Written Evidence submitted by The James Hutton Institute (TPW0041)

Introduction

The James Hutton Institute is one of the Scottish Environment, Food and Agriculture Research Institutes (sefari.scot), collaborating on the delivery of the Scottish Government funded Strategic Research Programme 2016-2021 on agriculture, environment, food and land. Its response to the Call for Evidence on Tree Planting and Woodlands has been collated from Institute experts in natural and social sciences relating to woodlands. The Institute has a long track record in research relating to woodlands, including studies of forest soils, biodiversity, pests and disease, land use, human health and wellbeing, socio-economic issues, the running of one of the UK network of agroforestry research sites (since 1988), and coordinating Scotland's Centre of Expertise in Plant Health. Our response comprises a summary of key points on selected questions, with references to support the evidence submitted.

Response to Consultation Questions

1) Are the UK Government's targets for increasing forestry coverage, and tree planting, for England and the UK sufficiently ambitious and realistic?

No response

2) Are the right structures in place to ensure that the UK wide target for increasing forestry coverage is delivered?

No response

3) How effective is the co-ordination between the four nations on forestry issues, including biosecurity, plant health and other cross-border issues?

The Plant Health Centre (www.planthealthcentre.scot/) is a virtual centre of expertise funded by Scottish Government Rural and Environment Science and Analytical Services Division to help tackle plant health challenges for Scotland. However, as noted below, its governance is such that it facilitates cross-border flows of information and expertise in relation to biosecurity and plant health.

Working with the Chief Plant Health Officer for Scotland, the Centre brings together plant sectors for forestry, horticulture, environment and agriculture to co-ordinate plant health knowledge, skills, needs and activities across Scotland. The Centre works with Scottish Government, public bodies and stakeholders to provide scientific evidence to help them make decisions about the pests and pathogens that threaten Scotland the most. The Centre Directorate is headed by the James Hutton Institute, with sector leads from Scotland's Rural College (agriculture), Royal Botanic Garden Edinburgh (horticulture and environment) and Forest Research (forestry).

A Science Advisory and Response Team (SART) comprises the organisations above along with partners from Universities of Edinburgh, Exeter and Strathclyde, Centre for Ecology & Hydrology and Biomathematics and Statistics Scotland, each contributing skills ranging from understanding public perceptions to long-term disease forecasting.

One of the four sectors of the Centre is dedicated to forestry (www.planthealthcentre.scot/sectors/forestry). It maintains a knowledge bank to signpost plant

health information, from across sectors, relevant to forestry and designed to be useful to practitioners in forestry and commercial tree nurseries. The sources of information contained is to help identify disease symptoms, organisms that cause them, and to provide guidance on management and biosecurity. As well as native pathogens, there are invasive non-native species (INNS) affecting both exotic and indigenous trees, and other disease-causing organisms which have recently become problematic, possibly due to climate change.

The Plant Health Centre, working through its partners across the UK, welcomes the opportunity to contribute to strengthening resilience and emergency response plans, mitigate plant health risks and contribute to an expansion of interdisciplinary networks to improve capacity to respond to threats across all plant health sectors.

4) Why were previous ambitions for increasing tree planting in England not met and what lessons should be learned?

No response

5) In relation to increasing forestry coverage in England, what should the Government be trying to achieve?

- **Mitigating or adapting to climate change**

Area-based targets for afforestation are a frequent and prominent component of policy discourses on forestry, land use and climate change emissions abatement. Such targets imply an expected contribution of afforestation to the net reduction of greenhouse gas emissions. However, the nature of afforestation undertaken and its geographical distribution means there is considerable uncertainty over the eventual emission reductions outcomes. To make an effective contribution to reducing greenhouse gas emissions account also has to be taken of the effects of planting on the amount of carbon that is stored in soil.

Recent work by Matthews *et al*. (2020) shows the potential changes in ecosystem carbon storage following woodland creation. The results (available as online map timeseries) show that conversion from semi-natural land to woodland can often result in net carbon loss for the first 20 years and, in some scenarios, it may be 80 years or more before woodlands provide a carbon benefit. In this modelling, estimates of net carbon balance are conservative as they do not take account of use of forest products and their substitution benefits (e.g. timber replacing concrete as a building material or replacing fossil fuels). However, the results still indicate that in some situations tree planting may not increase carbon storage within the timescales of the UK Government for achieving net zero carbon by 2050. Additional incentives or constraints may be needed to achieve aggregate rates of emission mitigation implied by policy commitments. For example, supplementary carbon storage tonnage targets for new forestry would introduce a floor for carbon sequestration outcomes, whilst allowing flexibility in achieving an appropriate balance in the trade-offs between carbon sequestration and the many other objectives that new woodlands are expected to deliver.

In these models, the predicted losses of carbon are caused by disturbance of the soil at planting, by drainage (if undertaken) and by other changes in soil processes due to the presence of the trees. Recent experimental work has shown losses of soil carbon even with minimal soil disturbance during tree (birch and pine) establishment on heather moorland on peaty podzol and podzol soils (Friggens *et al*., 2020). This experimental work showed no net gain in carbon storage 40 years after tree planting. Therefore, when prioritizing tree planting for climate mitigation, this should only be done in locations, with soil types and using silvicultural and land management methods, where increased carbon sequestration is likely to be achieved.

- **Promoting biodiversity and nature recovery**

Globally, tree species composition is changing due to species loss due to pests and pathogens. The impact of such change on ecological functioning is rarely tested. Findings by Mitchell *et al*. (2020) show that different tree species differ in their functioning and hence ecosystem services provided, even at the scale of individual trees. Thus, the tree species which replace diseased trees, even at the scale of single trees, will impact on the functions and ecosystem services provided.

The most effective way of protecting woodland biodiversity against tree diseases is to increase the resilience of woodlands. One way to achieve this is to increase the diversity of tree species within the woodlands (Mitchell *et al*., 2016; 2019). This will provide multiple hosts for biodiversity to use. Thus, if individual tree species decline, there are improved prospects that other tree species will be present which the tree associated biodiversity can use, although this will not apply to species that only use one tree species. Therefore, to achieve long-terms aims of woodland expansion, its planning should aim for a portfolio of woodlands, distributed across the country, in which a diversity of tree species is encouraged (e.g. through grant schemes), the aim of which is to increase the resilience of the woodlands to pests and disease as well as to climate change.

- **Health and well-being**

Scientific evidence shows the health and wellbeing benefits people derive from spending time outdoors in nature (e.g. Keniger *et al*., 2013). Interacting with natural environments may also facilitate connections to local landscape and motivations to care for the environment. Several reviews specifically consider the effects, and characteristics, of forests, that might explain the effects of different types and qualities (such as biodiversity) of greenspace and woodlands on mental health (e.g. Wen *et al*., 2019). Promoting the use of the outdoors is an issue of cross-sectoral significance, and is relevant to a number of policies at UK and devolved levels, particularly across the environment, health, planning and tourism domains. Increased opportunities to access good quality local greenspace, of which woodlands would form a part, may lead to their greater use, as might an increased awareness of the benefits of spending time in nature and greater access to nature-based interventions such as health walks.

Of associated importance is establishing and operating mechanisms for monitoring nature-based interventions that seek to engage people with forests and woodlands to increase health and wellbeing benefits. There will be challenges of identifying appropriate measures, and a need for transdisciplinary efforts, recognising the importance of research and practitioners working together to integrate research into existing nature-based interventions (Irvine *et al*., 2020).

The spatial distribution of the expansion of woodlands should be planned to increase the accessibility of woodland environments in urban and rural areas, particularly in areas of deprivation, to enable their uses as 'escape spaces' (Miller *et al*., 2014) that can aid in the alleviation of stress (Thompson *et al*., 2016) and be conducive to improving human well-being.

- **Suggested additional considerations**

i) Land systems approach, including agro-forestry - The UK Government should design its approaches to the expansion and management of woodlands such that they can be closely aligned with wider current, and new, land systems. This is not just blocks of woodlands; the UK Committee on Climate Change's recent report (January 2020) recognised agroforestry as offering the potential to help deliver the major shift in land use needed to achieve net-zero carbon emissions by 2050. It can contribute directly to policy objectives of increasing tree planting and encouraging low-carbon farming practices, as well as delivering co-benefits of animal welfare, biodiversity and the diversification of farm income, creating social, economic and environmental benefits for land managers and society.

Agro-forestry is an important land use system in the climate-positive farming being developed by the James Hutton Institute at its Glensaugh research farm in Aberdeenshire (https://glensaugh.hutton.ac.uk/climate-positive-farming/overview). The principal aim of climate-positive farming is to achieve net-zero or negative carbon emissions, whilst protecting and enhancing the natural assets of a farm and ensuring long-term financial sustainability of the farm business. Integrating trees and woodlands into farming systems is an important component of climate-positive farming, contributing to the ambitious goals of the UK and Scottish Governments to increase woodland cover to help progress towards targets of net-zero carbon emissions. Research and demonstration of the practicalities of woodland establishment and management on farms, whether agro-forestry or other integrative woodland planting, has a key role to play in providing a valuable resource for land managers exploring innovative approaches to contributing to woodland expansion on their land.

ii) Social innovation and woodlands

Increasing forest coverage in England provides new opportunities to expand the number and distribution of communities which have access, directly or indirectly, to new resources. Forests are of particular significance to communities living in rural areas where there are challenges regarding biophysical resources¸ transport and digital infrastructure, housing, and access to services, including health. Social innovation offers a promising means of responding to social demands through helping regenerate local economies and improving the quality of life of people who live and work in the vicinity, and those who visit (Nijnik *et al*., 2019). It can shape sustainable development trajectories, improve territorial capital and regional governance, and pave the way for a more integrated approach to rural development (e.g. Sarkki *et al*., 2019). Findings from the EU project on Social Innovation in Marginalised Rural Areas (SIMRA; http://www.simra-h2020.eu) show how woodlands can be a focal point for communities to develop and deliver new types of services that address unmet needs that help the sustainability of agro-food and forestry systems and wider social benefits.

Findings from a case study of a community woodland in Lochcarron, north-west Scotland, show the types of opportunities that can be created and developed when the purpose and governance of woodland changes from the State to the community. The woodland is planned, managed and used by the Lochcarron Community Development Company to provide multiple services (e.g. wood based and inspired handicraft workshops, creation of a heritage trail, engagement with the local primary school). Examples in Wales demonstrate how skills-based training and educational services were developed in communal woodlands (e.g. the Coppice Wood College, and Woodlands Skills Centre; Ludvig *et al*., 2018). In addition to outlets of products and the development of capabilities of individuals, the development of governance and operational structures helps engender community spirit and social capital, all aspects of sustainable development.

A database of social innovations in marginalised rural areas of Europe (Valero and Bryce, 2020) contains examples in forestry (e.g. carbon smart forestry, agrobiodiversity), agriculture and rural development. These examples provide insights to the successes of social innovation in rural areas. As woodlands are expanded across the UK, the potential roles that communities can play should be explored fully, recognising that for some communities (urban and rural), access to local woodlands in an area may be a new experience and opportunity. Insights to opportunities, and risks, can be learnt from engagement with the communities of relevant researchers and long-established networks (e.g. Woodland Trust) in England, and the rest of the United Kingdom (e.g. Community Woodlands Association, Scotland). Capturing the experiences of actors in communities, NGOs and private and public sectors as the process of woodland expansion evolves would be a valuable resource for developing shared learning, and could feed into processes of monitoring and improvement for future generations of managers and users of woodlands.

iii) Facilitating engagement – Forests and woodlands have a high level of public interest. The expansion of woodlands across the UK provides a valuable opportunity to increase engagement of the public in debate and understanding how changes in land use, including in their neighbourhood, can help address global challenges of climate change and biodiversity loss, as well as provide multiple benefits to their local communities. The examples below are of how information and data can be made available for the benefits of stakeholders in society, industry, policy and science.

(a) Online mapping: To help inform understanding by public audiences of the carbon storage outcomes of woodland expansion in Scotland, the James Hutton Institute has created an online mapping tool (https://woodlandexpansion.hutton.ac.uk/) to visualise net change in carbon (combining soils and vegetation) from afforestation over time for different woodland planting options. This example shows how planning for forest and woodland expansion can contribute to linked purposes of the UK Geospatial Commission in supporting delivery of a national (UK) land use framework, and the impact of research through delivery on open access to data.

(b) Open access to information and data: Open access resources for public and private sector woodland managers have been published to support the development of adaptive strategies to the benefit of biodiversity. One dataset is of all known birds, bryophytes, fungi, invertebrates, lichens and mammals that use oak (*Quercus petraea* and *Quercus robur*) in the UK, and on the ecology of each oak associated species. In total 2,300 species are listed in the dataset (https://catalogue.ceh.ac.uk/documents/22b3d41e-7c35-4c51-9e55-0f47bb845202). A second dataset is for all species known to occur on Ash trees (available at http://publications.naturalengland.org.uk/publication/5273931279761408). Investment in equivalent datasets for other key tree species in the UK, could be significant in supporting the spatial planning of the expansion of woodlands, and improving their resilience to threats from pests and diseases.

To encourage the uptake and implementation of land systems which may be new, or unfamiliar to land managers requires effective communication of the benefits and practicalities of what may be encountered. *O*nline outreach tools and information are publicly available about the climate-positive farming initiative in general, and the agro-forestry system in particular. These tools include an interactive webmapping tool (https://glensaughmaps.hutton.ac.uk/) and a hyperlinked video tour of the agro-forestry site from the air and on the ground (https://virtualfarm.hutton.ac.uk/glensaugh/). Investment in a coordinated approach to sharing information about agro-forestry systems could help guide land managers on the potential of such land systems, and provide a support network for innovation in their deployment in new combinations of land use.

(c) Open models for education: To accompany the planning and implementation of the significant expansion of woodlands, links should be made with relevant parts of the school curriculum. This would contribute to building shared understanding of the functions of woodlands, and new opportunities that land use change can offer the generations of society which would be amongst those most affected by climate change and biodiversity loss.

An open access virtual reality model has been developed to provide 'safe space' to learn the signs and symptoms of Chalara ash dieback, scenarios of the spread of infection, the death of trees and the regeneration of woodland flora and fauna. The model was designed for use by primary and secondary age children and their families, aligning with the Scottish Curriculum for Excellence outcomes on biodiversity, interdependence, and people and the environment. It was developed as part of the Chalara Action Plan for Scotland, to provide guidance on the responsible use of woodlands to minimise the spread of chalara and other plant diseases. Public and school audiences have used the model in a virtual reality theatre and downloaded it to use on a PC or virtual reality headset (https://zenodo.org/record/3906261#.X7Tmc2igJ9M). Its development brought together expertise from Forest Research, Royal Botanic Garden Edinburgh, and James Hutton Institute, and is

part of the science education resources of the Scottish Environment, Food and Agriculture Research Institutes Gateway (https://sefari.scot/).

6) Are the right policies and funding in place to appropriately protect and manage existing woodlands in England? How will prospective changes to policy and legislation effect this?

No response

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