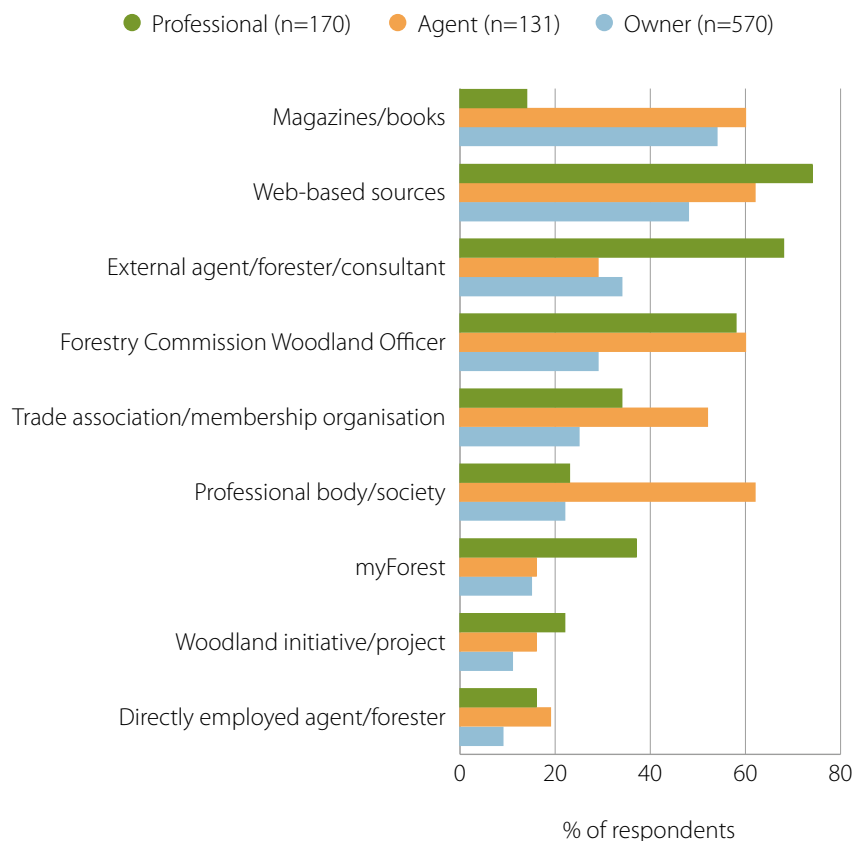


Information & Support

“Found it difficult to get info about local pests/ diseases when I was faced with evidence [of them].” *Woodland Owner*

Owners, agents and professionals were asked to specify sources of advice and/or information on forest management. Web-based sources were most popular among all respondents, while trade associations and professional bodies were more popular among agents (Figure 19).

Figure 19 Sources of advice and information on forest management (% of respondents using each source)



“This is loads of info out there. The trouble can be finding it. The FC website has tons of really good info, but there [sic] website is appallingly difficult to use, and find the info you want.” *Woodland Owner*

“Provision of a web portal with regional training or seminar opportunities relevant to woodland management would be useful.” *Professional Agent*

In response to a question about the usefulness of various types of information, there were no strong opinions among respondents favouring any one type (Table 11).

Table 11 Average (mean) and median scores (range: 0-10) for how useful various types of information would be for owners for managing and planning for resilience

How useful would the following types of information be for managing and planning for resilience?	mean	median
Local workshop events	6.2	7
An adviser on site	6.3	7
Online information and guidance	6.9	7
Printed information and guidance	6.3	6

A large majority (85%) of those who responded to a question about Continuing Professional Development (CPD) training on subjects relating to resilience would welcome more training.

BIOSECURITY

Respondents were asked to indicate what steps they take currently for biosecurity. A minority of woodland owners confirmed having any of five key practices in place. Only 7% of woodland owners provide cleaning and disinfecting facilities for visitors, whilst 33% of agents confirmed that they advise their clients to do this (Figure 20). 31% of nurseries reported providing cleaning and disinfecting facilities.

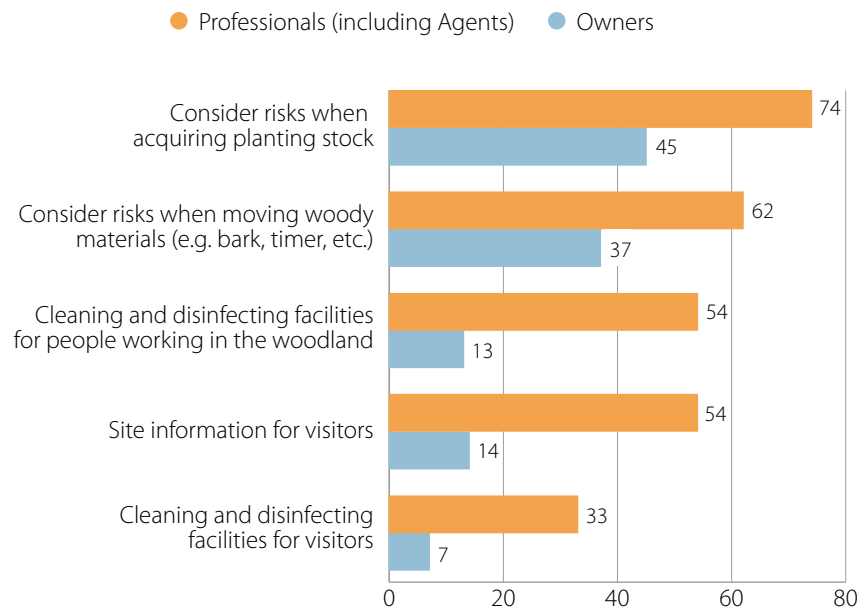
Overall, compliance with any action with respect to biosecurity was low amongst owners, with the exception of acquiring planting stock.

In response to whether cleaning and disinfection procedures were implemented, one woodland owner commented:

“Yes, on the one occasion where there has been a RFS visit. Otherwise, not.” *Woodland Owner*

Other free text comments in general mentioned that many measures were impractical and unenforceable, particularly in open woodlands.

Figure 20 *Biosecurity actions taken by owners and agents (% of respondents for each risk factor)*



Aspiration

Woodland owners were invited to share their thoughts about the resilience of the woodlands they manage via the following question:

One definition of resilience is an ability to 'bounce back better'. How would you summarise the outlook for your woodland?

A total of 449 woodland owners provided comments. Responses were coded with keywords. The three most frequent comments related to pests and pathogens in general (14%), specific mention of ash dieback (10%), and comments regarding species diversity (14%).

Responses were coded as being positive and/or negative – thus capturing comments that reflected multiple viewpoints – or neutral. 67% of responses were positive in nature, 16% neutral and 27% negative. Among negative responses, 52% expressed concern about pests or pathogens, with ash dieback representing 36% of all negative comments. Typical of the 47 comments related to ash dieback included:

“Watchful wakefulness. Much depends on spread of chalara fraxinea (ash is our predominant species, and widespread infection will be disastrous for us).”
Woodland Owner

“Overall pretty resilient but what is deeply depressing is the potential loss of iconic species – e.g ash which is so prominent in the landscape here.” *Woodland Owner*

“Presently quite grim, our predominant woodland is W9 Upland Ash woodlands and we are picking up lots of signs of Chalara within the Ash population.”
Woodland Owner

Comments relating to grey squirrels also featured strongly (15%) among negative comments.

ASPIRATIONS IN RELATION TO THE NEW ECOLOGICAL PARADIGM

Responses to the question were coded according to the New Ecological Paradigm scoring system, following Dunlap *et al.* (2000). In this system, environmental attitudes are measured following 15 summary viewpoints (Appendix II, page 32), of which seven represent statements endorsing the dominant social paradigm (DSP), and eight reflect endorsement of the new environmental paradigm (NEP). The two contrasting paradigms can be summarised as follows (Park and Allaby 2013):

- The DSP is the view that humans are superior to other all other species, the Earth provides unlimited resources for humans, and that progress is an inherent part of human history.
- The NEP is the view that humans represent only one among many species on Earth, that human activities are determined by the environment as well as by social and cultural factors, and that humans are strongly dependent upon the environment and its resources.

The method was applied at the analysis stage only (i.e. not in the design of the question), with responses coded either DSP or NEP. Of the 449 responses 33% could not be categorised, being too general in nature (e.g. 'good' or 'satisfactory'). Nonetheless it was possible to code comments from 301 respondents.

Of those that could be coded 54% of respondents' comments were identified as DSP, with typical comments including:

“fairly good as holdings diverse geographically”

“excellent for timber production”

“all depends on what grants are available”

“whilst [sic] in my ownership it is safe”

“unless I ramp up the management of the woodland it will loose [sic] its resilience”

46% of comments that could be categorised were identified as NEP. Responses typical in this category included:

“nature will adapt”

“nature will survive in its own way”

“natural regeneration creates resilience in a form suitable for the site eg species diversity & age”

“happy to let nature dictate resilience”

“No idea as we have no idea what the climate will do. The woodland will respond as it will.”

The two categories of responses following the NEP scoring system (i.e. DSP or NEP) were also compared to responses coded as negative or positive (see above). Among negative responses 60% were DSP and 40% NEP, whilst among positive responses 48% were DSP and 52% NEP. In summary, those respondents that endorsed the new environmental paradigm – i.e. have a pro-ecological world view – in general had a more positive outlook for the resilience of their woodlands.

Faith in the ability of nature to adapt to the likely rate and magnitude of environmental change indicates significant resistance to the implementation of adaptation measures and raises concerns over the future of our woodland resource. Specifically, it indicates that woodland owners and managers may not be aware of the magnitude of change that is predicted.

Implications for practical action

“I think the resilience agenda now needs to move from predominantly ‘research and recommendation’ working to ‘sponsored demonstration and implementation’ working. This will need a major increase in ‘pump priming’ resource levels from public sector sources and a change in thinking by some private sectors owners and investors in the uplands.” *Forestry Professional*

“If woodlands are so important to our country for forestry, conservation, public health, carbon storage, etc., why are we not planting more and getting existing woodlands into active management. Landowners who receive land management grants should be held to their agreements and money returned if they do not achieve the objectives.”

Woodland Owner

There are many clear outcomes from the survey that can be used to inform progress towards meeting current policies and targets, and which could help guide practical action.

As this survey was based upon the UK Forestry Standard, the implications for forestry policy and practice can be best summarised by comparing awareness, action and aspiration among the UK's forestry community to the range of 'Factors' within the UKFS that relate to adaptation (Forestry Commission 2011). Table 12 provides an indication of accordancy with the guidelines of the UKFS using a traffic light colour scoring system (red = negative accordancy; amber = neutral accordancy; green = positive accordancy), together with a summary of relevant evidence and the criteria by which this judgement was made.

Evidence from the 2015 British Woodlands Survey indicates that the resilience of the UK's forests is likely to be poor given the low accordancy with adaptation factors described in the UK Forestry Standard. Nonetheless, there are a number of positive aspects relating to current action and aspiration that can be built upon.

The clear relationship between observations of environmental change impacts and an awareness of possible future impacts of climate change, suggest that as climate change impacts further, owners may be more likely to be prepared to engage in issues relating to resilience. This is likely to be particularly so when focussed around issues of direct and local relevance.

Focus among owners and managers is understandably on immediate issues – such as an outbreak of pests or pathogens – and any longer term, ill-defined or uncertain threats that could arise from climate change may be too theoretical and impractical to contemplate. Equally, the impact from an immediate environmental threat, may not be perceived to have any connection with climate change already impacting the environment. The high degree of uncertainty about linkage between destructive environmental impacts and changing climate presents an opportunity for targeted support and information, particularly for owners.

The majority of respondents felt that there were few barriers to making their woodlands more resilient, also believing that they were already doing as much as possible. However, there was clearly a great deal of concern expressed about pathogens, both in terms of access to better information and funding to support control.

Professionals and Agents were generally more aware and active in implementing adaptation measures than owners, indicating that existing outreach activities among these groups have been moderately effective.

General lack of information and advice available to woodland owners and managers to help them respond to existing and emerging threats surfaced as a key issue and represents a practical way forward to fill this knowledge gap. A number of owners expressed a view that subjects covered by the survey were too technical. Existing assumptions concerning comprehension and knowledge of adaptation and resilience may be unrealistic. Practical action is unlikely to be embraced until risks are more clearly communicated and firmer, tailored, guidance is provided on how to address those risks.

Lack of contingency plans among owners and managers to deal with major events such as fire, pest and disease outbreaks, and extreme weather, is of considerable concern.

Low awareness of local climate projections, together with lack of knowledge of soils, means that most woodland stewards are unaware of the potential future impacts of environmental change on their woodland. Most owners have not reviewed species suitability under future projected environmental conditions, and are therefore unaware of the need to, and importance of, creating more resilient forests.

Uncertainty around the concept of provenance, improved material and genetic diversity points to a requirement for improvements in education and clearer, possibly less technical, sources of information, as these are important aspects that have been long-ignored in the forestry sector.

The low level of awareness and action in relation to biosecurity among owners, which was only marginally better among professional foresters, should lead to a review of the feasibility of recommended approaches, an assessment of risks, and feed into predictive modelling.

Targeted funding to support actions which might benefit the resilience of individual woods and woodland to pest (both vertebrate and invertebrate) management and control, in particular, would be highly beneficial.

Many of the actions for increasing resilience will flow from good management planning and levels of understanding of the issues, both of which appear to be insufficient. The high proportion of woodlands without a management plan could undermine attempts to secure resilience. We emphasise here that lack of a formal management plan does not necessarily indicate lack of planning, but clearly a measureable objective would be to increase the number of management plans in the private woodland sector.

The outlook among owners and agents for the resilience of woodlands under their stewardship was mostly positive, although this was based on the assumption that 'nature would cope'. Such faith in the ability of nature to adapt to the likely rate and magnitude of environmental change indicates significant resistance to the implementation of adaptation measures and raises concerns over the future of our woodland resource. Specifically, it indicates that woodland owners and managers may not be aware of the magnitude of change that is predicted.

Any plan of practical actions arising from this work should focus on those aspects in the UK Forestry Standard where awareness and action is currently dilatory, as indicated in the summary of accordance in Table 12. It is clear that there are now a number of clear priorities for action-focussed activity if we are to help secure a resilient tree and woodland resource in the UK that can adapt to the multitude of threats arising from unprecedented environmental change.

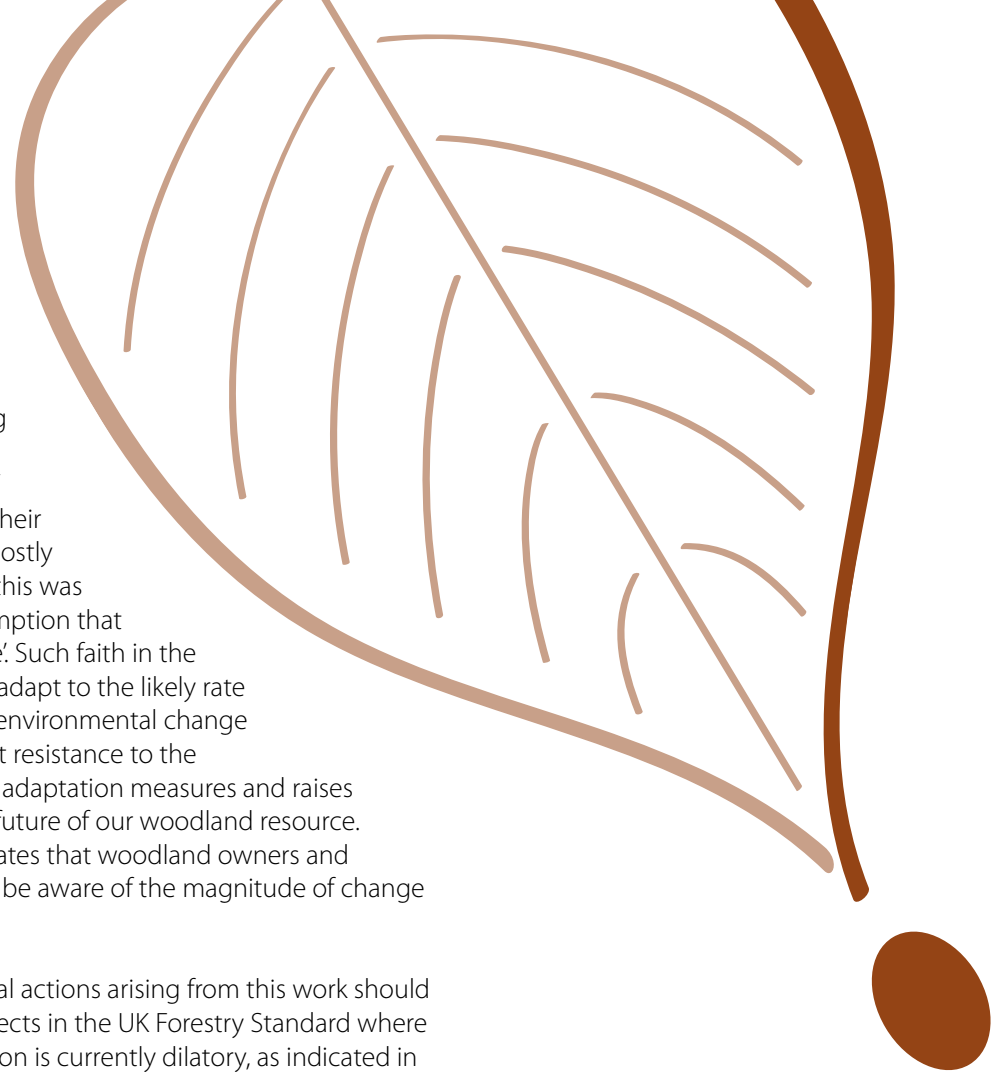


Table 12 *Accordance to best practice guidance for adaptation measures within the UK Forestry Standard.*

Theme	Factor	Measures	Accordance	Evidence from BWS2015	Judgement Criteria	
Forest Planning	16	Plan for forest resilience using a variety of ages, species and stand structure; consider the risks to the forest from wind, fire, and pest and disease outbreaks.	●	Species diversity seen as a priority among owners and agents, yet genetic diversity afforded low priority.	Advisory panel opinion	
				●	Most woodlands contained between 6-10 species, although ash is second most frequent species.	Advisory panel opinion
				✘	Fire risk afforded low priority for future management, especially among woodland owners compared to agents.	Measured against UKFS guidelines
				✓	Pests and Pathogens afforded high priority for future management.	Measured against UKFS guidelines. Positive future aspiration.
				✓	67% of respondents had a management plan, the majority of which were UKFS-compliant.	Currently 58% of English woodlands have a management plan.
	17	Consider alternatives to clearfell systems, such as continuous cover forestry, where suitable sites and species combinations allow and management objectives are compatible.	●	57% of respondents practised selective felling.	Advisory panel opinion	
				✓	Minority 19% practised clear felling.	Advisory panel opinion
				✓	23% owners/agents practised continuous cover management	Advisory panel opinion
	18	Have appropriate contingency plans in place to deal with risks to the forest, including spillages, pest and disease outbreaks, extreme weather events and fire.	✘	Small minority of owners made provision for fire (9%), wind (24%), pathogens (12%), drought (6%) or flooding (7%).	Measured against UKFS guidelines	
				✘	Provision for the same factors marginally higher among agents but still minority.	Measured against UKFS guidelines
				✓	Emphasis was placed on provision for pest control among owners (41%) and agents (57%).	Advisory panel opinion
				✘	Majority of agents reported no change to advice provided for fire, pollution or flooding.	Advisory panel opinion
	19	Consider projections of changes to rainfall patterns when specifying designs for culverts, drainage systems and roads.	✘	Not considered in detail.	n/a	
✘				Only 15% of owners/44% of agents had reviewed climate change projections for their region.	Advisory panel opinion	

✓ Positive accordane ● Neutral accordane ✘ Negative accordane ✱ No data

Table 12 *Accordance to best practice guidance for adaptation measures within the UK Forestry Standard continued*

Theme	Factor	Measures	Accordance	Evidence from BWS2015	Judgement Criteria
Adaptive Management	20	Review forest rotation lengths in response to changing productivity and wind risks, and review planting seasons in response to changing conditions and establishment success.	✱	Not specifically considered in survey.	n/a
				✘	Only 15% of owners/44% of agents had reviewed climate change projections for their region.
	21	Review species suitability and diversity over time as forest management plans are renewed.	✘	Minority of owners (15%)/agents (44%) had reviewed species suitability.	Measured against UKFS guidelines
				✓	In future a majority both groups expressed an intention to do so.
	22	Consider the susceptibility of forests to pests and diseases and develop appropriate strategies for protection; review practice as further evidence becomes available.	✘	Minority of woodland owners apply any of five key biosecurity actions recommended by Forestry Commission. e.g. 7% provide disinfecting facilities for visitors.	Measured against UKFS guidelines
				✓	Agents were more biosecurity aware with the majority considering risks when acquiring planting stock (74%), moving wood materials (62%), providing disinfecting facilities for workers (54%).
Tree and shrub species selection	23	Diversify forest composition so that no more than 75% of the forest management unit is allocated to a single species and a minimum of the following are incorporated: 10% open space; 10% other species or ground managed for environmental objectives; 5% native trees & shrubs.	✓	A requirement of the UKFS management plan template. 67% of respondents had a management plan, the majority of which were UKFS-compliant.	Measured against UKFS guidelines
	24	When managing or creating native woodland, encourage a representative range of the native species associated with the woodland type.	✓	Owners are generally favourable towards an increase in native species, over non-native.	Advisory panel opinion
	25	When selecting trees and shrubs for new woodlands, consider the risks and opportunities of climate change for particular species and regions to decide if alternative species or increased species diversity are merited.	●	Improved material was widely agreed to be less important than locally-sourced material.	Advisory panel opinion
●			55% of owners and 63% of agents had reviewed tree species suitability.	Measured against UKFS guidelines	

✓ Positive accordane ● Neutral accordane ✘ Negative accordane ✱ No data

Table 12 *Accordance to best practice guidance for adaptation measures within the UK Forestry Standard continued*

Theme	Factor	Measures	Accordance	Evidence from BWS2015	Judgement Criteria	
Tree and shrub species selection <i>continued</i>	26	Where timber production is an important objective, consider a wider range of tree species than has been typical of past planting, and consider the use of planting material from more southerly origins.		✘	Only 16% of owners/23% of agents were aware of the genetic variety of sources for three most frequently-occurring species.	Advisory panel opinion
				✘	Awareness of genetic variation particularly poor among those with broadleaved stands.	Advisory panel opinion
				✘	Only 15% of owners/44% of agents had reviewed climate change projections for their region.	Advisory panel opinion
				✓	44% of owners reported intention to specify provenance in next five years.	Advisory panel opinion
				●	Majority of owners believe local planting materials more important for resilience than improved material.	Advisory panel opinion
	27	Choose trees or shrubs which are well adapted to the site and are drawn from a sufficiently wide genetic base of parent trees to promote future adaptation.		✘	General confusion over terms such as provenance and improved material.	Advisory panel opinion
	28	Encourage natural regeneration of native tree and shrub species to promote natural selection and climate change adaptation, and conserve distinctive genetic patterns – especially in and around semi-natural woodlands.		*	Not specifically considered in survey.	n/a
Landscape ecology	29	Improve the ecological connectivity of the landscape for woodland and other species by extending and linking habitat features; consider the juxtaposition of wooded and non-wooded habitats and aim for the best overall result for biodiversity.		*	Not specifically considered in survey.	n/a
Environmental protection	30	When siting new woodland, consider the potential benefits in relation to flood alleviation, improvement of water quality and other ecosystem services.		✘	Minority (29%) of owners had conducted a soil survey.	Measured against UKFS guidelines
				✘	54% of agents had conducted a soil survey.	Measured against UKFS guidelines
	31	On steep slopes where there is a risk of slope failure or serious erosion, consider alternatives to clearfelling.		●	31% of owners/59% of agents had some woodland areas under continuous cover management.	Expert silviculturist opinion.
	32	In urban situations, consider the potential benefits of woodland and trees in reducing the impacts of climate change.		*	Not specifically considered in survey.	n/a
33	Be vigilant for pests and diseases in forests and woodlands, particularly in urban areas where the risks of new problems are high.		✘	Minority of woodland owners apply any of five key biosecurity actions recommended by Forestry Commission. e.g. 7% provide disinfecting facilities for visitors.	Measured Forestry Commission good working practice guidelines.	
			*	Urban context not considered in detail.	n/a	

✓ Positive accordancy ● Neutral accordancy ✘ Negative accordancy * No data

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Appendix II New Ecological Paradigm Scale

The revised New Ecological Paradigm scoring system was developed by Dunlap *et al.* (2000), and was applied in this research in analysing outlook among woodland owners and agents (page 26).

In this system, environmental attitudes are measured following 15 summary viewpoints, of which seven even-numbered represent statements endorsing by the dominant social paradigm (DSP), and the eight odd statements reflect endorsement of the new environmental paradigm (NEP).

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