Tree Nurseries in North Wales
Scoping Report

Funded through the LEADER Programme, a local development approach for rural areas. It is an EU and Welsh Government funded project, with emphasis on piloting projects in order to learn and share good practice.

Executive summary

Climate change, socioeconomic shifts in Welsh land use as a result of Brexit and Welsh Government tree planting targets necessitate large-scale tree planting in Wales. However, the current supply of planting material falls far short of the anticipated demand, and there are no large-scale tree nurseries in the region, with providers at present consisting only of a small number of micro-nurseries identified on farms and smallholdings, which supply planting stock for their own use or for their immediate community. As a consequence, many projects and land management schemes face challenges sourcing trees locally, and the provenances (seed sources) of available nursey stock may not be from North Wales trees and so may not be suitable for strategic planting. Local sourcing of trees for planting projects will deliver a variety of ecosystem services and benefits, aid stakeholders in meeting planting targets as well as delivering economic and employment benefits. Investing in and supporting both existing and proposed tree nurseries via a network will help Wales rise to the challenge of meeting ambitious planting targets necessitated by climate change and dependence on imported timber, as well as delivering biodiversity and other social and environmental benefits. Planting more trees will make areas more attractive places to live, work and visit, and by supporting existing and scheduled planting projects, networks linking people with green spaces will be strengthened, and provide communities with better access to the countryside.

By supporting the North Wales tree nursery sector, employment opportunities will be created for young people, who will benefit from receiving training in skills such as seed handling, plant propagation, tree seedling production, woodland and nursery management and plant health. By investing in this sector, volunteers who are involved in community woodlands or other projects will also be supported, strengthening community cohesion.

1.0 BACKGROUND

1.1 Menter Môn is a not for profit social enterprise that seeks opportunities to provide solutions to the socio-economic challenges faced by rural communities in Anglesey. Since it was established in 1995 the company has attracted more than £70 million of public funding to deliver projects which have had a demonstrable impact on people's lives.

1.2 We work with businesses, communities, and individuals to deliver meaningful projects that harness their strengths and contribute to a sustainable future. We embrace and recognise the value of our resources and seek to add value for the benefit of the community. These include our natural and built environment, our cultural heritage, our agricultural and food sectors and most importantly our people.

1.3 We work with all levels of government, third sector organisations and private businesses across a broad range of sectors. This includes:

- Engaging with communities of interest and developing programmes that respond their requirements and ambitions.
- Delivering support on behalf of other organisations to businesses, the third sector, community groups and individuals.
- Providing a vehicle which delivers innovative solutions on behalf of local and national government.
- Run and operate a vibrant building portfolio that includes assets that were previously redundant, derelict, or underutilised.

1.4 Our current project portfolio includes the following:

- Arloesi Môn and Arloesi Gwynedd (LEADER): We deliver the LEADER project in both counties. The projects have a combined value of £9 million and seek to pilot innovations which produce beneficial change in the rural economy. Both projects are managed by county level Local Action Groups which provide strategic direction. The Arloesi Môn project receives match funding via the Isle of Anglesey Trust Fund.
- Menter Iaith Môn: The Menter Iaith seeks to safeguard and promote the Welsh Language on Anglesey. It receives an annual grant from Welsh Government and attracts funding from various other sources. It also delivers a range of activities through the Anglesey Youth Theatre and Bocswn (Youth Music Studio and project).

- Morlais: Menter Môn is the leaseholder for the West Anglesey Demonstration Zone on behalf of the Crown Estate. Our objective is to attract tidal energy developers to Anglesey by providing grid connection and consent. We have recently secured £5 million of ERDF funding to support the development. Our motivation for undertaking the project is to maximise local economic and community benefit and to generate an income for Menter Môn's work on the island project activity.
- Cwlwm Seiriol: We were successful with a £1.2 million application to the Big Lottery Fund's Create Your Space programme. The aim of the programme is to help support communities to develop their own vision for improving their local natural environment in a way that meets their needs and those of future generations.
- Building Portfolio: Menter Môn owns several buildings which were bought from Anglesey County Council under an innovative asset transfer programme in 2008. These include three buildings in Amlwch Port, Llangefni Town Hall, and Princes Pier (Menai Bridge). Each of these buildings have been renovated and are self-sustaining. We also own the Aberlleiniog Estate near Penmon and an 8 unit Industrial Estate in Rhuthun.
- Future for Furniture: Menter Môn runs a furniture recycling centre in Llangefni which collects and renovates unwanted furniture, before selling it on to low income families.
- Enterprise Hub – Menter Môn works in partnership with M-SParc to deliver the WG Enterprise Hub Contract. This provides support for start-ups in North West Wales and is based in M-SParc.
- Regional Projects – Menter Môn delivers a number of regional projects, including the Fisheries Local Action Group and Môn Larder (both across North Wales) and Tech Tyfu: Vertical Farming (Ynys Mon and Gwynedd). A common thread across each of these is the focus of producers and the local supply chain. This report is in relation to the North West Wales Tree Partnership (NWWTP).

Introduction

It is widely accepted that during the 21st century humanity could be facing an imminent climate and biodiversity emergency. Governments around the world are tackling these problems with a range of mitigations. Of the many possible solutions to climatic change and biodiversity loss available to us, the most widely hailed to be both effective and cost-effective are tree planting initiatives. Trees have evolved over millennia to be highly effective at capturing atmospheric carbon dioxide through a process known as photosynthesis, locking up an average of more than 400 tonnes of carbon per hectare (Woodland Trust, 2020(a)), depending on management, species and site characteristics. Trees are not only great at carbon sequestration, but also relieve many of the problems associated with rising atmospheric carbon dioxide concentrations, such as; providing habitat for wildlife, nutrient processing, reducing air and water pollution, prevent soil run off and subsequent flood events and altering local weather conditions (Woodland Trust, 2020(b)).

The success of international afforestation initiatives is reliant on many complex factors, but especially on the availability of planting stock which are pest free, good quality and sufficiently adapted to local conditions found on the planting site to survive, compete and successfully reproduce. This issue is particularly a problem in the UK, a country which has relatively low forest cover when compared to other European nations (average forest cover 37%), with an average forest cover of 13% (10% in England, 15% in Wales, 19% in Scotland and 8% in Northern Ireland) (Woodland Trust, 2020(a)). As a result of this fact, the nations of the UK have all developed ambitious tree-planting targets, despite these in Wales and England forest cover has not increased as planned (Burke et al., 2020). If the government's policy objectives of increasing forest cover are to be met, a better understanding is required of the processes which underpin the selection of suitable tree seeds, the scale of the existing supply chain for tree planting stock and its suitability to supply projected demand necessitated by planting targets

In Wales there is a total of 305,000 hectares of forestry, this represents 10% of the UK's total forest area. The Welsh Government through the body National Resources Wales manages 37% of this woodland, the remainder is in private ownership and management or remains unmanaged. The area of forest in Wales has been remained fairly constant over the last 20 years with the only major increase in cover of 5%, taking place between 2001 and 2012 (Woodland Trust, 2020(a)). Since this time afforestation rates have stagnated with little progress being made, although areas of forest which have been harvested, have been replanted. The conifer to broadleaf tree numbers were estimated to be 252 conifer trees, 92 million broadleaf trees and 38 million forest shrubs, in 2010 with little alteration since then

(National Assembly for Wales, 2013). The forestry sector in Wales is estimated to add £429 million to the economy and employ 9,000 people directly. Indirect employment such as woodland recreation, tourism, energy generation and timber transport, was not included in this estimate (National Assembly for Wales, 2013).

A discussion around the North Wales tree supply chain was initiated in response to the proposed construction of a new nuclear power plant on Anglesey known as 'Wylfa Newydd' development on Anglesey. Anglesey County Council was keen to stipulate that all trees used in the landscaping and environmental work were locally sourced native trees. However, the council were unable to impose this condition as it was realised that at the time there was no local supply chain for local provenance native trees. The discussions were then widened, and it was found that the same barriers to sourcing local provenance trees were also found in the neighbouring counties of Gynedd and Conwy. A local network of stakeholders, the North West Wales Tree Partnership was formed in response to the lack of local native tree nurseries in Anglesey, Gwynedd and Conwy in the hopes that this informal consortium of partners can address the shortage of local suitable planting stock.

Since 2018, although the development of 'Wylfa Newydd' is now likely to be delayed the need for more tree planting has been prioritised not least by the Welsh Governments reaffirmation of the need for greater afforestation and the recent announcement of the Welsh National Forest, suggest that demand for planting stock that will establish, develop and in future reproduce has never been more needed. This report will analyse a range of literature as well as undertaking surveys and interviews to establish the demand for planting stock suitable for successful growth establishment and reproduction in the future climate of North West Wales. The output from this research will then be used to inform future project funding applications

1. Background

a. Adaptation of European tree species

Trees which we consider UK native trees today are therefore trees which colonised between the beginning of the end of the last ice age 10,000 years ago, but before the English Channel melted. It was thought that the trees had naturally migrated north, expanding their range as the ice retreated exposing soil. However modern pollen data suggests that many of these trees were probably moved by our Neolithic ancestors into the north of Europe as the speed of migration north (over 100m/year) is faster than expected.

b. Importance of local provenance

Trees have both an origin (the country from which they originate) and a provenance. Origin is only important in the case of non-native exotic tree species planted in the UK producing seed,

the origin would be the native range and the provenance would be the area the mother tree was planted in. In the UK, a universal system of 4 Regions of Provenance (R.O.P.): 10, 20, 30 and 40 and smaller local seed zones were developed by the then Forestry Commission (Hubert and Cundall, 2006) (see Figure 1). As can be seen on the map, Wales was divided into two local seed zones, 303, which is most of the areas in the east and south that are affected by salt spray from the South-Westerly prevailing wind. The remainder of the country, the North-east coast and the counties that border the English Marches are known as zone 304.

Recent selection of suitable planting stock has often been based on the premise that very local provenance is always best, however with altering climatic conditions, evidence of this going forwards is limited (Hancock and Hughes, 2014). This assumes that tree population found in the locality are already well adapted. This assumption was based an understanding that during the Holocene climatic conditions have not altered significantly for a period. Recently there has been a realisation that the climate is no-longer as stable as it was and that climate change can be rapid, heterogenous and unpredictable, making general predictions problematic (Wittett et al, 2016). What remains clear is that the UK has a markedly different growing conditions to those found on continental mainland Europe and that UK adapted planting stock will generally be more successful than imported European planting stock (Wittett et al, 2017).

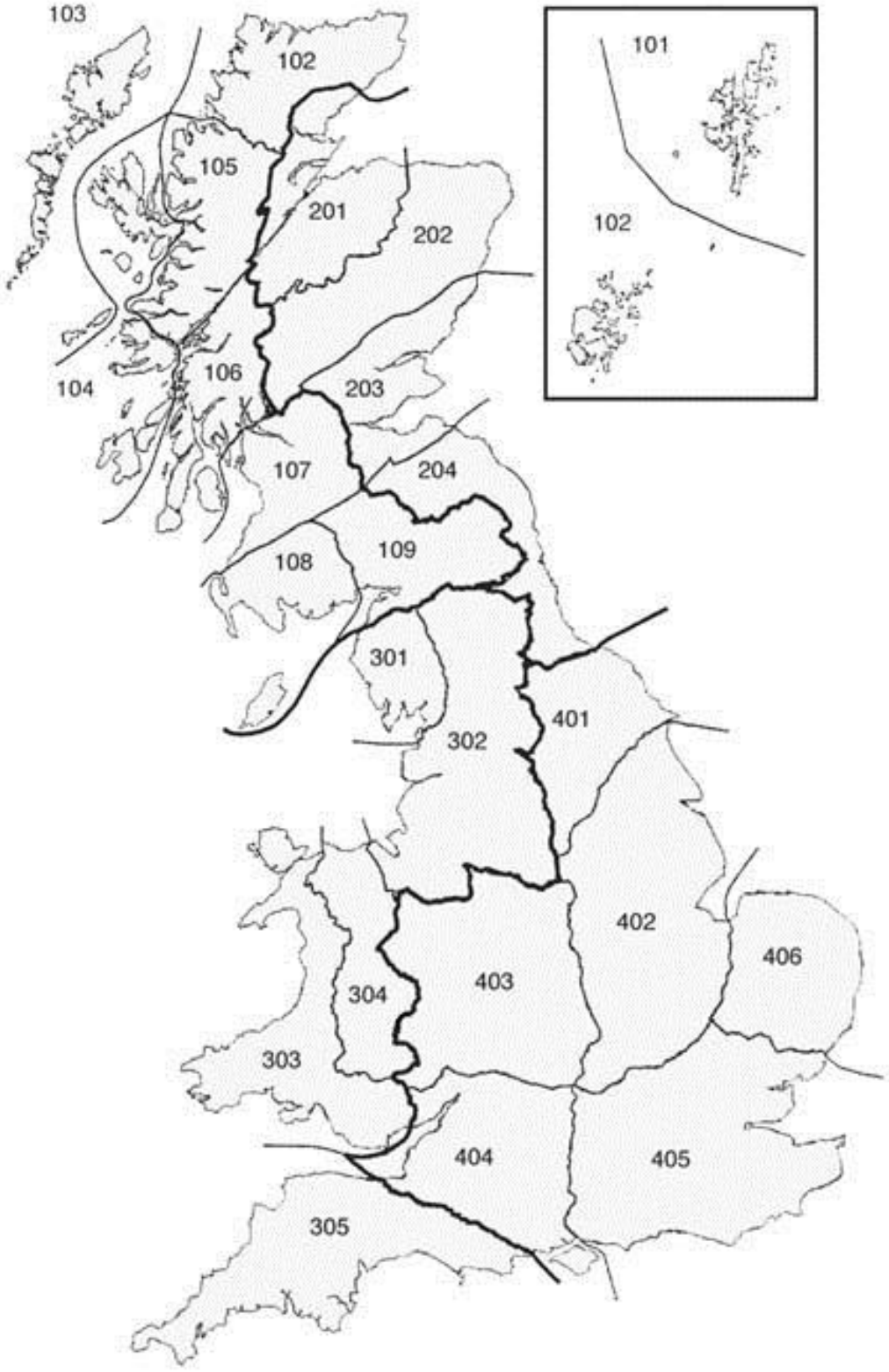

Figure 1: UK regions of provenance (ROP) and native seed-zones (Herbert, et al.,1999).

North West Wales in a varied landscape with a diverse range of climates in which newly planted trees must survive, from coastal sand dunes to the windswept mountains of Snowdonia. The species and provenance of trees to be planted will vary depending on, the

conditions found at the planting site, the reason for planting (firewood, biodiversity, or timber production) and management methods (clear-cut forestry or continuous cover). Significant effort has gone into the development of woodland creation opportunities maps (Burke et al, 2020). However, the unique growing conditions found in North Wales can be challenging for trees originating from and propagated in other more challenging growing conditions.

Trees fit for the future will therefore be-

- Windfirm- undercutting/ no undercutting, air pruning etc
- Pest and disease resistant-
- Future tree timber/ biodiversity species
- Species which continue to supply Wales with ecosystem services
- Resilient- (less monoculture) diverse species, genetics, provenances, and age structure

The UK Forestry Standard (UKFS) is the reference standard for sustainable forest management in the UK and as such, defines standards and requirements, and provides a basis for regulation and monitoring (Forestry Commission, 2017). The guidance on planting stock was adopted from the Helsinki Declaration and states that for a forests management to be considered sustainable native species and local provenance should be preferred (Hubert and Cundall, 2006).

c. Anthropogenic climate change

Anthropogenic climatic change is an obvious confounding factor which makes prediction of suitability of planting stock problematic (Hubert and Cundall, 2006). The UK climate has warmed at a rate of between 0.1 and 0.2ºC per decade, in recent years and it is anticipated that in the next decade warming is likely to be between 0.1 and 0.3ºC per decade (Broadmeadow and Ray, 2005). As a result, a compromise will need to be struck between the use of local planting stock assumed to be adapted to local climatic conditions and those which maybe better adapted to future growing conditions (Hubert and Cundall, 2006).

d. Pests and diseases and the need for biosecurity

A major threat to UK forests in recent years has been the accelerating influx of pests and pathogens, which delivers devastating ecological damage (Defra, 2013). Chief among which are ash dieback, acute oak decline, *Phytophthora* spp., the Asian longhorn beetle, needle blight in conifers and the spruce bark beetle. The economic impact of recent tree diseases in the UK is alarming. Hill et al. (2019) estimate the cost of ash dieback in the UK at £15 billion, with projected mortality of 15 million mature trees and 2 billion saplings by 2040 (Woodland

Trust, 2020). Importing planting stock from overseas has been a major vector for the introduction and proliferation of such diseases (most recently and most devastatingly in the case of ash dieback).

The extent of the threat is very great, with almost all UK native tree species impacted to some degree by a pest or pathogen introduced within the last 30 years (Defra, 2020), and according to the UK Plant Health Risk Register, there are 127 further pests and pathogens which will have devastating impacts on the UK should they be introduced to the country. As such, the planting of trees which have been sourced and propagated in Wales is the most straightforward preventative measure to prevent the spread of existing diseases, and the most effective step to prevent the arrival of new diseases (Woodland Trust, 2020).

Implications for biodiversity are severe – the loss of native trees as a consequence of imported pests and pathogens will have wider effects on living systems. Native trees support a wide variety of insect, bird, lichen, fungi, and plant species which are host specific. In Wales, sessile oak and ash trees fulfil many of these ecological roles, both of which are under threat from a number of diseases (acute oak decline and sudden oak death for the former, and the aforementioned ash dieback for the latter). The costs associated with the loss of ecosystem services such as these are the most substantial identified with the ingress of non-native pests and pathogens (Hill et al., 2019).

Importing trees from overseas remains current practice in many places, with over 1.1 million oak trees being imported into the UK between 2013 and 2015 (Woodland Trust 2020). This comes at the price of exposing native trees to disease pressure, against which they have no natural defence mechanisms. In addition, natural regulatory processes of the diseases themselves (predator species) will not be present, allowing pests to proliferate unchecked, often with critical impact.

In summary, climate change targets for Wales and the UK necessitate large scale woodland creation within the next 30 years, and the impact of pests and diseases will only increase the difficulty of reaching these targets. In addition to this climate change will confound the problems caused by diseases through increasing temperatures and precipitation, creating ideal conditions for these microbes and invertebrates to reproduce and flourish. Adverse tree growing conditions caused by pollution, climatic change, also adds to the trees problems by making them more susceptible to attacks. As a result, researchers are continuously horizon scanning in the hope of anticipating the next potential problem for tree health, however the possibility of an unexpected pest or disease arriving in the UK is still likely. The need for increased local production of nursery stock and a reduction in imported horticultural and

forestry planting stock is needed to reduce that risk, in conjunction with a planned increase in the resilience of our forests.

2. Data collection

In order to scope the requirement for North Wales specific suitable planting stock both web-based questionnaire and telephone/ video conference interviews were utilised.

2.1 Interviews

Initially, key stakeholders, interested parties and organisations likely to be crucial to the success of the project were contacted for either video conferences, face to face interviews (socially distanced) or telephone interviews.

Interviewees included-

- Heidi V Williams- C'N'G Cefn Gwlad~ Farm and Country Farming Consultant
- Jenny Wong- Wild Resources/ Llais y Goedwig/ Dewis Gwyllt
- Lucy Kew- Dewis Gwyllt
- Maria Wilding and Liz Mutch- Llais y Goedwig
- Laura Shewring- Woodland Trust- Treescapes Development Lead
- Ruth Pybus- Bron Haul
- Simon Hunt- Coed Cymru
- Rhydian Roberts- National Park's tree nursery lead in Plas Tan y Bwlch
- Simon Rogers- National Trust Warden
- Sara Parry/ Sarah Collick- Social Farms and Gardens
- Ian Sturrock- North Wales Fruit Tree Nursery
- John Healey- Forest Ecologist Bangor University
- Ed Henderson Anglesey Councils senior Tree Officer
- John Williams- Anglesey Council
- Alex Jones- NMWTRA
- Jon Taylor/ Carol Owen NRW
- Gareth Evans- Keep Wales Tidy
- Geraint Jones- Farming Connect (previously ran Glynllifon Tree Nursery)
- Chris Wynne- NWWT
- Rob Booth NWWT- runs tree nursery at Gwaith Powdwr, Penrhyndeudraeth.
- Ed Midmore- Woodland Trust
- Geraint Hughes- Mentor Mon

2.1.1 Results

The detailed notes from all of these interviews/ conversations have been summarised into the key themes and points that came from these discussions.

- There is a large demand for local trees, shrubs, and plants
- Currently many tree customers have to source from elsewhere- Press Heath, Maelor, Alba, Dingle and Heathwood Nurseries
- Most if not all of the trees supplied by these nurseries are not Welsh provenances (303, 304)
- Survival rates of these trees from elsewhere are often significantly less than expected, this is believed in many cases because the planting stock is unsuitable
- Availability of the right stock/ species from UKISG (UK and Ireland Sourced and Grown) sources is a challenge
- The increased need for resilience in our forests will inevitably lead to a more diverse range of tree species being planted in Wales in the future
- There is a need for a resource in wales which could evaluate, register, collect a wide range of 303 and 304 provenance trees of a wide range of species
- A key role for local growers might be to supply the minor species where it is difficult to collect sufficient quantities for a batch at a commercial nursery
- Only one single UKISG registered grower in Wales
- It is particularly hard to sustain a profitable small-scale commercial nursery
- There is a need for an organisation with a role in supporting existing nurseries to scale up or encourage community growing as well as to support the setting up of new tree seed collectors or growers.

One of the key questions which was asked of interviewees who had been involved in previous North Wales Tree Nursery projects. Particular attention was given to asking those individuals and organisation why previous attempts to establish a North West Wales Tree Nursery had been unsuccessful in the longterm. It was felt that a thorough understanding of the barriers to successful establishment early-on would reduce the chances of his project going the same way. The following points were raised as to why previous initiatives had not persisted-

- Nurseries not specialised enough in terms of species
- Requires the correct staff member with diverse skills enthusiasm, horticultural care of seedlings and certification
- Logistics can be problematic
- Funding streams are sporadic, inconsistent, and difficult to predict

- Trends in tree planting are difficult to predict

2.2 Questionnaires

A bilingual questionnaire was created using the online survey creation software SurveyMonkey. The link to the questionnaire was then sent around to the key members of the forestry, conservation, horticultural and agricultural sectors in North Wales and posted frequently during the data collection period of various social media platforms- including Facebook, Twitter and Researchgate. Respondents were asked a series of 20 questions See Appendix 1 and 2) which determined their interest, previous involvement with producing forest nursery stock and which species if any they have struggled to source in the past.

2.2.1 Results

A total of 45 respondents answered the online Tree Nursery Scoping Survey, all of which gave consent for the data to be used to assess the need for a North Wales nursery. The range of organisations which the respondents represented was large and varied and great care was taken to ensure that only one individual from each organisation answered to avoid duplication of data. Organisations which responded included:

- Arfon Timber Co-operative- a local green wood timber frame and milling operation based just outside Caernarfon, Gwynedd.
- North and Mid-Wales Trunk Road Agency (NMWTRA)- the public body responsible for managing, maintaining, and improving the strategic road network in North and Mid Wales on behalf of the Welsh Government.
- National Trust
- Snowdonia National Park
- Natural Resources Wales
- Keep Wales Tidy- who locally manage Anglesey Area of Outstanding Natural Beauty
- Gwynant Trees- family run mountain tree nursery based in Snowdonia National Park.
- Botanical Society of Britain and Ireland- a scientific society for the study of flora, plant distribution and taxonomy relating to Great Britain, Ireland, the Channel Islands, and the Isle of Man.
- Horticulture Wales- a project helping Welsh growers and producers reduce waste, improve shelf life, and encourage collaborative working.
- Wales Heritage Orchard Cluster- a collaboration to promote planting Welsh heritage variety fruit trees, to map orchards and encourage collaboration between growers to explore new markets.
- New Forest Energy- biomass energy company (Bodorgan Estate)

- Several private woodland owners
- Woodland Skills Centre, Denbighshire
- North Wales Wildlife Trust
- Bron Haul Farm (broadleaf wales)
- Miller Land management
- Plas Tirion Timber
- Wrexham County Borough Council
- Gwynedd Council
- Anglesey Council
- UPM Tilhill
- Snowdonia Tree Services
- Green Centre, Eirias Park Environmental Trust
- Keyhoe Countryside
- Ediston Limited
- Plas Newydd Estate
- Bangor University
- Ian Sturrock Fruit Nursey
- Anglesey Woods CIC
- Coed Llwynonn
- Elwy Working Woods
- Wild Elements
- Llyn Parc Mawr Community Woodland Group
- Social Farms and Gardens
- Woodland Trust
- Llais y Goedwig

Of the organisations and individuals that responded 50% reported they were based in Anglesey and Gwynedd and the remainder were from Conwy and other North Wales counties. The sectors which the respondents reported were their primary sector of concern was a third forestry, a third environmental/ conservation, around ten percent of respondents reported their primary activity as agriculture and remainder was other unspecific activities.

A total of 67% of the respondents reported they had experienced shortages of planting stock that they considered suitable for North Wales. Of those that had reported a lack of suitable planting stock, half indicated that unsuitable planting stock of the same species was available. The reason given for the available planting stock not being suitable included because the planting stock was from outside of the UK (15% of respondents), from outside Wales (20% of

respondents), incorrect provenance (15%) and incorrect size (15%) whereas 12% said the available stock was not considered hardy enough to have survived in the planting sites conditions. A third of respondent revealed that a lack of what they considered to be suitable planting stock had actually discouraged or prevented them from tree planting.

The organisations and individuals surveyed reported that 25% of them had a small-scale tree nursery, to propagate their own supply of native local provenance trees and 18% reported occasionally having an excess of a particular species. 96% of the organisation and individuals anticipated planting trees in the near future of these 53% reported that this tree planting would be funded by private capital, whereas 18% where reliant on Glastir funding for planting and 29% from a different unspecified grant funding application, such as for example the National Lottery.

Organisations were then asked to try and anticipate which species they are likely to be planting in the short to medium term. Firstly 64% of the organisation surveyed stated that they would be planting only deciduous trees (trees that lose their leaves in winter). 2% stated that they would be planting only evergreen species and the remaining 33% intend to plant a mixture of both deciduous and evergreen trees. When asked if they anticipated planting native or non-native trees in the future 56% stated they would only be planting native trees and 44% would likely plant native and non-native. No respondents stated that they would be planting only non-native trees. It is possible that some survey participants were unsure of exactly which specie sand native and which are not and some trees are considered native to the UK such as beech (*Fagus sylvatica*) but not considered native to North Wales.

The organisations were then asked to report which species they intended to plant if this was known. Four of the organisations or individuals stated that they were unsure of the species selection that would be planted. The other species which were reported as likely to be planted in the future by the organisations and individuals are tabulated below (see Table 1).

Table 1: Species stated as likely to be planted by surveyed organisations and individuals

Scientific name	**Common name**	**Frequency tally**
Corylus avellana	Hazel	6
Quercus petraea	Sessile oak	6
Quercus robur	Pedunculate oak	4
Populus tremula	Aspen	3
Tilia cordata	Small leaved lime	3

Castanea sativa	Sweet chestnut	2
Ilex aquifolium	European holly	2
Sequoia sempervirens	Coast redwood	2
Metasequoia glyptostroboides	Dawn redwood	1
Pinus contorta	Lodgepole pine	1
Malus domestica	Apple	1
Prunus spinosa	Damson	1
Taxodium distichum	Swamp cypress	1
Pinus peuce	Macedonian pine	1
Fagus sylvatica	Beech	1
Fraxinus excelsior	Ash	1
Salix alba	White willow	1
Picea sitchensis	Sitka spruce	1
Betula pubescens	Downy birch	1
Malus sylvatica	Crab apple	1
Taxus baccata	Yew	1
Juniperus communis	Juniper	1
Salix pentandra	Bay willow	1
Sorbus sp	Rowan/ whitebeam	1
Euonymus europaeus	Spindle tree	1
Crataegus monogyna	Hawthorn	1
Prunus spinosa	Blackthorn	1
Populus nigra	Black poplar	1
Ulex europaeus	European gorse	1
Ulmus glabra	Wych elm	1
Salix sp.	Unspecified willow	1
Thuja plicata	Western red cedar	1

Pseudotsuga menziesii	Douglas fir	1

The diversity of species which respondents are likely to plant in the future can be seen in Table 1 and most of the species are native species. This correlates with the answers given to the question of if organisations thought they were likely to plant exclusively native species (56%) and native/ non-native species mixtures (44%). Trees can be planted for a variety of reasons and the reason for planting often alters the species choice, establishment and even size of the required planting stock. The survey asked those who intended to plant trees ion the future to rank their reasons for planting from 1-5 (1 being the first priority and 5 the least important). The results of this question are tabulated in Table 2. It would also be wise to attempt to anticipate trends not mentioned by the respondents, for example the death of ash trees in the landscape, may have to result in an increase in interest in planting sycamore, a non-native tree which is ecologically most similar to ash and may therefore become a common replacement. Continual horizon scanning is a necessity in the nursery sector to attempt to anticipate these trends prior to demand in a specific tree altering.

Table 2: Ranking of reasons respondents gave for planting

Objective	**Reason for planting (ranked 1-5) number (%)**					
	1	**2**	**3**	**4**	**5**	**SCORE**
Timber production	9 (20%)	6 (16%)	10 (22%)	2 (4%)	17 (38%)	2.76
Social forestry	2 (4%)	12 (27%)	14 (31%)	11 (24%)	6 (13%)	2.84
Education	2 (4%)	12 (27%)	9 (20%)	9 (20%)	13 (29%)	2.58
Non-wood forest products	2 (4%)	6 (13%)	11 (24%)	19 (42%)	7 (16%)	2.49
Biodiversity/ carbon capture	30 (67%)	8 (18%)	1 (2%)	4 (9%)	2 (4%)	4.33

The most notable result from this question was that timber production was a low priority. The most frequently stated top priority was biodiversity conservation and carbon capture, demonstrating that for many landowners' ecological concerns are prompting a renewed interest in tree planting. This is important because in the main, biodiversity conservation planting mixtures tend to be exclusively native species.

The final few questions asked if the organisation surveyed were interested in-

1) being kept informed of the progress of this project and/ or invited to a stakeholder meeting

51% of those surveyed expressed a wish to be kept informed of any progress and/ or invited to a stake holder meeting.

2) the development of a network of tree nurseries in North West wales

40 out of 45 respondents showed an interest in being informed of any developments in the formation of a North West wales tree nursery cluster/ network.

3. Funding for woodland creation

A key variable in predicting the species that will be planted in the short and medium to long term is the potential funding streams which are likely to pay for the planting. The tree planting grants that are available can be quite species specific, so likely funded stream is linked to species selection. This section will discuss not only the funding landscape in Wales over the next decade but also how that will alter the species of trees demanded.

The questionnaire and interviews revealed how landowners and managers intended to pay for the trees. The answers were divided into three categories.

3.1 Glastir funding through the Welsh Government

Glastir is the sustainable land management scheme through which the Welsh Government provides farmers and land managers with financial support. The woodland elements of this agricultural subsidy are Glastir Woodland Management and the Glastir Woodland Creation schemes, introduced to replace the Better Woodlands for Wales (BWW) scheme which ran from 2006 until 2010/11. These were funded initially through the Rural Development Plan 2007-2013, and then through the Rural Development Plan 2014-2020. Glastir Woodland Creation became operational from November 2010; the fourth window for grants under this scheme was between March and May 2017. Glastir Woodland Management was launched in April 2013, however, no new applications for funding have been permitted since 2015; the government has no plans to reopen the scheme. There is also a Glastir Woodland Restoration scheme, launched in 2015 to enable woodlands infected by *Phytophthora ramorum* (larch tree disease) or areas of larch felled to help slow the spread of the disease, to be replanted.

Of the questionnaire respondents, 18% stated that Glastir would fund the planting. The Glastir Woodland Creation packages are prescriptive particularly when it comes to species selection.

Table 3: Woodland Category, specifications, and grant rates for Glastir woodland creation.

Woodland Category	**Glastir Capital Works No.**	**Specification**	**New Planting Payment £ per ha**	**Annual Maintenance Payment £ per ha**	**Annual Premium Payment £ per ha**
Enhanced Mixed Woodland	803	• Minimum of 5 major species (at least 10% of each) • Minimum of 25% broadleaves inclusive of woody shrub element • Maximum 10% woody shrub element • No more than 50% of a single species • Stocking density 2,500/ha • Exclude livestock	3,600	60 (12 Years)	350
Native Woodland - Carbon	802	• Native species mixture • Suitable provenance planting stock* • Maximum 20% woody shrubs allowed • Stocking density 2,500/ha • Exclude Livestock **It is a requirement you register your new planting scheme with the Woodland Carbon Code.**	4,500	60 (12 Years)	350
Native Woodland **- Biodiversity**	801	• Native species - mix should be site native and largely conform to Habitat Action Plan types (for example upland oak, lowland mixed deciduous woods), however, local conditions may necessitate some variation from these. • Suitable provenance planting stock* • Maximum 20% woody shrubs allowed • Clumped distribution of species with variable spacing • Stocking density 1,600/ha • Exclude Livestock	3,000	60 (12 Years)	350

Agroforestry - scattered trees	804	• 80 trees per hectare • Not eligible for fencing grant • Not eligible for Premium payment	1,600	30 (5 Years)	N/A
Fencing	595	Post and wire fencing and stock netting	3.48/metre		

Table 3 above demonstrates the types of planting that Glastir Woodland Creation is prepared to fund, these particular planting specifications are due to run until 23rd March 2023. Of the four afforestation categories only Enhanced Mixed Woodland and agroforestry would allow for the selection of non-native species. Previous Glastir schemes have has very poor take up rates of the agroforestry component. The other two categories Native Woodland Carbon and Native Woodland Biodiversity as the name suggests will only allow native species selection. Dramatic changes in these woodland creation categories are not expected post 2023.

3.2 Private capital

Surprisingly of the 45 organisations surveyed 53% reported that the tree planting they anticipated would be funded by private capital. Private capital planting tends to be the most difficult to predict in terms of which species are planted. Although from the other questions it is clear that no respondent planned to plant only exotic species and that only 44% stated that they would have a native/ non-native mix.

3.3 Other grants

Grant application windows are opening and closing continually, and many tree planting and biodiversity protecting schemes are opening next year (2021). Of the organisations surveyed 29% stated that they would be paying for afforestation from a different unspecified grant funding application, such as for example the National Lottery. Below is a summary of funding opportunities for tree planting projects:

1. Rural Development Fund: a general theme is that woodland creation and restoration is one of the RDF's top priorities.
    a. Co-operative Forest Planning Scheme: Part of the Co-operation and Supply Chain Development Scheme
    b. Sustainable Production Grant
    c. Timber business investment scheme
2. The National Forest Community Woodland Grant Fund: Made up of £1.5m from Welsh Government, and £600k from the National Lottery Heritage Fund – a total fund of £2.1m. The fund will allow not-for-profit organisations to apply for anywhere between £10,000 and £250,000 for capital spending. Organisations will have until October 2021 to apply. The fund is open to not-for-profit organisations to deliver woodland projects to help meet the needs of communities and boost ecosystems. This may include new woodland creation; planting in urban areas or planting corridors of trees between woodlands to allow habitat connectivity.
3. Local Places for Nature Capital Fund: £1.05m in total made up of £900k from Welsh Government and £150k from the National Lottery Heritage Fund. Grants will range from £10,000 to £50,000 of capital funding. Funds must be used by March 2021. The scheme is aimed at community-led ventures to restore and enhance nature in their local areas, particularly in disadvantaged communities or where people have limited access to nature.
4. AONB Sustainable Development Fund (SDF): this fund is financed by the welsh Government and is administered locally by the Anglesey SAONB team. Its aim is to

support environmental, economic, and social projects of a sustainable nature that are within Wales's AONBS.

5. Green Recovery Capacity Building Scheme launched on 23rd November is a scheme which sees te Welsh Government team up with the Heritage Lottery to offer grant of between £5,000 and £100,000 to not for profit to increase capacity.

3.4 Welsh National Forest scheme.

In March 2020, the Welsh government officially launched the National Forest Programme, an ambitious project that plans a forest that runs the length and breadth of the country. The National Forest will be an ecological network with a significant role in reducing biodiversity loss by protecting nature and backed by £5m in this year's budget and an extra £10m of woodland creation and restoration funding. A recent announcement clarified the expansion of the Welsh government Forest estate with additional land purchased for planting at Clocaenog Forest in North Wales and Hafren Forest, Mid-Wales will expand by 350ha. although this increase will only actually compensate for forest cover lost through the expansion of renewable energy projects at both sites. This forest expansion programme is a positive step for Wales forest expansion ambitions and will no doubt result in more funding grants becoming active over the coming years.

4. Barriers to tree planting in Wales

Wales is falling behind te other nations in tree-planting. In 2019-20 an estimated 80 hectares of new woodland was created. To put that in perspective it was only 4% of Wales's tree planting target for that period. The Welsh government admitted this was disappointing and stated they were taking significant steps to tackle this situation. It is important to understand the cultural, socioeconomic, and environmental barriers to tree planting in wales. A recent survey of farmers were asked what would encourage them to plant new or larger areas of woodland in future, 44% of respondents said 'nothing would', 37% said 'higher grant payments', 5% said 'higher price for timber or wood fuel', and another 5% said 'higher and quicker returns on investment' So for the 44%, why were they adamant that they were not interested in afforesting their farms. The reasons for this are highly complex but from the interviews the following reason were given for a historic lack of uptake in welsh tree planting initiatives-

- Not enough long-term investment in tree planting incentives
- A need for simplification and revision of the current application system
- Inaccuracies in the Glastir woodland creation Opportunities map
- A need for urban tree planting incentives schemes

- A need for long term commitment to ensure saplings become trees
- Insufficient funding
- Perceived conflict with traditional hill farming

5. Findings

5.1. Recent planting and restocking by species in Wales

In order to anticipate the species likely to be planted in the future we can analyse the recent plantings and afforestation which has taken place over during the last decade. The species planted in the last 10 years in Wales, is in the public domain and on NRW's website. Table 1 shows the breakdown of trees planted for the last decade by species. It shows that consistently over the last decade in wales more ha. of productive conifer plantations have been planted than native broadleaf forest. This data is for all forests in wales, including the private sector, so this is to be expected. The largest component of this is Sitka spruce with Douglas fir coming in as second most popular conifer tree to be planted and pine species third. Within the broadleaf planting the most popular species to be planted in the last decade are sessile oak and birch. The most planted non-native broadleaf tree was the naturalised sweet chestnut.

Table 4: Species planted in Wales over the last decade (hectares)

Species	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
Conifers								
Douglas Fir	178	150	217	164	184	172	127	189
Other Firs	16	35	23	43	9	40	22	45
Norway Spruce	126	112	119	82	95	59	75	93
Sitka Spruce	426	483	502	300	446	507	255	539
Other Spruces	17	39	49	67	34	1	11	2
Pines	46	69	61	82	99	100	58	112
Other Conifers	25	48	38	36	27	34	3	55
Broadleaves								
Willow	16	19	14	16	8	9	19	0
Alder	20	20	34	19	9	15	11	25
Birch	58	93	87	88	112	72	54	106
Rowan	36	59	28	29	40	30	7	33
Beech	6	8	18	4	26	40	9	27
Sessile Oak	105	169	160	155	124	117	49	304
Pedunculate Oak	16	14	37	21	27	28	16	23
Sweet Chestnut	0	2	13	3	0	10	2	15
Cherry	3	9	17	22	14	12	18	34
Oth. Broadleaves	99	75	89	61	59	48	59	100
Split								
Conifers	835	935	1008	774	894	913	1036	1035
Broadleaves	358	467	498	418	420	381	735	666

NB: Predicted figures from 2018-19 onwards are based on the assumption that conifers are planted @ 2. A 10% reduction was made on the tree numbers ordered to account for trees used for beat-up.

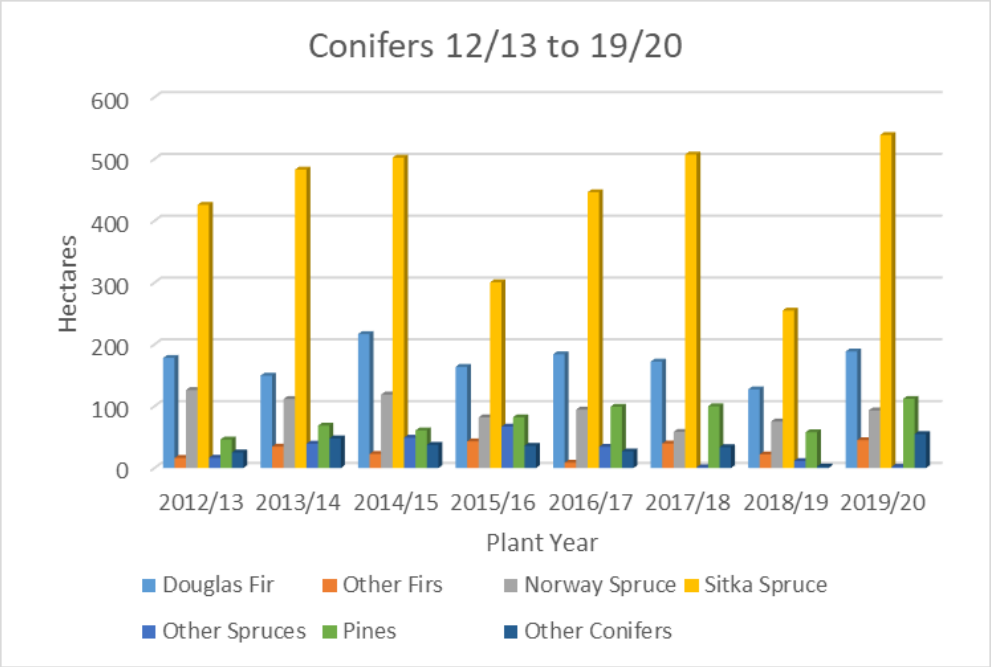

Figure 3: Conifer species planted in Wales between 2012 and 2019

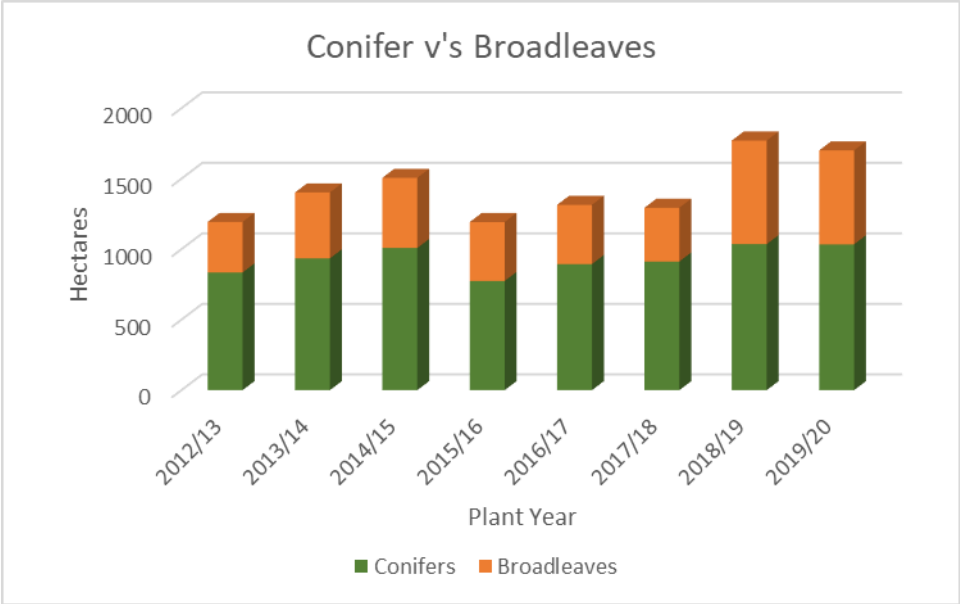

Figure 4: Relative contribution to new planting of deciduous and coniferous tree species

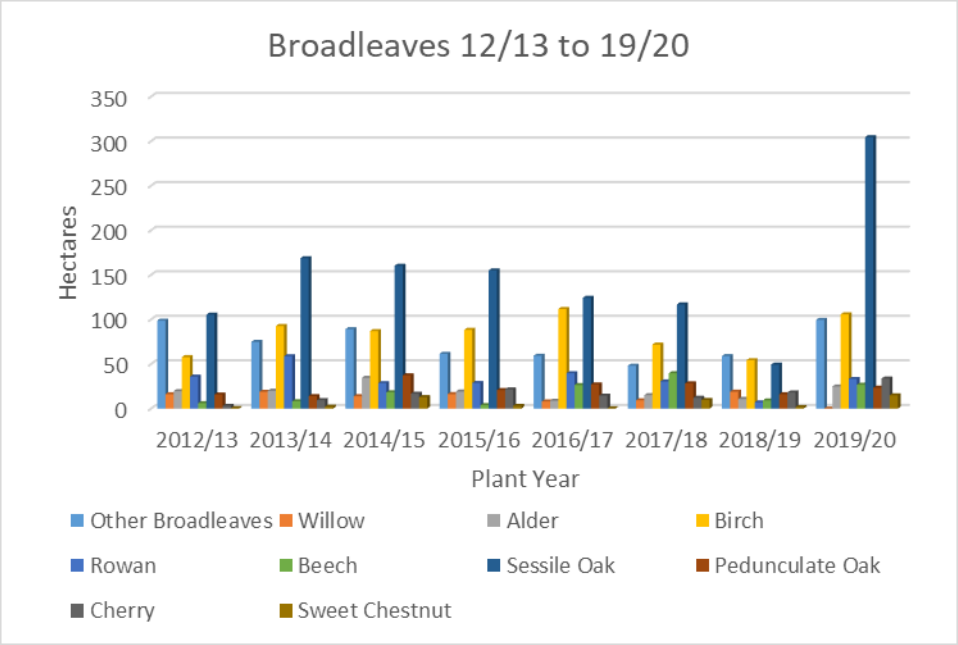

Figure 5: Deciduous species planted in Wales between 2012 and 2019

5.2 Current/ present demand for trees in North West Wales

Wales is one of the least wooded countries in Europe, with woodland covering only 15% of the land area, compared to the EU average of 37% (Natural Resources Wales, 2020). In 2010 the Welsh Government policy was to establish 100,000 ha of new woodland of mainly native trees by 2030. However, the Woodland For Wales Action Plan (2015-2020) stated that only 3,203 ha of new planting had taken place between 2010 and 2015, vastly below the ambitious targets As a result, the UK has to import around 80% of our wood and wood products. In 2020 the UKs total forest carbon stock is estimated at 4 billion tonnes of which 8% (0.3 billion tonnes) in store in Welsh public estate forests. The character of woodland in Wales has been influenced by both historic land use and previous governments policy, and Welsh woodland falls broadly into three main categories:

1) Woodland that is primarily conifer, normally single-species, even-aged stands created during the twentieth century, which generally have been managed by clear-felling and are currently the main source of home-grown timber.

2) Native woodland, mostly small and fragmented, often on farms and much of it not actively managed. Not all native woodland is old, but a significant proportion has been continuously wooded for at least 400 years (including some that was more recently converted to non-native planted woodland).

3) Stands that are undergoing transformation and restoration to diversify species and structure.

The Welsh Government has recently declared a climate emergency, which has increased both interest and potential funding streams for afforestation (see Section 4.3 for more details on the future funding opportunities for afforestation). The benefits of trees in the landscape are diverse and varied and their increased use for public goods and services is a Welsh government Natural Resources Policy (NRP) policy priority (Natural Resources Wales, 2020) in the following areas:

a) Reverse biodiversity decline

Approximately 5% of Wales' woodland has been designated as national or international biodiversity importance, however of this woodland only 26% of this was considered to be in Favourable condition, with a further 21% in unfavourable condition. The Welsh Government 'Woodlands for Wales Strategy' has missed its target to get 95% of this woodland SSSIs into a better condition by 2015 and therefore work still needs to be done to bring this woodland under better management (National Assembly of Wales, 2013). Since then new legislation in the form of the Environment (Wales) Act 2016 requires all Wales natural resources to be both sustainable managed and to be made more resilient. Resilience is built into landscapes through well-functioning, well managed and biodiverse ecosystems. The Act requires public authorities to maintain and enhance biodiversity so far as consistent with the proper exercise of their functions and in so doing promote the resilience of ecosystems (National Assembly of Wales, 2016).

b) Reduce air pollution and noise pollution

Trees can capture dust and other harmful pollutants from the atmosphere which can cause respiratory diseases and in doing so improve air quality, this is most significant in the most polluted regions such as in large towns and cities (Xing, et al., 2019). They can also protect against pollution by providing a buffer between source and receptor or help the recovery of contaminated land. The presence of trees in towns, cities and roadside can reduce noise levels particularly the sudden noises which are reported to cause residents located near roads the most annoyance (Muellor, et al., 2020).

c) Improve water quality

Water catchments with higher levels of forest cover show lower levels of nitrates and other chemicals in the water bodies which flow through them, than catchments with fewer trees (Burt et al., 2020). \The presence of trees in the landscape therefore increases the quality of drinking water in the vicinity and as a result the cost of drinking water treatment (Lopes et al., 2019).

d) Reduce flooding

The establishment of trees in the landscape changes the surface and subsurface hydrology which can delay peak discharge and lower the risks of floods (Marapara et al., 2020). Woodlands can also help to stabilise soils, particularly in upland areas which can reduce erosion and soil run-off and therefore prevent silt deposition in water courses.

e) Carbon sequestration and storage

Wales has committed to reducing greenhouse gas emissions by 95% before 2050. This will only be possible by increasing the forest cover of Wales significantly. Woodlands and their soils are important reserves of carbon, as the trees photosynthesise, they absorb carbon dioxide from the atmosphere sequestering it as plant matter, microbial carbon, and soil carbon.

f) Provisioning

As over 80% of wood and wood products are currently imported to Wales there is an obvious need to increase provisioning, especially in a post-Brexit Britain where imported goods and likely to be significantly more expensive than previously.

Tree can provide North-West Wales with the following sustainable products

i) Raw materials – construction materials, paper pulp and wood chip, packaging, and pallets

ii) Non-timber products – such as game, honey, berries, fungi, seed, flowers, lichen.

iii) Wood fuel for power plants, business, community or domestic supply of heat and power

iv) Timber and wood products offer a cost effective and valuable alternative to fossil fuel rich materials such as steel and concrete

g) Nutrient cycling

Forests are important for soil formation through leaf litter inputs and root exudates which prime the microbial component of the soil and increases its nutrient cycling processes (Aponte et al., 2013).

h) Localised climate regulation

Tree canopies provide shade, shelter, and absorb sound. Soils, animals, and humans can be protected from the extremes our weather and climate throw at us. The is more significant and important in urban areas, but trees can regulate localised climatic conditions even in the country.

i) Wellbeing

Woodlands and forests provide great settings for play, education and learning, outdoor pursuits, community activities and enterprise and are being found to be important for the maintenance of human well-being. When surveyed 64% of welsh adults surveyed reported they had visited woodland recreationally in the last few years. Of all outdoor visits, 52% reported spending sometime in a woodland. It is now well understood that taking time out from our stressful lives to spend time in woodlands, reduces stress and have a restorative effect on mental and physical well-being.

5.3 Future demand for trees in North West Wales

Anglesey has presently the lowest level of forest cover of any county in the UK with 4% of the island forested (Forest Research, 2020) and according to the Glastir Woodland Creation Opportunities map, much of the island is considered favourable to afforestation (Welsh Government, 2020). Gwynedd although currently more forested than Anglesey, due to the mountainous terrain and area of deep peats, this county has less woodland creation opportunities as a percentage of total area, than Anglesey. This section of the report will forecast likely market conditions for afforestation the short and medium term in Wales.

5.3.1 Short term

The Welsh Government's strategy for woodlands and trees is contained within Woodlands for Wales, published by the Welsh Government in 2009 and the subsequent five-year plans; the first was published by Forestry Commission Wales in 2010, and the second by the Welsh Government in 2015. During February 2017, an inquiry into the delivery of the government's Strategy for Woodlands and Trees was commissioned by the National Assembly launched. The single biggest issue raised by respondents to the inquiry's consultation is the lack of new woodland creation. The Welsh Government's Climate Change Strategy (2010) called for the "expansion of woodland in Wales by increasing the average planting rate from about 500 ha to 5,000 ha per annum maintained over 20 years". The Welsh Government are committed to increasing the area trees and woodlands in Wales and have set an aspirational target of 100,000 hectares of new woodland by 2030. This will help Wales to meet its carbon emission reduction targets. It is widely acknowledged that new woodland creation is one of the most cost-effective ways of tackling net carbon emissions.

5.3.2 Medium-long term

The Welsh Government are aiming for forest cover in Wales to increase by at least 2000 hectares per annum from 2020 to 2030 and beyond to meet strategy priorities and to maintain the overall productive potential from Welsh woodlands. Estimates from a study in 2012 reveal

that the overall net present value from this new planting would, over a 100-year time frame, range from £299 million (lowest estimate) to £8.6 billion (highest estimate). The long-term 50 Year Forecast of Softwood Availability for Wales shows a catastrophic decline in timber production in the near future. This will reduce investment by wood processing companies and threatens jobs.

5.4 Species anticipated

The anticipated species choices of potential tree planters can be done in a number of ways.

The questionnaire data shows a large variety of species that organisations were already planning on planting in the short term, Trends in planting have seem an increase in species diversity and with forest resilience being a priority for forest planners it seems reasonable to expect this trend to continue into the future.

Grant funding requirements with specify species choices can also be used to predict species likely to be planted, this is discussed in section 3. Many of the newly launched grant application calls have tackling the decline in UK biodiversity as a theme. T seems unlikely that grants driven by this principle would look favourably on non-native monocultures. It seems more likely that native and naturalised species will be favoured.

Many of the potential partnerships identified during te course of conducting this research were also more concerned with a supply of local native trees, the provenance of non- native trees is not seen as am issue.

In summary it seems that many new planting schemes that are driven by the conservation of biodiversity or in response to the climate crisis will be choosing almost exclusively native trees. Some woodlands will be enhanced mixes with a non- native minor component. Commercial forestry Glastir funding streams. I suggest 80% of demand will be native with mainly of the non-native being trees now considered naturalised such as sycamore, sweet chestnut, and steadily decreasing component of Sitka spruce.

5.5 Quantities anticipated

5.5.1 Planting for woodland

Anticipating likely quantities of trees required in the medium to long term is notoriously difficult. However, by looking at future planting targets and likely planting densities, one can extrapolate an educated estimate. A hectare is exactly 10,000 $m^{2,}$ which equates to one hundredth of a square kilometre band approximately 2.471 acres. Planting density is obviously very variable depending on the type of tree, reason for planting etc. The average spacing for new planting of native mixed woodland is around 1,600 trees per hectare, at about 2.5 m apart. This distancing will allow the wood to establish and be ready for thinning after approximately 15

years depending on the yield class of the site and the species planted. If the main objective of the new planting is timber production, then the trees are planted closer together to ensure straight growth with minimal side-branching. The generally accepted optimum density for timber producing stands in terms of costs and potential return is 2m x 2m spacing, which equates to 2,500 trees per hectare planted. Table x shows the trees required for different types of planting.

Table 5: Number of trees per hectare of planting for different reasons

Planting type	**Spacing**	**No of trees per hectare**	**No of tree per acre**
Parkland	25m	16	6
Farm orchard- traditional	10m	100	40
Farm orchard- modern	8m	144	58
Orchard	6m	256	104
Dwarf fruit	5m	400	162
Amenity	4m	625	253
Amenity	3m	1089	441
Broadleaved	2.5m	1600	648
Conifers	2m	2500	1012

5.5.2 Planting for hedgerows

If the planting stock is destined for hedging then the quantities needed will differ greatly, an ideal hedge is planted in either one row approximately 6 inches apart or in two offset rows with plants 30 cm apart. This leads to a required number of plants of between 5-6 tree per metre depending on species, site conditions, slope etc. As an example, a perfectly square one-hectare field will measure 400 metres around its perimeter. To plant a hedge around this field would therefore take 2,000 plants, however it is also worth noting that the same area field which was more rectangular in shape would require more plants to plant-up and perimeter hedge.

5.5.3 Planting shelterwood

A shelterwood is an area of trees planted exclusively to provide a windbreak and as a result will generally need to be wider than a hedge, on average they tend to be 5 metres width.

5.5.4 Estimated quantities of planting stock demanded in Wales.

As previously mentioned, the Welsh Governments ambitious planting targets have been not been met. The Welsh Governments Climate Change Committee have suggested that planting targets should be as much as 4000 hectares annually. It's hard to estimate which type of planting this will be, but at a conservative estimate of 1000 trees per hectares (based roughly on an estimate of the planting per hectare shown in Table x) would equate to 4 million trees per annum. Although as most new plantings are likely to be native, broadleaf species planted at 1600 trees per hectare, it is likely that this is an underestimate.

5.6 Provenances demanded

The interviews conducted as well as the questionnaire responses are clear in demonstrating that there is a demand for both the provenance zones of Wales. The provenance zones are large so this would still allow for significant assisted migration to occur (by selecting a seed tree slightly further south of the planting site) without significant risks. The four reasons given for why available planting stock was considered unsuitable were that the trees were-

- from outside of the UK (15% of respondents)
- from outside Wales (20% of respondents)
- incorrect provenance (15%)
- not considered hardy enough to have survived in the planting sites conditions (12%)

All of these misgivings would be tackled by sourcing seeds from within 303 and 304 tree seed zones.

5.7 Plant sizes and specifications for tree planting stock in the region.

The final reason given for the available trees not being suitable was that they were the incorrect size. This section will discuss planting stock sizes and specifications. On average forestry planting stock is 40-60cm tall but can be up to 1 metre and as small as 20-40cm. Hedging plants are normally between 30cm and 80cm depending and species and planting site conditions. Orchard and parkland trees are much larger and will generally be around 1.2 to 1.5m tall. Larger trees e.g., 1.2m can also be planted in specific cases, for example where bracken is a problem or you want a more instant result such as urban planting projects, garden, and parks. Native tree planting stock is normally bare rooted as 1- or 2-year olds trees. However, some species or planting sites need to be planted as either cell or pot grown stock, usually holly (*Ilex aquifolium*) or very sandy planting sites. In the case of extremely sandy soils, the compost in the cell can buffer the free-draining nature of the substrate and increase survival rates. Plants should be stocky and sufficiently "hardened off" to withstand local weather conditions, particularly in exposed and salt spray areas. Generally, the larger the tree,

the more effort is needed to establish the tree successfully, particularly in terms of watering. The other side of this is when the planting stock is too small more weeding, mulching and maintenance is required to continually control the weeds and ground vegetation from outcompeting the planting stock. Just as important as height of the tree is the general sturdiness of the transplant and the 'root collar diameter' (the thickness of the stem at the base of the tree), which indicates the development of the root system. Nursery catalogues use a system of numbers and symbols to indicate the grade of plants and the age. "+" indicates a transplant (if: the tree has been lifted and lined back out at wider spacing); this creates a sturdier tree. "u" indicates that while the tree has not been lifted and moved during the growing cycle, the roots have been undercut by a special machine to create a more favourable root system. So, for example '1u1' means a tree that has been grown for 1 year, undercut and grown on for another year before lifting and sale. "1+2" would indicate a larger sturdier tree that has been transplanted after one year and grown on for a further 2 years. This sort of tree would usually be 1.2-1.5m tall, etc. Undercut and transplanted trees are usually worth the additional cost over the one-year seedlings ("1+0") as they are sturdier and of better quality. There will be greater transportation and planting effort required, however, but longer-term survival and growth usually outweighs the additional cost.

Another consideration when estimating the required height of tree demanded in Wales is a recent trend is what has become known as Sabre planting. Sabre planting was developed in the mountains of North Wales with the very particular issues that landscape has for the establishment of trees. Namely the sheer number of livestock both domesticated sheep and in infamous wild goat population of Snowdonia. Both these herbivores have evolved a taste for tree saplings as an alternative to the grasses normally available to them. The way to avoid the new planting from being grazed is he employment of the technique of sabre planting whereby the trees are grown in the nursery to approximately 1 metre in height, normally in 1 litre containers. These trees are then carried out to the hillside and planted on steep slopes at an angle that is perpendicular to the hillside. This way when the trees starts to grow the leading shoot is already out of the way of the livestock, dramatically increasing their rates of survival. As the tree grow upwards it starts to bend towards the light and takes on the shape of a sabre.

Plate 1: Sabre planting on mountainside (Source: Natural Forest Practice http://www.naturalforestpractice.com/images/treeshepherd/sabre1.JPGwww.naturalforestpractice.com/treeshepherd.htm)

This methodology is a localised solution to a particular issue experienced in the uplands of North West wales as m das a result the large commercial forestry planting stock supplier are not growing trees large enough.

5.8 Current supply/ producers

To anticipate if there is enough capacity in the tree nursery supply chain to meet the likely increase in demand over the coming decades we must first analyse the capacity, quantity, quality and specifications offered by existing tree nurseries in the sector. During conducting the interviews, I asked local organisation who had reported tree planting recently where they sourced the planting stock. Most reported needing to order these in from outside of the area. The following forest reproductive material suppliers were given a having supplied North Wales organisations with planting stock in the recent past:

a) **Maelor Forest Nurseries Limited** is located at Fields Farm, Bronington on the Welsh Borders. The nursery is part of the BSW Timber Group Limited (UPMTilhill's parent company) and produces an extensive range of commercial forestry and native broadleaf species, marketing approximately 28 million trees a year to customers

throughout the UK and Europe. However, a quick search reveals that Maelor although on the Welsh borders is not currently supplying any Welsh provenance (303 and 304) planting stock.

b) **Alba Trees Forest Nursery** is located near Edinburgh in Scotland and is the UK' largest supplier of nursery stock, producing 10 million trees a year. They are currently only supplying trees with Scottish and English provenances.

c) **Heartwoods Nursery, Prees Heath, Whitchurch, Shropshire Heathwood Nurseries** are an established grower of quality trees, hedging plants and shrubs on near to the Welsh border, but do not currently sell Welsh provenance planting stock.

d) **Dingle Nurseries, Welshpool-** an independent family owned business which specialises in horticultural species but does supply native hedging pack s and some trees, none of which are Welsh provenance.

An internet search attempting to source Welsh provenance trees for sale reveals that the only tree suppliers that are advertising welsh provenance are in the orchard tree sector. Suppliers such as Ian Sturrock and Sons, Welsh Mountain Tree Nursery and Tom the Appleman, based in Oswestry. This confirms what was suggested by interviewees and questionnaire respondents, which is that obtaining Welsh provenance planting stock is extremely difficult and, in most cases, just not available at all.

6. Recommendations

6.1 Problem identified

There has been a historic failure to plant sufficient trees caused in part by a lack of suitable, hardy Welsh provenance (303, 304) native planting stock across the whole of Wales. The current native tree supply chain comes nowhere near to be able to supply sufficient trees for the welsh Governments ambitious planting targets. The issue is that if the Welsh forest expansion is relying on English and Scottish provenance planting stock that the trees supplied will be poorly adapted to the unique condition in north wales and therefore are ultimately destined to fail. The benefits to the economy, the environment and the wider community of tree planting are only realised if the trees establish, grow, reproduce, and eventually produce resilient, biodiverse, healthy forests.

6.2 Solution identified

The solution to this problem would be a community-based tree nursery which identifies suitable forest stands from within Wales, to organise seed collection and uses that to produce suitable planting stock that will become the resilient Welsh forests of the future. The role of this North Wales Tree Cluster would also be to administrate the acquisition of forest reproductive certification to prove local provenance and therefore assist a network of smaller local tree nurseries to trade and sell on to trade customers when they have an excess of a particular species, as evidenced by the questionnaire responses.

6.3 Roles identified for Menter Môn

By the nature of being a non-profit, dynamic social enterprise with extensive skills and connections, Menter Môn is uniquely positioned to fulfil a key role in facilitating a tree nursery network. Menter Môn has no vested interest beyond the well-being of communities and responsible stewardship of the landscape. Within the organisation, a unique range of competencies and skills exists, as well as a proven track record of successful project delivery in the environmental and business sectors. Menter Môn have a track record in delivering environmental and employment projects and have combined both in the past with significant success. These have included the Anglesey Coastal Path, the Dingle and Aberlleiniog LNR boardwalks, and several community improvements schemes.

We propose a number of roles that Menter Môn will be well suited to delivering to support work in this sector:

1. **Administration**: Many respondents to the survey and stakeholders interviewed faced a number of barriers to their nursery businesses being able to supply appropriate local planting stock. Some of these barriers could be overcome by a relatively

straightforward approach benefiting from administrative support from an enterprise such as Menter Môn, with one such instance being obtaining 303 provenance certifications for planting stock. Some small nurseries have not been able to sell locally grown trees as 303 provenance because they lack this certification (Forest Reproductive Materials), which due to the time constraints and challenges of running a small business they have been unable to obtain. This means in essence that the volume of potentially available local planting stock certified as local provenance could easily be greatly increased by a simple administrative process. Other similar areas of administration that could be managed by Menter Môn on behalf of a network of tree nurseries include plant health documentation, organic certification with the Soil Association, best practice guidance and a collaborative supply chain strategy.

2. **Strategic supply chain management**: In this report, we explain some of the reasons for previous projects working on tree nurseries have been short-lived, which has related to the shared tendency of them to focus on a specific nursery growing specific trees for a specific purpose, and when the purpose of sourcing the tree seedlings has been achieved, the project has ceased to operate. This report proposes that a more effective strategy is to have a more dynamic rationale, with a more coordinated approach to sourcing trees that may be obtained from a number of nurseries across a network for a number of possible projects as opposed to a specific one. Menter Môn is uniquely positioned to deliver this, having the necessary contacts, the required skills and past experience in this area.

3. **Network building:** As previously mentioned, Menter Môn has developed an extensive network of contacts and partners who will be able to contribute in various ways to the delivery of the project. This will be essential to developing a resilient project that will be able to respond to shifts in demand or scale up when required to meet the needs of a specific project or scheme. Menter Môn is well-positioned to bring together the necessary stakeholders for this project to be able to deliver.

4. **Seed collection:** Obtaining appropriate seeds for propagating planting stock is an essential task for nurseries, and of the stakeholders engaged with during the course of this scoping report, many have offered to support this work either by providing access to specimen trees ideal for obtaining seed collection or by offering help in some other form. This is an area of ongoing work within various local community projects, and scope exists for Menter Môn to support it.

5. **Providing training:** As mentioned above, in order for local trees to be marketed as local provenance, Forest Reproductive Materials certification must be obtained. Menter Môn could be involved in facilitating appropriate training to support nurseries reach this standard. Menter Môn would not only be able to offer support to such businesses by guiding them through the certification process but could also proceed in the direction of developing or facilitating training in this area. Other possible areas of training Menter Môn could develop include propagation, nursery management, plant health, as well as forest and business management.

6. **Starting a nursery**: There is definitely scope for Menter Môn to develop a tree nursery of its own on Anglesey. A workable scenario would likely involve obtaining land (perhaps via asset transfer from the Council) in close proximity to the A55 to allow effective transportation of the stock. The scenario may involve supplying trees for specific planting projects of a niche variety, to avoid competition with larger nurseries (Maelor Forest Nursery, Alba Nursery, Dingle Nurseries). Discussions with the council and other stakeholders will be necessary to advance this project, and possibilities for continuity of supply may exist in conjunction with voluntary organisations. This will help create employment as well as deliver ecosystem services.

7. Summary

In North Wales, there exist many challenges with sourcing local trees, and available nursey stock provenances are in many cases not necessarily be suitable for strategic planting or desirable for organisations intending to plant trees. As well as filling this gap in the supply chain, sourcing trees locally for planting projects will deliver a variety of ecosystem services and benefits, attain planting targets and affording economic and employment benefits. By supporting tree nurseries, employment will be generated, and key skills can be obtained. Community cohesion will be improved by the support this work will give to the voluntary sector, as well as supporting planting projects that improve access to nature.

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9. Appendices

7.1 Appendix 1- Welsh Tree Nursery Scoping Questionnaire

C1. Ydych chi'n cytuno i gymryd rhan yn yr arolwg hwn? Dim ond i asesu'r angen am stoc plannu addas ar gyfer Gogledd Cymru y bydd y data a gesglir yn cael ei ddefnyddio.

Ydw, rwy'n hapus i gymryd rhan yn yr arolwg hwn a rhoi caniatâd i'r data gael ei ddefnyddio i asesu'r angen am feithrinfa yng Ngogledd Cymru

Na, nid wyf am gymryd rhan yn yr arolwg

C2. Pa sefydliad (os o gwbl) ydych chi'n ei gynrychioli?

C3. Ym mha sir ydych chi / y mae eich sefydliad wedi'i leoli?

Ynys Mon

Gwynedd

Conwy

Arall

C4. Beth yw'r sector cynradd rydych chi neu'ch sefydliad yn gweithio ynddo?

Coedwigaeth

Amgylcheddol / cadwraeth

Amaethyddiaeth

Arall

C5. A ydych chi neu'ch sefydliad erioed wedi profi prinder stoc plannu addas?

Ydw

Na

C6. Pa rywogaethau nad oeddech yn gallu eu cael (amherthnasol os nad oedd un)?

C7. A oedd stoc plannu anaddas o'r un rhywogaeth ar gael?

Ydw

Na

Amherthnasol

C8. Pam oedd y stoc plannu yn anaddas ?

Roedd o'r tu allan i'r DU

Roedd o'r tu allan i Gymru

Tarddiad anghywir

Maint anghywir

Nid oedd yn ddigon caled

Amherthnasol

C9. A ydych chi neu'ch sefydliad wedi cael eich atal rhag plannu coed, oherwydd diffyg stoc plannu?

Ydw

Na

C10. Oes gennych chi neu'ch sefydliad eich meithrinfa goed eich hun?

Ydw

Na

C11. Pa rywogaeth mae'r feithrinfa'n ei chynhyrchu? (os nad oes un, nodwch Amherthnasol)

C12. Oes gennych chi ormodedd o rywogaeth benodol erioed?

Na

Ydw

C13. A ydych chi neu'ch sefydliad yn rhagweld plannu coed yn y dyfodol agos?

Ydw

Na

C14. Sut bydd y plannu coed hwn yn cael ei ariannu

Glastir

Cyfalaf preifat

Grant

Amherthnasol

C15. Beth ydych chi'n bwriadu ei blannu?

Collddail

Bytholwyrdd

Y ddau

C16. Ydych chi'n bwriadu plannu

coed brodorol?

Coed anfrodorol?

Y ddau?

C17. Pa rywogaethau ydych chi'n bwriadu eu plannu (os yw'n hysbys) (Amherthnasol os nad oes coed i'w plannu)

C18. Safle mewn trefn flaenoriaeth i chi neu'ch sefydliadau resymau dros blannu coed?

Cynhyrchu pren

Coedwigaeth gymdeithasol

Addysg

Cynhyrchion coedwig nad ydynt yn bren

Cadwraeth / amgylchedd

C19. Hoffech chi gael y wybodaeth ddiweddaraf am hynt y prosiect hwn a / neu eich gwahodd i gyfarfodydd rhanddeiliaid?

Na

Ydw

Os oes, nodwch isod

C20. Pe byddem yn datblygu rhwydwaith o feithrinfeydd bach yng Ngogledd Cymru, a yw hyn yn rhywbeth y byddai gennych chi neu'ch sefydliad ddiddordeb ynddo?

Na

Ydw

Os oes, nodwch

7.2 Appendix 2- English Tree Nursery Scoping Questionnaire

Q1. Do you agree to take part in this survey? The data collected will only be used to assess the need for suitable planting stock for North Wales.

Yes, I am happy to take part in this survey and give consent for the data to be used to assess the need for a North Wales nursery

No, I do not wish to take part in the survey

Q2. Which organisation (if any) do you represent?

Q3. Which county are you/ is your organisation based in?

Ynys Mon

Gwynedd

Conwy

Other

Q4. What is the primary sector that you or your organisation work in?

Forestry

Environmental/ conservation

Agriculture

Other

Q5. Have you or your organisation ever experienced shortages in suitable planting stock?

Yes

No

Q6. Which species were you unable to obtain (n/a if none)?

Q7. Was unsuitable planting stock of the same species available?

Yes

No

N/A

Q8. Why was the planting stock unsuitable?

It was from outside the UK

It was from outside Wales

Incorrect provenance

Incorrect size

It was not hardy enough

N/A

Q9. Have you or your organisation been put off tree planting, due to lack of available planting stock?

Yes

No

Q10. Do you or your organisation have your own tree nursery?

Yes

No

Q11. Which species does the nursery produce? (if none, please state N/A)

Q12. Do you ever have an excess of a particular species?

No

Yes

Q13. Do you or your organisation anticipate tree planting in the near future?

Yes

No

Q14. How will this tree planting be funded?

Glastir

Private capital

A grant

N/A

Q15. What do you plan to plant?

Deciduous

Evergreen

Both

Q16. Do you plan to plant

native trees?

Non-native trees?

Both?

Q17. What species do you plan to plant (if known) (N/A if no trees to be planted)

Q18. Rank in priority order you or your organisations reasons for planting trees?

Timber production

Social forestry

Education

Non-wood forest products

Conservation/ environment

Q19. Would you like to be kept up to date with the progress of this project and/ or invited to stakeholder meetings?

No

Yes

If yes, please enter below

Q20. If we were to develop a network of small nurseries in North Wales, is this something you or your organisation would be interested in?

No

Yes

If yes, please enter