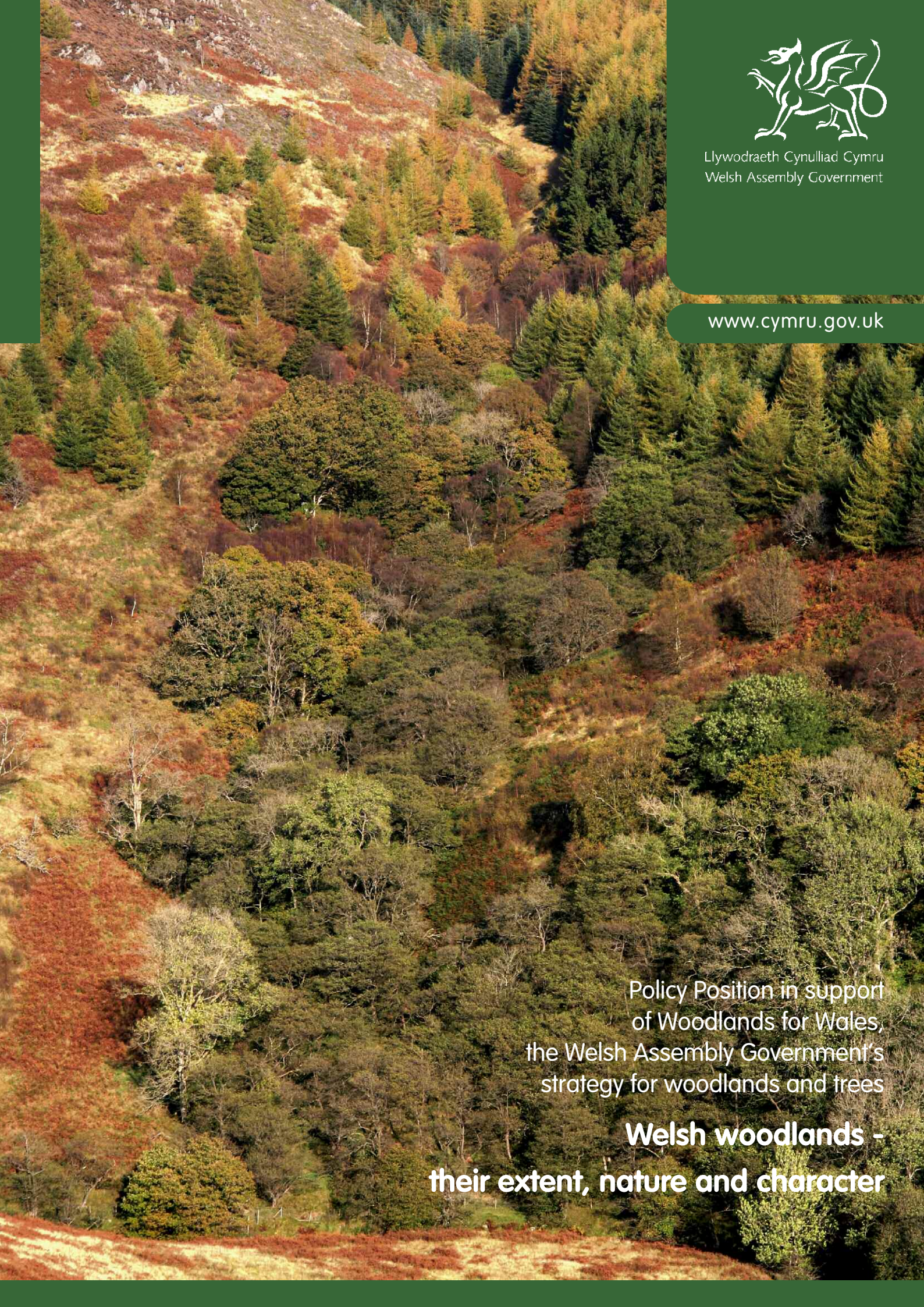

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Policy Position in support
of Woodlands for Wales,
the Welsh Assembly Government's
strategy for woodlands and trees

Welsh woodlands - their extent, nature and character


Photo: Dafydd Fryer

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glossary — Glossary of Terms and Acronyms.

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Purpose and Audience

This Policy Position is one of a suite designed to provide further background and evidence for the outcomes sought in Woodlands for Wales and the actions required to achieve these outcomes (see **Appendix 1** for full Policy Position list). Each Policy Position proposes an 'Agenda for Action' which collectively provide the implementation framework for the whole strategy. The 5-year Action Plan for Woodlands for Wales takes its lead from the combined 'Agendas' from each of the Policy Positions and sets out the short-term priorities for all the organisations responsible for helping to implement the strategy.

The primary purpose of these Policy Positions is therefore to support the implementation of the strategy through the relevant corporate processes of each organisation identified with a responsibility in the Action Plan. Forestry Commission Wales (FCW) is already aligning its corporate programme development in this way and we hope that all the other lead and supporting organisations will act similarly.

Therefore the main intended audience for these Policy Positions are those responsible for policy development and policy implementation through corporate planning. However we hope that because of the way the Policy Positions are presented, they will be of wider relevance to those with an interest in the particular subject matter or Woodlands for Wales as a whole.

1: Introduction

1.1 Aims and objectives

In Woodlands for Wales[1], the Welsh Assembly Government (WAG) made a commitment to bring more woodlands into management, expand woodland cover and increase the resilience of Welsh woodlands and trees so that they deliver more benefit to the public.

The aims of this Policy Position are to achieve these commitments through:

- Supporting the development of programmes under the Welsh Woodlands and Trees and Responding to Climate Change themes of Woodlands for Wales; and
- Supporting the development of WAG programmes and those supporting programmes of the third sector, private sector and other public sector organisations relating to trees and woodlands. In addition, woodlands and trees deliver wider public policy priorities including helping society adapt to climate change; carbon abatement; sustainable development; health and well being; learning and skills; economic development; and the protection, quality and management of the environment, culture, heritage and landscape of Wales.

The diagram in **Appendix 1** shows where this Policy Position fits into the policy hierarchy from both WAG and FCW perspectives.

1.2 Equality and Diversity

WAG is committed to developing an organisation in which fairness and equality of opportunity are central to our business. We will ensure that we treat all users of our woodland, our stakeholders and staff fairly, with dignity and respect, regardless of race disability, gender, age, sexual orientation and religion and belief. We will assess the ability of potential users to access woodlands, activities and services and take appropriate steps to ensure that barriers are reduced or minimised. A summary of equality and diversity evidence in relation to this policy position on woodland extent, nature and character in Wales is included at **Appendix 2**.

1.3 Policy drivers

1.3.1 International and UK commitments on Sustainable Forest Management

The main international and European debates on forestry are held in the United Nations Forum on Forests (UNFF), the European Union (EU), the Ministerial Conference on the Protection of Forests in Europe (MCPFE)[2] (now known as FOREST EUROPE), the 'G8' and meetings of the signatories to the Convention on Biological Diversity (CBD)[3] and the Framework Convention on Climate Change[4].
The UK plays a positive and active role in all these international bodies and we have taken forward domestically many of the changes that were catalysed by Rio in 1992, for example, by the:

- setting standards of sustainable forest management
- adoption of multi-purpose forestry policies
- implementation of regulations for sustainable forestry policy
- publication of guidelines and best practice
- implementation of forestry certification schemes

Sustainability and, in particular, achieving sustainable forest management has been central to the development of all forestry policy for nearly two decades and will remain at the core of managing, developing and monitoring Welsh woodland in the future (refer to **figure 1**).

'Sustainable forest management is... the stewardship and use of forests and forest lands in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfil, now and in the future, relevant ecological, economic and social functions, at local, national and global levels, and that does not cause damage to other ecosystems...'[5]

Figure 1: Conceptual framework of sustainable forest management

International - The first government commitments to sustainable forest management were made at the 1992 UN Conference on Environment and Development in Rio de Janeiro

→

European - The European response and first commitment was made the following year (1993) at the second ministerial Conference on the protection of Forests for Europe (MCPFE) in Helsinki where the UK Government adopted a forest policy to promote sustainability.

For the UK this was expressed in two statements:

The sustainable management of our existing woods and forest; and,
A steady expansion of tree cover to increase the many diverse benefits that forest can provide.

→

The **UK Forestry Standard** was first published in 1998 and put the UK interpretation on the principles of sustainable forest management as set out at the European and International level. It sets the standards for all UK forests and woodlands. It is the basis for guiding and monitoring forestry. It was revised again in 2004, and is currently under revision, with a third edition due in 2010.

There are five key statements within the General Guidelines of the second MCPFE, Helsinki (1993) which still guide UK forest policy:

- Multiple-use forestry should be promoted to achieve an appropriate balance between the various needs of society
- Silvicultural practices emulating nature should be encouraged. Practices contrary to sustainable management should be actively discouraged
- In the management of existing forests and the development of new forests, the chosen tree species should be well suited to local conditions and be capable of tolerating climatic and other stresses, such as insects and diseases, and potential climate changes, throughout the growing period
- Afforestation should be conducted in a manner that does not negatively affect ecologically interesting or noteworthy sites and landscapes
- Native species and local provenance should be preferred where appropriate[6]

The UK Forestry Standard (UKFS) and Guidelines[7] (under revision) set the management standards for all UK forests and woodlands covering all aspects of economic, social and environmental functions that our forests can provide. **Appendix 3** shows the relationship between the UKFS and our Policy Positions. It is recognised that the forests of the UK differ fundamentally from those of the rest of Continental Europe and Scandinavia in that we have only one commonly planted native conifer and much of our woodland resource is made up of planted non-native conifer species. There are two key statements made in the 2004 UKFS which will remain guiding principles. Firstly,

> '... to retain as much as possible of existing diversity while maintaining or increasing productivity. Possible changes include restocking conifer areas with a greater variety of conifers, a conifer-broadleaved mixture, or broadleaved woodland.'[8]

Secondly that,

'Other less diverse woodlands, particularly many of the areas afforested with conifers in the latter half of the 20th century, have been planted with a more limited range of species, often only one or two. Few have developed structural diversity and positive action is required, especially on poor soil in upland areas, if they are to do so. In these cases the felling and restocking stage provides an important opportunity to begin to improve forest design and increase diversity. In wet and exposed uplands
the process of adequately developing structural diversity in large forests may take more than one felling cycle.'[9]

1.3.2 EC Directives and the EU Forest Action Plan

The Water Framework Directive (WFD)[10] is a strategic framework for achieving sustainable management of water resources and good chemical and ecological quality. The Directive targets the prevention of pollution and the mitigation of floods and droughts with particular focus on the changing climate. There are specific actions that we must take to ensure that the key pressures identified for woodlands and their management are minimised. Existing trees and woodlands and new woodland creation has an important role to play in providing land management solutions in priority catchments 'at risk' of failing to meet the objectives of the Directive.

There is no formal agreement for a European Commission (EC) Soil Framework Directive (SFD)[11] to date, however, the overall objective of a SFD is the protection and sustainable use of soil and it recognises that woodlands play a key role in soil management, formation and protection. The guiding principles for a SFD are twofold: to prevent further soil degradation and preserving its functions; and, to restore degraded soils to a level of functionality consistent at least with current and intended use, thus also considering the cost implications of the restoration of soil.

Further EC Directives provide protective measures for trees and woodlands, the change of land use from wooded cover and the protection of woodland dependent and associate habitats and species including:

- The Plant Health Directive[12] which provides measures against the introduction into the Community of organisms harmful to plants or plant products and against their spread within the Community - of particular concern with the predicted increase in pests and pathogens with our changing climate
- The Forest Reproductive Material Directive[13] which provides a framework for the marketing of forest reproductive material
- The Strategic Environmental Assessment[14] (SEA) and Environmental Impact Assessment (EIA) Directives[15] provide a framework for the assessment of the effects of certain public and private plans and programmes (SEA) and projects (EIA) on the environment
- The Habitats Directive on the conservation of natural habitats and of wild fauna and flora and the Birds Directive on the conservation of wild birds[16]

The EU Forest Action Plan[17] aims to improve co-ordination and coherence between different policy areas in the Member States to deliver Sustainable Forest Management across the EU supported by the UK. The Action Plan focuses on four main objectives: to improve long-term competitiveness; to improve and protect the environment; to contribute to the quality of life; and to foster co-ordination and communication. Eighteen key actions are proposed by the European Commission to be implemented jointly with the Member States during the period of five years (2007-2011).

1.3.3 Woodlands for Wales Strategy

Woodlands for Wales[1] (2009) contains three principle objectives relating to this Policy Position which is to:

- Bring more woodlands into management
- Expand woodland cover
- Increase the resilience of Welsh woodlands and trees so that they deliver more benefit to the public

The way that we manage our existing trees and woodlands and plan for the creation of new woodlands is central to the achievement of all of these goals if they are to stand the test of time. The strategy vision remains,

> 'Wales will be known for its high-quality woodlands that enhance the landscape, are appropriate to local conditions and have a diverse mixture of species and habitats.'

1.3.4 Other Welsh Assembly Government strategies

One Wales: A progressive agenda for the Government of Wales[18] recognises that Wales' rich and diverse environment needs to be protected and enhanced. It includes the commitment 'We will provide support for indigenous woodlands, including a tree for every child born or adopted in Wales, helping to create a Welsh National Forest of native trees to act as a carbon sink'. The innovative Plant![19] scheme, effective since 1st January 2008, was developed to help with this task, and by the end of 2010 will have created 60 hectares of new native woodland near Usk, Tredegar and Tywyn - the equivalent of 111,000 trees. More fundamentally, Woodlands for Wales (2009) highlighted that all of Wales's woodlands and any that might be created in the future, collectively act as the Welsh National Forest.

One Wales: One Planet: A new sustainable development scheme for Wales (2009)[20] is a strategic document which brings together the outcomes which we want to achieve across our policy portfolio commitments for the benefit of the people and communities in Wales. Sustainable development is our central organising principle of Government and of the public sector in Wales and links sustainable resource use, a sustainable society, economy and environment with the well-being of Wales. It provides a framework to monitor progress against indicators and targets.

The Wales Environment Strategy[21] sets out commitments that underpin the Welsh Assembly Government's UK and international commitments to the environment with an Action Plan that describes how they will be achieved. It recognises the value and role of woodlands in Wales' biodiversity, supporting many of Wales' iconic and important species of wildlife, its cultural and heritage value and the benefits people derive from woodland ecosystems. It makes particular reference to the role of woodland in mitigation of climate change, helping society adapt to a changing climate, soil conservation, halting the loss of biodiversity, landscape quality, access to green space and the provision of goods such as wood fuel.

1.3.5 Other economic, social and environmental drivers

The UK Climate Change programme sets out the UK Government's policy on climate change. With the Climate Change Commission for Wales, we are developing the Wales Climate Change Strategy[22] to set out how we will deliver our commitments and set targets for reduction in emissions and adaptation to the impact of climate change. The Climate Change Commission for Wales will have a key role in advising us on implementing the Strategy. Consideration of the role of woodland is considered within our policy responses such as the Renewable Energy Route Map[23], our Energy Policy Statement[24] and implementation programmes such as the Wood Energy Business Scheme[25]. Combating Climate Change - A role for UK forests (2009)[26], known as 'The Read Report', provides an independent national assessment of UK forestry and climate change. It examines the potential of the UK's trees and woodlands to mitigate and adapt to our changing climate. In summary there are three distinct drivers for action in:

- The adaptation of woodland to maintain their resilience
- The role of forests in helping society adapt to the impacts of a changing climate
- The role of trees and timber in climate change mitigation beyond just sequestration (i.e. net carbon abatement)

The consultation document on the proposed Welsh Soils Action Plan[27] recognises the need to assess the role that trees and woodlands can play in the management of flood risk, diffuse pollution and soil erosion, within the review and development of our agri-environment schemes.

In March 2010 a new ambitious tree planting programme was announced which will be part of the targeted element of Glastir (the new sustainable land management scheme for Wales). This aims to expand the area of woodland in Wales by 100,000 hectares over the next 20 years.

There are a series of actions falling under various water policies in Wales which have implications for the extent, nature, character and location of existing trees and woodlands but also new woodland creation. The actions are targeted at the broad spectrum of improvements required to protect and better manage water quantity, quality, ecology and resource protection and management[28]. They also consider ways of coping in our changing climate. Included are the programmes and plans resulting from the implementation of the WFD such as River Basin Management Plans, Catchment Flood Management Plans and Water for People and the Environment[29].

The policy, programmes and plans of action that have emerged from UK and Wales' commitments to biodiversity provide guiding principles for the extent, nature, character and location of our existing trees and woodlands and new woodland creation. They will have considerable influence in the development and refinement of woodland programmes and action plans[30]. The UK Biodiversity Partnership framework document Conserving Biodiversity - The UK Approach (October 2007)[31] identifies three priorities for action: to protect the best sites for wildlife; targeted action on priority species and habitats; and, to embed proper consideration of biodiversity and ecosystem services in all relevant sectors of policy and decision-making. The UK Biodiversity Action Plan (UK BAP)[32] sets targets for the protection and enhancement of native woodland habitats and priority woodland species. The Biodiversity Framework for Wales[33] set out commitments that underpin WAG's UK and international commitments to the conservation of biodiversity.

There is recognition of the important role which trees and woodlands play in Wales across our policy portfolio including their contribution to the distinctive / special character of the Welsh landscape, the cultural and heritage value of trees and woodlands. Also recognised are the wider benefits they contribute to society such as health and well being[34], learning and skills and opportunities for community involvement. Included are National Strategic Framework for Community Development in Wales (2007; The Learning Country: Vision into Action - education and training opportunities available in Wales from early years through to old age; Skills that Work for Wales: a skills and employment strategy and action plan; and, Out of Classroom Learning: making the most of first hand experiences of the natural environment[35].

1.4 Summary

Collectively, the broad policy drivers in Wales provide a clear steer that:

- Sustainable Forest Management is the core principle guiding all woodland policy and programme development and that given the current nature of many Welsh woodlands there is a change required to deliver this principle
- Trees and woodlands are promoted as a positive and integrated land management solution providing multiple benefits for the people of Wales
- Trees and woodlands play an equally important role in the urban and rural environment
- Welsh trees and woodlands are adapted to increase their resilience to a changing climate, help society adapt to the impacts of a changing climate and should be given a prominent role in carbon abatement policy and practice
- The net area of woodland in Wales expands (with a strong presumption against the permanent removal of woodland)
- The area of native woodland increases and that native woodland condition improves
- Woodland resource productivity is maintained or increased at a national level

2: Background

This section describes the current nature of the woodland resource in Wales and the main silvicultural options used in its management. It summarises research evidence, recent developments and how current planning and processes are delivering against policy drivers, particularly in the period since sustainable forestry management (SFM) became a commonly accepted concept.

2.1 The current state of Welsh woodlands

2.1.1 Extent and distribution

Woodland covers 14% of the land surface in Wales, in comparison to a European average of just over 37%[36], an area roughly equivalent to 265,740 football pitches. Over the last five years new woodland is being established at the rate of around 380 ha per year[37] (the equivalent of an additional 352 football pitches). Our woodland varies in its nature and character with a very uneven spatial distribution of the main woodland types and clear distinctions between ownership - see **Figure 2**.

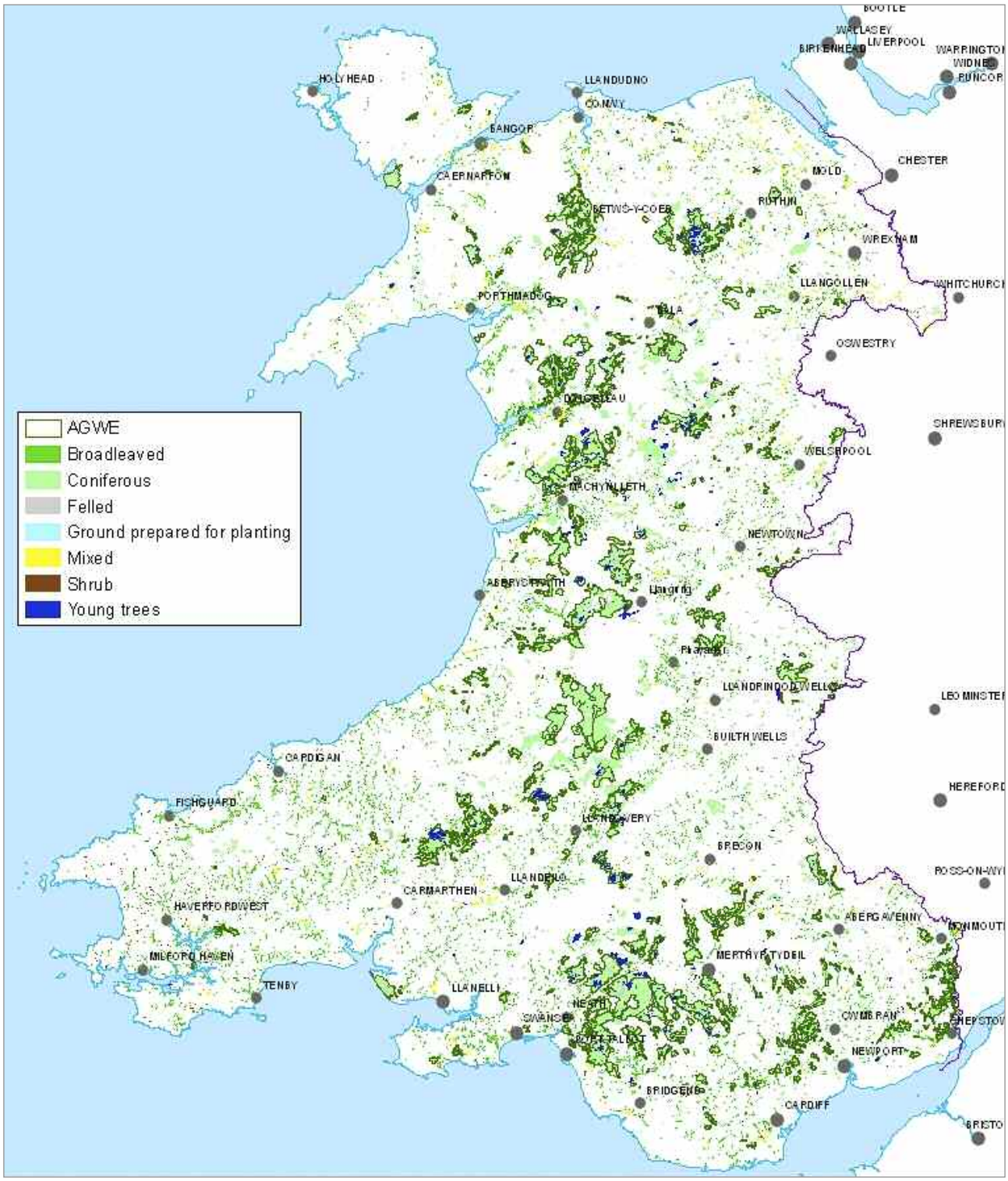
2.1.2 Nature and character

The vast majority of our remnant Ancient Semi-Natural Woodland (ASNW) and native woodlands are small and fragmented, often unmanaged, generally set within an intensively managed agricultural landscape and are often close to towns and villages but often with little or no access for people (**Figure 3**). Many of our large single-species plantations are disproportionately located on the poorer soils in upland Wales - a legacy of policy and land availability in the post-war period of the last century - and managed by FCW as part of the AGWE. These woodlands are generally not close to major towns but do have good levels of open access for people (**Figure 4**). These woodlands have largely been managed on a clearfell and restock regime in an attempt to add structural diversity and bring an even supply of timber to market. Modest opportunities to change tree species have been taken as part of this restructuring. Some of our native woodlands are set within intricately mixed agricultural and wooded landscapes (**Figure 5**) and some are set within highly wooded landscapes with a significant proportion of Plantations on Ancient Woodland Sites, often well connected to other semi-natural habitats (**Figure 6**).

Figure 7 provides a description of Welsh woodlands now and where we want them to be in the future.

Photo: Dafydd Fryer

Figure 2: The distribution of woodland (by ownership) in Wales



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Comisiwn Coedwigaeth Cymru
Forestry Commission Wales

Figure 3: Fragmented woodlands in agricultural landscape - Montgomeryshire

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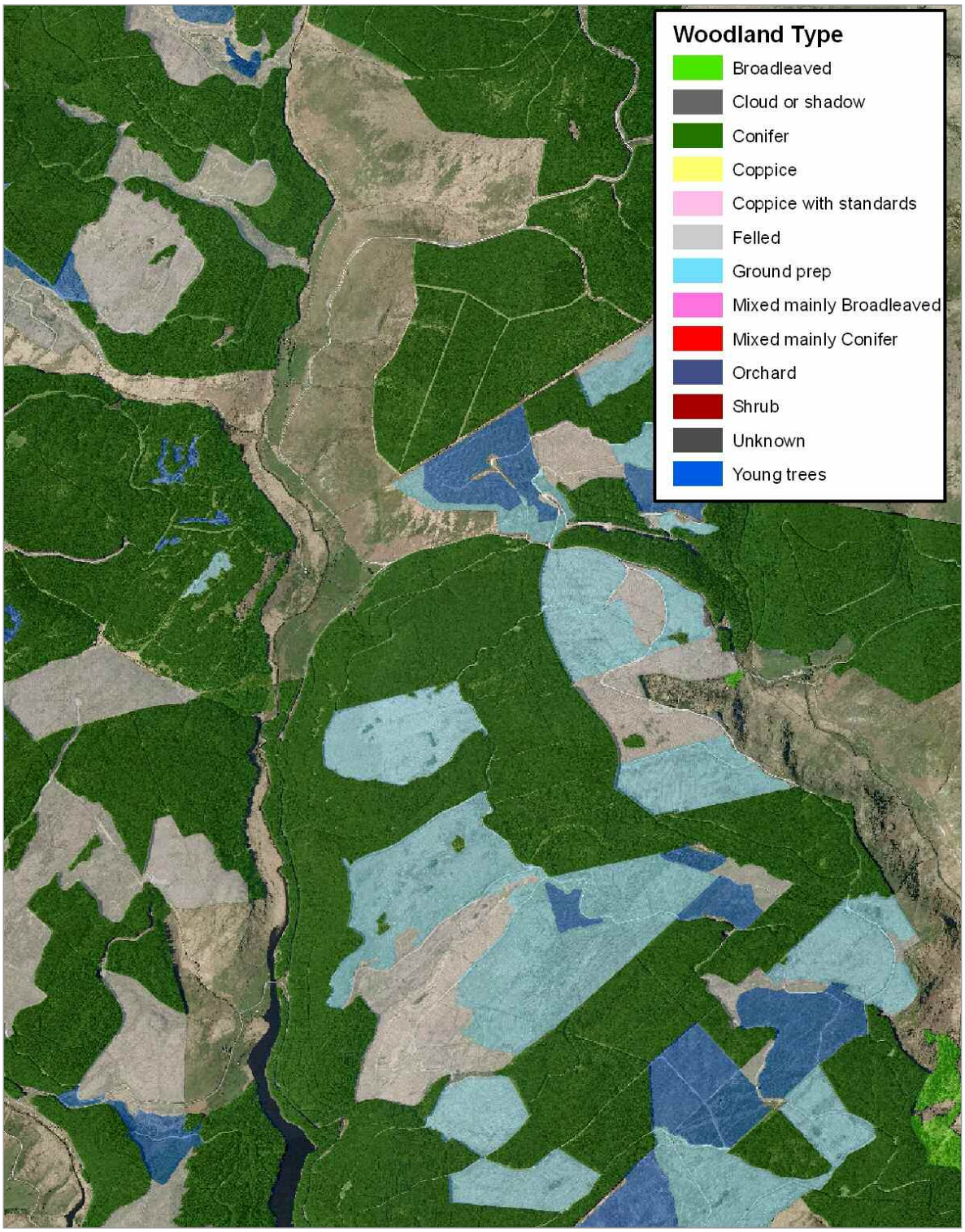
Forestry Commission Wales

Figure 4: Single Species plantations - Tywi Forest



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Forestry Commission Wales

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Figure 5: Mixed agricultural and wooded landscape - Pembrokeshire

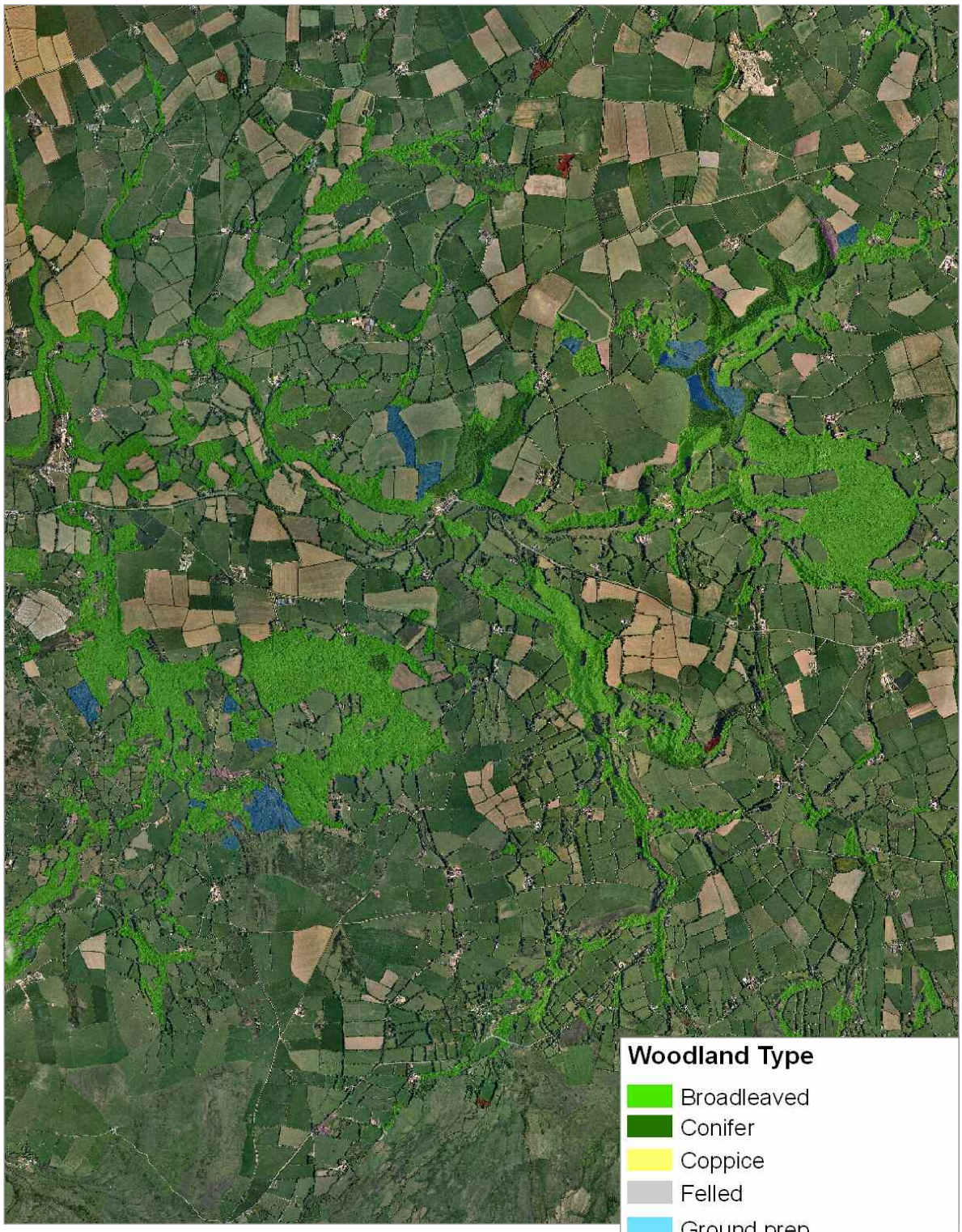

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Figure 6: Woodland, habitat types and river networks - Merionnydd

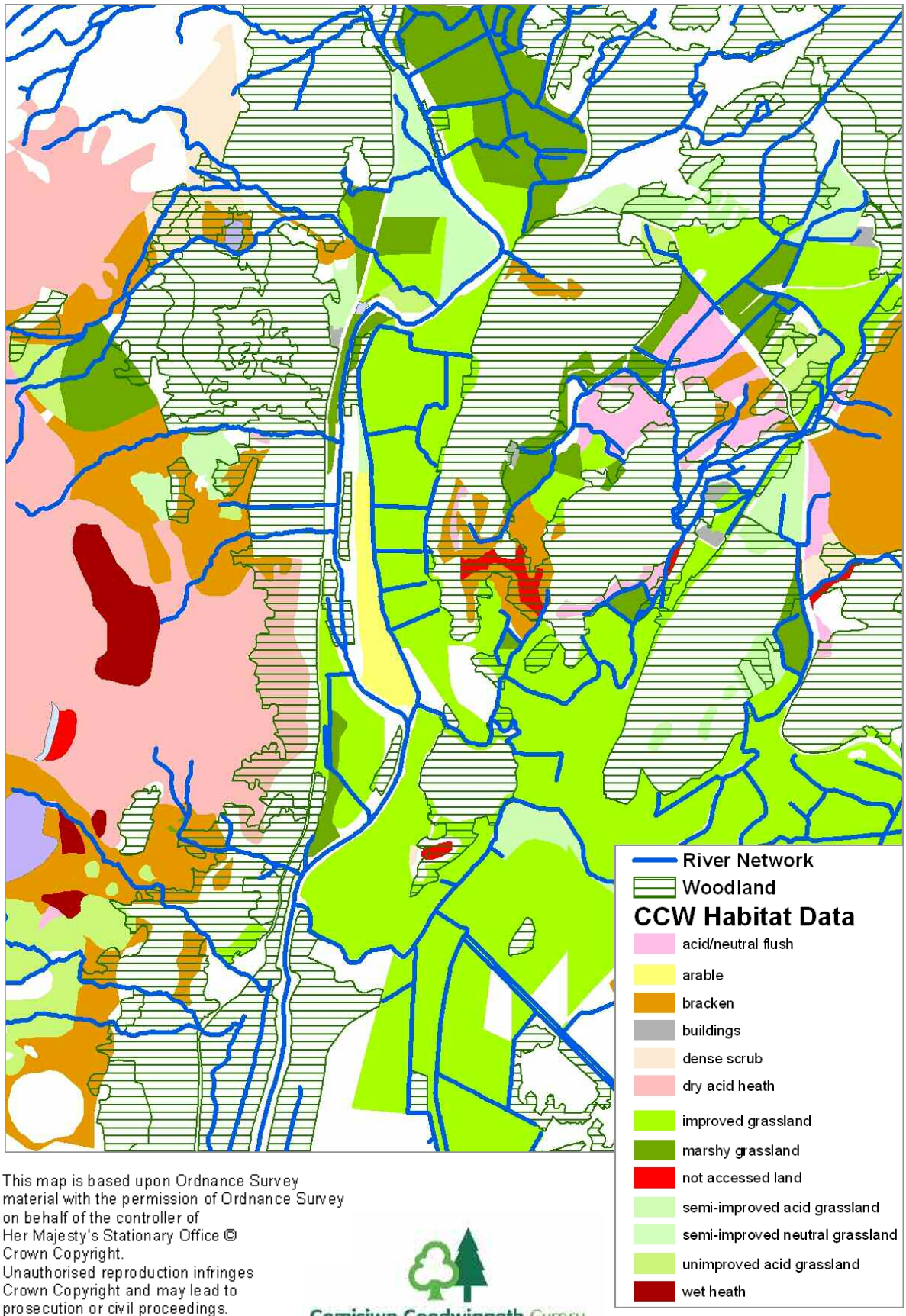

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Figure 7: A summary of where we are now and where we want to be

2.1.3 The Welsh Woodland Resource

- The preliminary National Forest Inventory map, based on analysis of 2006 aerial photographs, identifies 304,000 hectares of woodlands in Wales[38]. This is an increase of 17,000 hectares since the previous inventory in 1998 (which recorded 287,000 hectares). The reasons for this change are still to be analysed, though a significant proportion is likely to be due to changes in survey methodology and improved mapping. Figure 8 gives a summary of the woodland resource in 1998
- The 2006 map shows that conifer woodland covers 129,600 hectares of all woodland (43%), and broadleaved 116,000 hectares (38%). Mixed conifer & broadleaved woodland[39] only accounts for 12,000 ha just 4% of woodland area. Other areas (15%) include felled areas, young trees, and shrub
- Spruce is the dominant conifer species, covering 37% of High Forest area in Wales in 1998[40] but accounting for 65% of the available softwood in Wales (95,000 m^3 per year)[41]

- Oak is the dominant broadleaved species covering 43,000 ha (15%) of the High Forest area in 1998. Broadleaves as a whole make up 42% of the High Forest area[42], but current timber supply from them is small, averaging 24,000 m^3 per year[43]
- 105,000 ha or 37% of the woodland area is owned by or leased by WAG and managed by FCW. 179,000 ha (63%) is managed under other ownership, only 39,000 ha (22%) of which is under a current management scheme
- 124,000 hectares of woodland are certified to the UK Woodland Assurance standard (UKWAS)
- Most of Wales's 109,500 hectares of native woodland (semi-natural or planted) and virtually all of the ASNW in Wales is in private ownership
- New woodland funded by grant schemes is currently being created at a rate of 380 ha/yr, mainly new native woodland
- Currently an estimated
  - 24% of woodland is managed by clearfell,
  - 12% is actively managed for timber products without using clearfell,
  - 12% is managed as a 'natural reserve' with little or no harvesting activity.
  - The management of the remaining 52% (147,000 ha) is unknown as this is not in a current grant scheme.

Photo: Dafydd Fryer

Figure 8: The woodland resource in Wales in 1998

Woodland Resource in 1998: Total area 287,000 ha*

Not native
Total 177,000 ha (62%)

Plantations on **Ancient** Woodland Sites (PAWS) with greater than 50% canopy non native species (Predominantly conifers)

17,000 ha
AGWE 44%, Non-AGWE: 56%

Non-native non-ancient with greater than 50% canopy non native species (Predominantly single species conifer plantation)

160,000 ha
AGWE 65%, Non-AGWE 35%

These woodlands are mainly commercially managed for timber, large mono-cultures with a heavily reliance on a limited number of non-native conifer species.

This Policy Position concerns itself with these woodlands to increase their structural and species diversity to help deliver a wider variety of ecosystem services and improve their resilience to a changing climate.

Native**
Total 110,000 ha (38%)

Ancient Woodland with greater than 50% canopy native species (Includes ASNW and PAWs with less than 50% non-native species)

45,000 ha
AGWE 15%, Non-AGWE 85%

These woodlands will largely be dealt with in the Policy Position on Biodiversity other than the key strategies identified here relating to increasing their resilience to climate change.

Non ancient native woods (Greater than 50% canopy native species)

65,000 ha
AGWE 13% Non-AGWE 87%

Many of these woodlands are unmanaged but with high potential ecological value, a potential for increased timber production and a wider variety of ecosystem services

Woodland Loss - Restoring priority habitats, development, other

Creating new mixed woodland

This document will explore the nature of these new woodlands

Changes to Resource area

* Source: National Inventory of Woodland and Trees, Ancient Woodland inventory, Priority Habitats of Wales (2003), Pryor and Smith (2002), Forestry Statistics

** Native woodland is that with 50% or more of the canopy composed of native species

2.1.4 Non-native woodlands

Table 1: Species break-down of non-native woodlands in Wales

Not native 177,000 ha (62% of all woodland) in 1998

NON-NATIVE	AGWE	non-AGWE	TOTAL
Spruces	25%	12%	37%
Larches	5%	4%	9%
Pines	4%	2%	6%
Douglas fir	2%	2%	4%
Other conifers	2%	1%	3%
Non-native Broadleaves	0%	3%	3%
Total Non-native	**38%**	**24%**	**62%**

Based on 1998 data, our non-native woodlands are made up of 17,000 ha of Plantations on Ancient Woodland Sites and 160,000 ha of non-ancient woodland sites planted with non-native species (mainly conifers). Of the latter approximately 50% of the woodland in Wales are dominated by a limited age structure, limited tree species (mostly large scale single species) and limited structural diversity[44]. These plantations were created during the early to mid 20th century as a strategic reserve of timber with the majority managed as part of the AGWE. In Wales these forests are dominated by spruce (see **Table 1** above) with spruce providing two thirds of the timber currently supplied to the timber trade in Wales[45].

Almost all of these forests are managed either through Better Woodlands for Wales (BWW) management plans (BWW will close to new applications at the end of 2010) or through Forest Design Plans (FDP's)[46]. Transformation of these woodlands has been on-going, particularly on the AGWE with emphasis on:-

- Improvements to the aesthetic appearance of woodlands and landscape issues perceived to be visually detrimental to the Welsh landscape, particularly close to communities and in areas of high landscape value
- Improving environmental value, particularly increasing the area and improving the condition of our native woodlands in Wales, permanent removal of planted areas for the restoration of open habitats, management of priority and protected species, better riparian management and wetland restoration
- Improving the value of woodlands for a range of social outputs including learning, recreation, health, community involvement and tourism
- Ensuring a reasonable balance of the above with potential timber production

However these issues have had little strategic prioritisation across the country and current forest planning processes need overhaul to better deliver public benefits and outcomes for:

- wider economic, social and environmental benefits of woodlands including climate change impacts on the current woodland resource and an assessment of adaptation strategies
- consideration of the potential for woodlands and wood products to mitigate the effects of climate change globally through sequestration and substitution (carbon abatement)
- an exploration of the way in which woodland can help society adapt to the effects of our changing climate

2.1.5 Mixed woodland at the stand scale

Our information on the area of mixed woodland at the stand scale is currently limited.

- Data from the 2006 NFI suggest that there were 12,260 ha of mixed coniferous and broadleaf woodland (4% of total woodland area in Wales)[47]. This shows that despite considerable restructuring of woodlands in the past ten to fifteen years many individual woodland blocks are dominated in character by either conifer or broadleaf trees
- Data from 1997 (from the National Inventory of Woodlands and Trees field survey of 1 ha sample plots) suggest that 53% of conifer woodland (and 30% of all woodland in Wales) contained only a single species. 19% contained 2 species (which in some cases may have been only a single tree of a different species), 10% 3 species, and 18% 4 or more species. The NFI field survey report in 2014 will give us more information on the area of conifer woodland containing mixed conifer species
- Data from 1997 (from the National Inventory of Woodlands and Trees field survey of 1 ha sample plots) suggest that mixtures of native species are more common, with 88% having 2 or more species. This information will also be updated in 2014 by the NFI

Overall, very little of the non-native woodland resource in Wales can be classed as mixed woodland at the stand scale. Mixed woodland of native species is more common.

2.1.6 Our native woodlands

Native woodland is covered in full in the Policy Position on Biodiversity and here we concentrate on the productive potential that exists from the native woodland resource. It is important to reiterate that the term native covers our most prized and ecologically rich woodland on Ancient Woodland Sites and native woodland more recently established. These two 'categories' of native woodlands are described separately.

Around 38% of Wales' woodlands are native - this total includes those of ancient origin, see **Table 2** below. There are around 47,000 ha of non-ancient semi-natural woodland mostly in other ownership (those established more recently than 1600). These woodlands are generally small (around two-thirds under 20 ha[48]), fragmented and few are actively managed for timber products. Farm woodlands account for half of Wales' native woodland and approximately a quarter of these are within a current grant scheme administered by FCW.

Table 2: Main tree species composition of native woodland by ownership in 1998[49]

Native 109,500 ha (38% of all woodland) in 1998

NATIVE	AGWE	non-AGWE	TOTAL
Oak	2%	13%	15%
Ash	0%	7%	7%
Birch	1%	3%	4%
Beech	1%	2%	3%
Other Native	-	-	-
Broadleaves	1%	8%	9%
Total Native	**5%**	**33%**	**38%**

Approximately 5,000 ha of non-native woodland has been converted to native woodland since 2000. Outside the AGWE, plans for the conversion of 6,300 ha of conifer to native woodland have been submitted to the BWW grant scheme since its launch in 2006 (BWW closes to new applications at the end of 2010).

There is the potential for more timber production within our existing native woodland and the new native woodland we create. There is approximately 80,000 ha of unmanaged native woodland in Wales, this at conservative estimates could produce 100,000 - 200,000 m^3 of timber and/or fuelwood[50]. This resource is largely unmanaged due to:

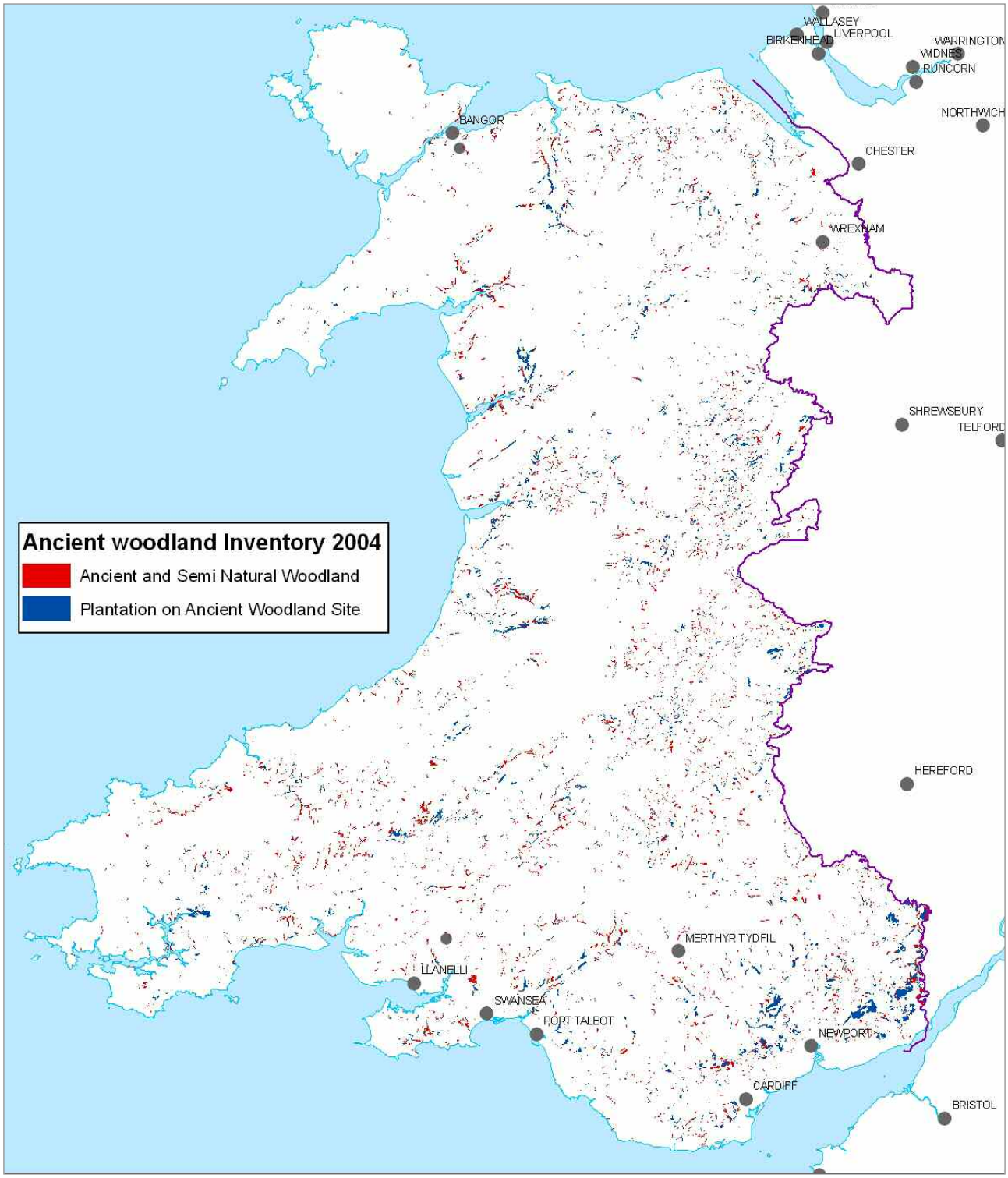
- Their characteristics - mainly small woodlands on steep ground
- No or limited infrastructure or access
- Mainly farm woodland with no recent history of planned management as part of the business
- Incentives do not exist or are insufficient to influence current shooting or grazing management regimes or catalyse management
- The training, skills and equipment required to manage this type of woodland are lacking, do not attract sufficient investment, are not sufficiently valued and in many areas of Wales do not exist[51]

Research[52] has shown that this lack of woodland management can impoverish the ecological value of our native woodlands. The lack of disturbance can cause a decrease in species suited to lighter open conditions diminishing the proportion of ruderal species and an increased representation of more competitive species[53]. Bringing these woodlands into sustainable management would improve the condition of our native woodland and the species it is able to support.

Ancient Woodland Sites Roughly 20% of Wales' woodlands are included in the current Ancient Woodland Inventory (**Figure 9**) with just over a quarter of these planted with non-native species (known as Plantations on Ancient Woodland Sites or PAWS). In 2009, FCW and CCW jointly commissioned a pilot study[54] to look at the implications of revising the Ancient Woodland Inventory (AWI) based on newly available electronic versions of the Epoch 1 County Series Maps from the 1800's. Research by CCW had previously shown that woodland shown on the Epoch 1 maps is not distinguishable from woodland shown on AWI at a sample of sites[55]. The pilot found that the revision would greatly improve the accuracy of the AWI. It also suggested that it would increase the known area of ancient woodland in Wales by perhaps 40%, partly due to improved mapping accuracy and because woodlands between 0.5 and 2 ha were included. The pilot also found that a higher proportion of ancient woodland would be classified as ASNW than on the existing inventory. The project to revise the AWI is due to start in early 2010, with completion in early 2011.

Ancient Semi-Natural Woodlands (ASNW) have high ecological value because of their long temporal continuity supporting a high proportion of scarce or rare woodland flora and fauna often those with limited dispersal ability and as such are our most important woodland type.

Figure 9: Ancient woodland inventory 2004



Comisiwn Coedwigaeth Cymru
Forestry Commission Wales

1:950,000

Virtually all of Wales' ASNW is in non-WAG ownership. Unlike our native woodland of non-ancient origin any management objectives for ASNW are generally prioritised towards biodiversity gain. 6,000 ha of the 34,000 ha of ANSW are found in SSSI's, and therefore have a have a degree of protection and / or management action prescribed under SAC/SSSI Site Management Plans. In some instances no management is appropriate. However ANSW is a significant resource and its potential for supplying some high quality timber, woodfuel and many social benefits is high.

There are 27,000 ha of **Plantations on Ancient Woodland Sites (PAWS)**[56] in Wales. 10,000 ha of these sites are planted with native species, and 17,000 with non-native species. PAWS planted with conifer crops therefore represent a relatively small proportion of Wales' woodlands (6%), and they are largely located on highly productive land (brown earth soils) with a high proportion of Douglas fir and larch crops. The management of PAWS varies between ownership. On the AGWE conifer crops are currently being replaced with native broadleaf species as part of ongoing PAWS restoration work, which could have an effect on the long-term softwood timber availability if this 'trade-off' is not managed. Management of PAWS in private ownership depends on a mix of the owners objectives, any statutory designation and incentives available. Full restoration is an over-arching priority for some owners but for others more commercial timber outputs still drive their management.

2.1.7 New woodland creation

In recent years new woodland has been created at a rate of approximately 380 hectares per annum, mainly through BWW, and this roughly compensates for woodland loss to development for example. This recent woodland expansion has been largely for environmental benefits, with low density planting of native broadleaf species. The size of new woodlands has been generally small, mostly less than 10 ha with only one or two areas of woodland greater than 50 ha created every year. Some targeting of native woodland expansion is encouraged by increased grant incentives within the focal and core habitat network areas[57].

The area of conifer planting has virtually ceased with only 30 ha of new coniferous woodland being grant aided per year through BWW (BWW closes to new applications at the end of 2010).

Glastir, our new land managment scheme, will play a vital role in enabling the farming community to respond positively to the challenges posed by climate change. In March 2010 we announced an ambitious tree planting programme under the Glastir Woodland Creation Scheme which aims to expand the area of woodland in Wales by 100,000 hectares over the next 20 years. This increase in woodland, of which at least 50% will be native woodland and the remainder mixed, will help provide a more favourable landscape for water and soil quality and resources.

Photo: Dafydd Fryer

2.1.8 Urban woodland, farmland and other land use management

Recent research suggests that increasing urban green space (parks and street trees) can significantly reduce the 'urban heat island' effect in cities in summer[58], which, under climate change, would create a more comfortable environment, reduce the costs of air conditioning, and reduce high-temperature stresses for urban residents. The role of trees and woodland in helping to cool urban environments has yet to become incorporated into planning strategy. Trees have also been shown to help trap particulate pollution improving urban air quality[59]. Urban and street trees also have a role to play in the development of Sustainable Urban Drainage Systems[60] and within new developments[61].

There appears to be little integration of woodland management within most farm businesses and many farmers are unaware that there are woodland grant schemes available to help them bring their woodlands into management or create new woodland[62]. Integrated land management solutions are widely recognised as the way forward yet to date there has been little practical progress across policy and incentive schemes[63]. The review of the Rural Development Plan and development of the Glastir scheme in Wales will provide real opportunity to address this issue.

Trees and woodlands are being increasingly valued in post industrial reclamation schemes as an effective, relatively cost effective means of providing a wide range of socio-economic, health and environmental benefits[64]. Woodland establishment improves the aesthetic appearance of derelict land, but it can also provide many additional environmental improvements to both the site and the surrounding area and offers the possibility of economic activity on what may have become unproductive land.

2.2 Silviculture in Wales - how we currently manage our woodlands

Figure 10 provides a summary of how woodlands are currently managed in Wales.

Figure 10: Current condition and management of Welsh woodlands

2.2.1 Clearfell and Restocking[65]

Clearfelling and restocking continues to be the most commonly used silvicultural practice in Wales with 66% of the AGWE managed in this way (over 72,000 ha out of a total productive area of 109,000 ha). The scale of individual clearfell coupes varies according to site type, existing crop stability, site objectives and sensitivities. On the AGWE many clearfells have been designed primarily to ameliorate landscape issues and to facilitate age restructuring. Clearfelling is considered the simplest (and cheapest) management system to adopt with the lowest management input. Investment in timber harvesting machinery, equipment and skills are largely, though not exclusively, suited to clearfell and restocking. The modern timber processing industry as it exists in Wales has developed to utilise and market products from this type of system. Clearfelling is widely considered the management regime of choice for commercial conifer plantations in private ownership. However many of these woodlands are younger[66] with fewer second rotation crops.

Clearfell can be the only viable option available, in a number of circumstances, for example to:

- permanently deforest areas on deep peat and restore other priority open habitats;
- remove western hemlock to restore native woodland
- where site conditions do not allow transformation of the current crop to a non-clearfell system and by clearfelling and starting again, alternative silvicultural systems will be possible through management of the replanted area
- where site conditions do not support long-term management by non-clearfell systems

Appendix 4 shows the recent trends in species used for restocking the AGWE between 2000 and 2009. There has been a 47% increase in the area of broadleaf planting over that period and a 10% decline in the total area of coniferous planting (roughly equivalent to a 20% swing to broadleaved tree numbers planted across the public estate). Changes in species in recent years have focused on improving the landscape appearance of Welsh woodlands and the restoration of PAWS and a more general drive to increase the area of our native woodland species. The AGWE currently uses 25 species within its restocking programmes but there is considerable reliance within long term FDPs upon the 'bread and butter' species of Sitka spruce and larch.

Emphasis has been in increasing the area of native woodland in the expansion of new woodlands within BWW and under the previous Woodland Grant Scheme (WGS) with an annual increase of woodland area of around 380 hectares. Between 2000 and 2007 (latest figures) less than 500 hectares of conifer have been planted. Over the same period approximately 3,200 hectares of broadleaf (native) species have been planted. The use of natural regeneration as a technique is recognised where site objectives favour, usually on more ecologically sensitive sites. BWW has established an approach to encourage a four basic planting types[67]:

a) **Standard** - No species restriction at a sub-cpt level providing they are suited to site and woodland meets UKFS and environmental standards.

b) **Simple Mixtures** - Minimum of 3 species with no more than 75% of any one species. Minimum of 25% broadleaves. Maximum of 10% woody shrub element.

c) **Quality Mixtures** - (New woodlands with potential to grow quality timber in mixtures that have scope for later transformation to non-clearfell systems). Limited to less exposed sites and/or those with good rooting potential. Minimum of 5 major species (at least 10% of each). Minimum of 25% broadleaves. Maximum of 10% woody shrub element. No more than 50% of a single species.

d) **Native Woodland** - Site native species, planted in communities corresponding to Habitat Action Plan native woodland types. Suitable local provenance planting stock. Maximum of 20% woody shrubs allowed. Clumped distribution of species with variable spacing.

2.2.2 Non-clearfell management systems

Non-clearfell systems have increasing relevance to meet the outcomes required of our woodlands. In particular the need to better deliver wider public policy outcomes for the environment and to society but also to protect our woodlands from some of the impacts of climate change[68]. Physical constraints, climate, soils and terrain, combined with the tradition, culture and owner/manager skills in British forestry, almost exclusively that of clearfell regimes, provide significant obstacles and limitations. The dominance of exotic species means we have further challenges before we can clearly define all the options and opportunities that non-clearfelling management systems can offer.

There are three non-clearfell system trial sites in Wales as part of a GB network. Undertaken in conjunction with Bangor University and Forest Research (FR) these trial sites have started to give us greater insight into the opportunities non-clearfell systems have to offer. FCW work closely with FR on a range of relevant projects to the development of non-clearfell systems in GB, for example to improve woodland resilience to climate change, soil and water management and carbon sequestration.

Over 37,000 hectares of productive forest on the AGWE have been designated as non-clearfell through the FDP process. BWW incorporates funding for non-clearfell systems management into their grant structure to encourage private woodland owners to adopt these methods[69]. It offers enhanced grants for thinning interventions and permanent infrastructure such as tracks. Funding is given for non-clearfell systems specialist assessments to provide expert advice to owners wishing to convert their woodlands to this type of management regime. BWW closes to new applications at the end of 2010, woodland management grant aid will be funded through Glastir which is being developed.

Non-clearfell management systems are given a variety of names: continuous cover forestry (CCF) - low impact silvicultural systems (LISS) - alternatives to clearfelling (ATC). The range of terminology used to describe the range of silvicultural options available will no doubt continue to be debated but we must focus on the outcomes we wish to achieve using those systems rather than on what we call it. The key to this is by following four principles:

- Managing the forest ecosystem rather than just the trees
- Using natural processes as the basis for stand management
- Working within site limitations
- Creation of a diverse stand structure with a range of species

2.2.3 Short Rotation Forestry

Short-rotation coppice (SRC) is grown as a long-term woody perennial crop that is generally harvested every 3 years. The growing of, for example, willow or poplar SRC is more comparable to agricultural cropping methods than it is to forestry[70] and is not considered by this Policy Position.

Short-rotation forestry (SRF), by which fast-growing trees are cultivated and harvested between eight and 20 years after planting, has potential as a source of renewable fuel for heat and power generation in Wales[71]. A major study in 2006 provided an overview of the potential impact of SRF on biodiversity, soils, hydrology and landscape and considered this woodland / management type to be '... an efficient way of capturing and storing carbon'[72]. It is an efficient system of producing a certain product from certain site types but should not be allowed to compromise other objectives. Species under investigation include the Eucalypts and Nothofagus of the southern hemisphere but a wide range of native pioneer species also prove suitable. Where SRF is a suitable site-based objective then it must be established to the UKFS framework standards. SRF offers added flexibility in that it can subsequently be managed as high forest. In summary SRF is more akin to a management objective than a specific silvicultural system.

2.2.4 Forest protection

> 'Broadleaved tree seedlings of many species are unlikely to establish without protection unless deer numbers are controlled.'[73]

The establishment of woodland has always required tree protection measures to control and limit the impact of browsing and grazing animals[74]. Most first rotation plantings were established prior to the outbreak of myxomatosis[75] which all but eradicated the rabbit population but the pressures of browsing and grazing still remain. Protection measures for subsequent plantings have required extensive and expensive fencing to allow establishment to occur. Rabbit damage can be locally severe and is increasing. The establishment of broadleaf crops is particularly susceptible due to the locations of many of these areas, the slower establishment phase and their palatability.

Deer populations in Wales have been generally low in comparison with other parts of the UK. To date they have not been considered a significant barrier to woodland establishment except in isolated pockets. However there is considerable concern about the spread of all deer species into Wales, their abundance and the impact this could have on the establishment of both planted and naturally regenerated crops. Deer pose a considerable risk with the drive for increased use of natural regeneration, the reduced reliance on clearfelling and the increase of habitat networks and should not be underestimated. Our Partnership led by FCW with the Countryside Council for Wales and The Deer Initiative, is developing a Strategy and Action Plan to deliver a co-ordinated approach to ensure that Wales benefits from a wild deer population in balance with the environment.

Grey squirrels pose a risk to tree quality, natural regeneration of woodlands (especially native woodlands), conservation of the red squirrel (especially its association with spreading the squirrelpox virus) and associated wider reductions in public benefits from woodlands. An action plan is being prepared to provide a clearer position on when, where, why and how grey squirrels should be targeted for management whilst recognising that sustained and well co-ordinated control across ownership boundaries is expensive. The emphasis on bringing more woodlands into management with a diversity of species, structures and habitats and an expansion in native woodland area will increase habitat suitability for grey squirrel. There is a programme of research carried out by Forest Research and other providers to support and improve grey squirrel control measures.

One of the likely impacts of climate change is that mammal numbers including deer, rabbit and grey squirrel are likely to increase, due to mild winters, increasing habitat suitability and, for grey squirrel, increased competitive advantage over the red squirrel[76].

Grazing by domestic livestock, particularly sheep, can cause locally severe damage to tree establishment where fencing is not maintained. Sheep grazing is of particular importance to some of our privately owned native woodland areas, which have in recent years been subject to heavy grazing restricting natural regeneration and development of a woodland understorey and ground vegetation. Grazing at low levels can be beneficial for some of our native woodlands. Other mammals such as hare, wild boar, feral goat and vole have impacts on establishment of woodland that, although not necessarily significant, do need taking into account as part of a wider strategy on wildlife management.

Photo: Dafydd Fryer

2.2.5 Plant Health, Pests and diseases

Pests and diseases have significant potential to impact on the tree health of our woodlands, the best illustration of this being the almost complete loss of Elms from the British landscape over the past fifty years[77]. More recently the impacts of Red Band Needle Blight on Corsican Pine, particularly in Southern and Eastern England, are only just starting to be realised. Over the past decade, several new pests and diseases have been found in the UK, and some have established with serious economic consequences. There are many pathways for pests and pathogens to enter the UK - we trade plants and timber globally and increasingly use wood-based packaging material. Awareness of the impact of climate change on the severity of some of our existing pest and disease problems is also crucial, since climate has a major influence on behaviour and population dynamics of many organisms, both positively and negatively. Effective control methods must be practical at a range of spatial scales, while also conforming to woodland certification and more general policy demands to minimise chemical use[78]. FC GB have recently established a Biosecurity Programme Board[79] with an executive and advisory role. Membership is drawn across a number of industry and voluntary associations and Defra's Food & Environment Research Agency (FERA) and will publish a Tree Health Strategy to,

> 'Preserve the health and vitality of our forests, trees and woodlands through strategies which exclude, detect, and respond to, existing and new pests and pathogens of trees, whether of native or exotic origin.'

WAG's Plant Health and Biotechnology Unit has responsibility for plant health in Wales - through agreement with Defra some of it's work ian agreement with Defra for them

Wales' reliance on a very narrow range of species makes it particularly vulnerable, especially if specific diseases take hold. Improving silvicultural systems, increasing the diversity of species and care over provenance choice as guided by the research will play a vital role in the future health of Welsh woodlands. Of particular concern in Wales is the genera *Phytophthora* (Greek for 'plant destroyer') which has over the last two decades significantly increased its impact upon European forest ecosystems[80]. In 2003 two introduced invasive *Phytophthora* species were found in the UK. Both *P. ramorum* and *P. kernoviae* were found in woodlands and garden-parks in the south-west of England, mainly infecting ornamental species such as rhododendron but also causing lethal stem cankers on a range of broadleaved tree species - most commonly beech (*Fagus sylvatica*) and red oak (*Quercus rubra*). Up until very recently, *P. ramorum* has been largely associated with *Rhododendron ponticum*. These new finds, detected in August 2009, are in Japanese larch - this is the first time that conifer species have been found to be infected by *P. ramorum*.

In June 2010 an outbreak of *P. ramorum* was found in S Wales with approximately 700 ha of Japanese Larch on the AGWE being infected. FCW has been issued with instructions by the FC Plant Health Services to fell the infected areas. In addition FCW is ground surveying all larch stands in S Wales. Fera is undertaking helicopter surveys in mid Wales.

Both pathogens are subject to control measures intended to eradicate or contain disease outbreaks found in the natural environment with supporting research aimed at gaining a better understanding of the biology to improve the effectiveness of disease management and eradication. Also of concern are[81]:

- Red Band Needle Blight[82] (caused by the fungus *Dothistroma septosporum*) is of increasing concern with a widespread impact in Britain, mainly on Corsican pine, but also on other species of pine, and may become more acute in Wales in the future. It causes premature needle defoliation, resulting in loss of yield and, in severe cases, tree death
- Pine weevil, *Hylobius abietes* and *Hylastes spp* is particular a particular problem associated with the clearfell and restock regime with all conifer species affected. They jointly represent the most serious pests of newly planted trees in the UK (would approximate to £5 million per year in the UK). Managers in the FC are expected to adopt integrated forest management approaches to reduce chemical usage and non-chemical strategies that afford protection against *Hylobius* where these are dependable and cost-effective such as nemotode treatment
- Great Spruce bark beetle, *Dendroctonus micans* is a well-established pest in western Britain, that was accidentally introduced from continental Europe. Spruce is our most important commercial tree species and managing this pest is a high priority
- A new disease condition of oak trees, Acute Oak Decline (AOD), is taking hold in Britain. Mature oaks (>50 years old) are affected, and trees are characterised by symptoms of extensive stem bleeding. Both of Britain's native oak species, pedunculate oak (*Quercus robur*) and sessile oak (*Q. petraea*) are affected. To date, there appear to be some 55 sites infected, mainly in the English Midlands, with some 2750 trees infected
- *Phytophthora cinnamomi* - wetter and milder winters may predispose oak and other broadleaved species to such root pathogens
- In spruce forests, population outbreaks of the spruce aphid, *Elatobium abietinum*, may cause significant defoliation resulting in loss of annual increment
- Citrus Longhorn Beetle, *Anoplophora chinesis*, is a longhorn wood borer that will attack a wide range of deciduous trees, notably Acer spp. There are currently outbreaks in Italy and The Netherlands, both associated with imports of *Acer palmatum* from China, and there have been two contained incidents in Britain since 2005
- As the climate becomes more favourable (milder wetter winters), outbreaks of oak processionary moth *Thaumetopoea processionea*, gypsy moth *Lymantria dispar* and the European spruce bark beetle *Ips typographus*, might occur[83]

Photo: Dafydd Fryer

2.3 Influencing the sustainable management of woodland in Wales

2.3.1 Woodland Grants and Regulations

All forestry work must meet the standards set out in the UKFS, the UKs guide to sustainable forestry. Tree felling (with some exceptions) requires a Felling Licence controlled and administered by FCW. The UK Woodland Assurance Standard[84] (UKWAS) was launched in 1999 and is undergoing its third revision. It is a voluntary independent certification standard. UKWAS is recognised by the two forest certification programmes operated in the UK by the Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification Programmes (PEFC). The FSC label is now increasingly used on UK grown forest products to assure buyers and users that wood and wood products come from sustainably managed woodlands.

The AGWE received certification in 1999 and is subject to annual independent audits to ensure compliance with the UKWAS standard. The commitment to sustainable forest management within private woodlands is emphasised within FCWs Better Woodlands for Wales (BWW) grant scheme.

In May 2009, an additional streamlined process, BWW Smallwoods, was introduced to the BWW grant scheme, especially designed for farmers and owners of small woodlands who are keen to have an introduction to woodland management. The scheme is available to those whose total woodland holding does not exceed 20 hectares and the minimum scheme area is 0.25 ha. It can include both new woodland planting and management of existing woodland.

It should be noted that only 22% of private woodlands in Wales are covered by a grant scheme[85]. Seventy-eight percent (147,000 ha) are outwith any forestry management scheme representing half of all Welsh woodland.

Forestry Commission Wales administers the Environmental Impact Assessment (Forestry) (England and Wales) Regulations 1999[86]. These Regulations apply to the activities of four 'forestry projects': afforestation (planting new woodlands), deforestation (felling trees to convert the land to another use), forestry roads and forestry quarries and must meet agreed environmental standards. An Environmental Statement prepared as part of the application process informs the conditions of a consent.

2.3.2 Other Grants and Regulations

Since 2005 farm payments have no longer been linked to a requirement to keep livestock, offering new opportunities to revive the links between farmland and woodland. A decision to remove the conflict between single farm payment (SFP) scheme and woodland grant scheme removed another barrier to farmers for planting new woodland as woodlands areas will be included within the SFP. From 2012, the five existing agri-environment schemes under the Rural Development Plan will be replaced by one scheme, Glastir[87], which will be better positioned to meet current and future environmental challenges. Glastir, when it is fully developed will include grant aid for woodland creation and management.

2.3.3 AGWE Forest Design Plans

Forest design planning for the AGWE began in the early 1990s and was the first strategic scale approach to restructuring the public forest estate. Aspirations to meet the wider aspects of sustainable forestry were only just being recognised within British forestry (the first edition of the UKFS was not published until 1998). Consultation over forest planning was introduced to a wide stakeholder audience, concepts of non-clearfell systems were first being discussed and applied in some areas. Holistic whole plan approaches to a range of issues including conservation, landscaping and social aspects were applied. Restructuring of predominantly very even aged forests and a long-term approach to production forecasting were considered an important objective of the first phase of forest design planning. Environmental improvements increasing the area of native species planted, improving habitat networks and removing 'blocks' of conifer from landscape sensitive areas have received significant attention.

Since the turn of the century the social value and use of woodlands gained greater recognition and greatly influenced forest planning decisions. The planning processes has evolved rapidly over the past fifteen years and since the first edition of the Woodlands for Wales strategy in 2001, the management of the AGWE has focused on meeting a rounded public policy agenda. The assignment of 37,000 ha of the productive area on the AGWE to non-clearfell systems has been one of the most significant changes. It is recognised that, although progress has been made over the past decade in understanding and implementation of non-clearfell systems, we still have much to do and much to learn.

2.3.4 Woodlands not in a management scheme and unmanaged woodlands

There are 147,000 ha of woodland outside a current grant scheme in Wales. A number of woodlands in Wales are being managed through felling licenses and independently without grant aid. 4,000 ha of woodland outside a grant scheme have been granted a felling or selective felling licence in the last 11 years.

Our understanding is that few of the remaining 147,000 ha have much management. Legally, owners are able to harvest 5 cubic metres of timber per calendar quarter without needing a felling licence, and are also able to thin out trees less than 10 cm in diameter at breast height. However, a recent survey of farmers[88] showed that in the previous three years only 14% had done any thinning work, 20% had felled a few trees, and only 5% had felled several trees and replanted.

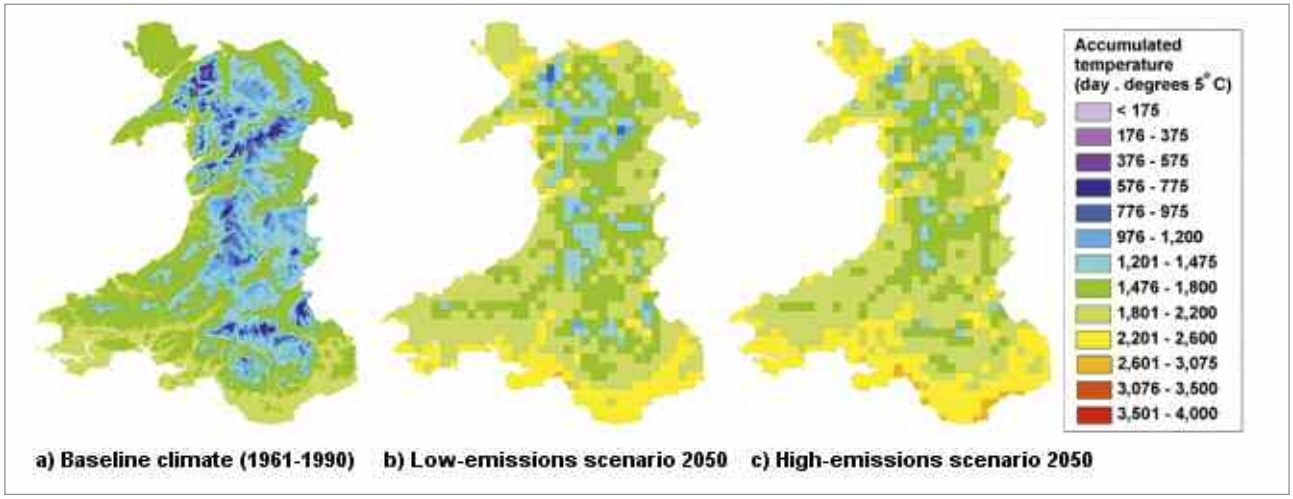
2.4 The changing climate

2.4.1 Climate change projections for Wales and likely impacts on Wales' woodlands

> 'As the climate changes we can expect a longer growing season, with increased growth and production potential, but also greater risk of winter storm damage and summer drought and fires. Changes in the pattern of outbreaks of pests and diseases could present an even more serious threat, especially to single species woodlands'.[89]

Research into climate change and the need to provide woodland owners and managers with better information is of the highest priority and our knowledge on the effects of climate change and how we might protect our woodlands is constantly being improved[90]. Predicting future climate is not an exact science. The reliance of Welsh forestry on a very limited range of species of often limited provenance for our timber products within crops that are mainly monocultures is a risky strategy, and one we should seek to redress[91]. **Figures 11** and **12** show the projected changes in temperature (measure of warmth available for plant growth) and soil moisture deficit (a good indication of water available for plant growth). Undoubtedly there will be significant effects on the climate in Wales and for our woodlands - refer to **Table 3**.

Figure 11[92] - Accumulated temperature distribution in Wales: a) baseline climate, 1961-1990; b) projection for 2050 & 2080 Low-emissions scenario; c) projection for 2050 & 2080 High-emissions scenario.



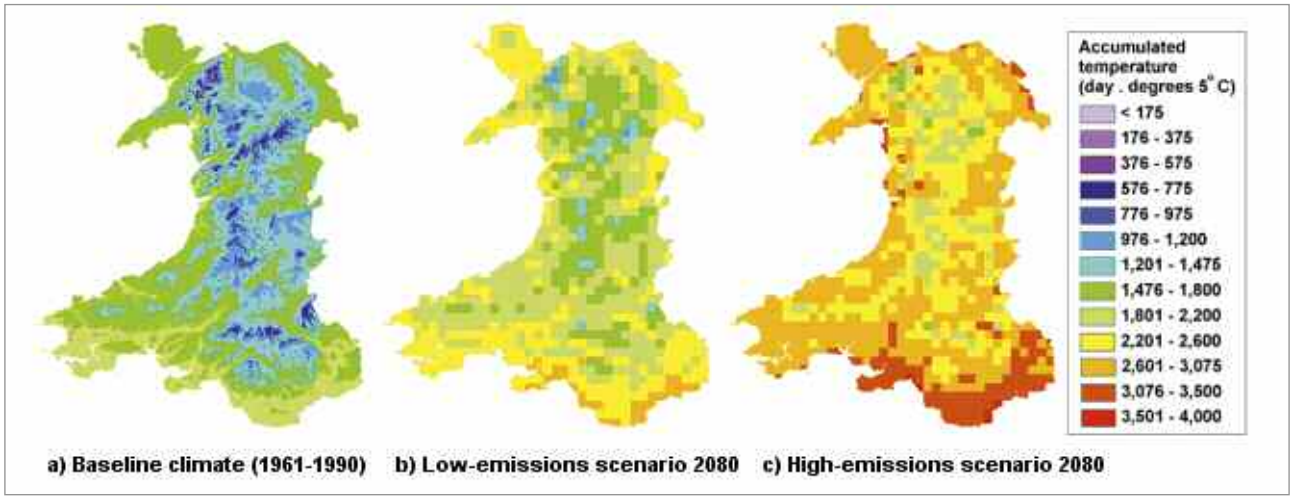


Figure 12[93] - Moisture deficit distribution in Wales: a) baseline climate, 1961-1990; b) projection for 2050 Low-emissions scenario; c) projection for 2050 High-emissions scenario.

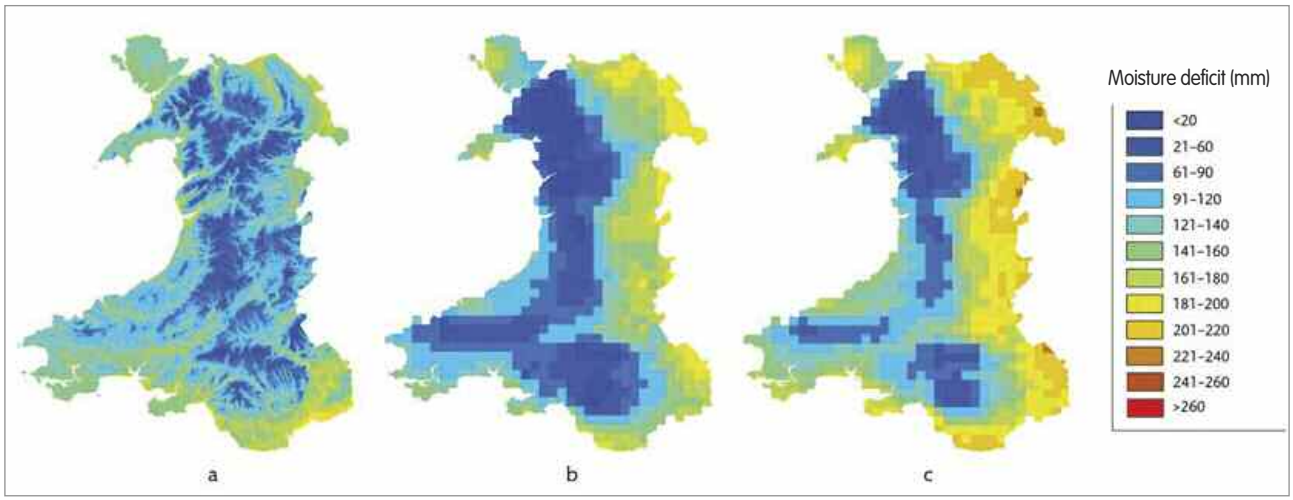


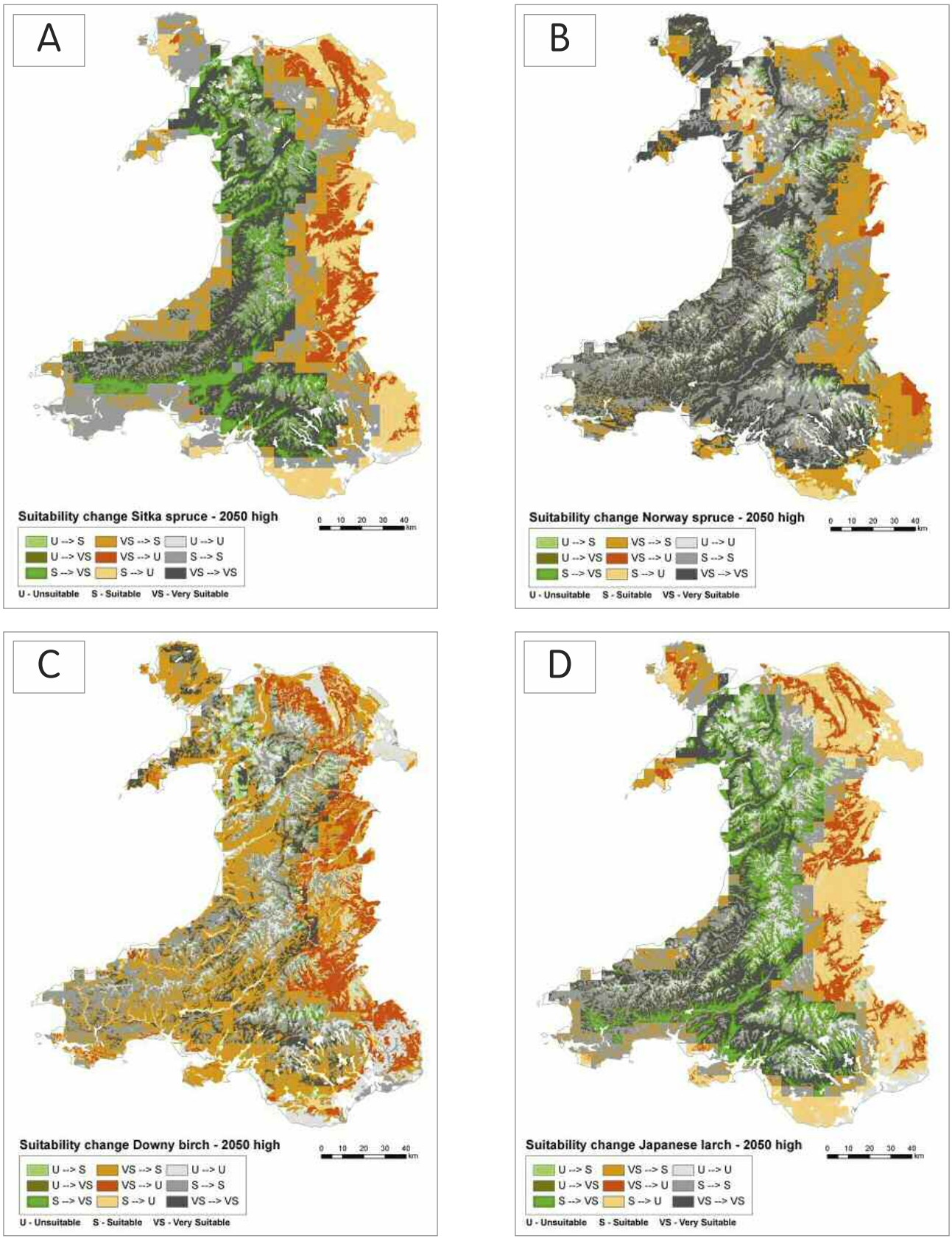
Table 3 - Projected climatic impacts and consequences for Wales' woodlands[94]

Climatic variable	Projection	Likely consequence for Wales'
Temperature	Summers will become warmer and winters milder with fewer frost days	Longer growing season growth rates of many of our 'bread and butter' tree species will increase. Require changes in provenance for some species such as Douglas fir. Extension of planting season for containerised trees. Increasing weed competition.
Rainfall distribution	Drier summers in the east and south. Wetter winters	Tree stress. Change in tree species suitability and productivity
High intensity rainfall	Increased frequency predominantly though not exclusively, in winter leading to a greatly increased risk of flooding, landslips, wetter soils and risk of soil erosion	Tree stress, increased risk of pests and disease. Change in tree species suitability and productivity. Increased risk of sedimentation of watercourses. Coping with uncertainty
Drought	Increased frequency of drought, especially in south, and fires in summer	Tree stress, increased risk of pests and disease. Change in tree species suitability and productivity. Limitations to planting season of bare-root stock
Wind speed	More frequent strong winds	Storm damage - limitation for some silvicultural systems in exposed locations. Coping with uncertainty

There is convincing evidence that we need to increase the resilience of our woodlands through the species choices we make, the silviculture and operations we undertake, the infrastructure we use for woodland management and in the management of priority woodland habitat. The increased risk of existing and new pest and disease outbreaks could well turn out to be more serious for our woodlands than all other climate change effects.

Modelling for tree species suitability predicts significant changes to some of our key species even within the lifetime of the next rotation in certain parts of Wales. Of primary concern are the changes that will effect Sitka spruce, currently our primary timber resource. Over the last two decades planting trends have reduced the genetic diversity of our crops by targeting timber yield as the major objective (largely related to the genetic improvements made to Sitka). In Eastern Wales by 2050, even under the low emissions scenario, suitability is predicted to decline significantly[95] (refer to **figure 13**). Under the high emissions scenario there is significant deterioration of both Sitka and Norway spruce in Eastern Wales. Japanese larch and downy birch also show a significant reduction in suitability. Other species such as sessile oak and Douglas fir show little change over the same period and some species begin to increase in suitability. These modelled predictions make clear that future planting plans need to include 'adaptive planting' to spread the risks of the variability in tree species and woodland ecosystem responses to climate change, including 'untried' species in addition to those species we already know perform well in Wales. Climate matching research, looking at the future suitability of using plant material from European locations which 'match' the future climate of Wales show that carefully designed genetic diversity measures will be an important tactic to support this 'portfolio approach'[96].

Figure 13 - Indicative changes in the suitability of four species of tree in Wales by 2050 for High-emissions scenarios: a) Sitka spruce; b) Norway spruce; c) downy birch; d) Japanese larch.
Green indicates increasing suitability; red/orange declining suitability.



Our five priority native woodland habitats will require targeted strategies to increase their resilience[97]. It is likely that climate change will drive successional change leading to gradual changes in woodland type. Species assemblages and the 'typical communities' of our native woodlands may well change as their 'climate space' changes. Many of our woodlands are small and isolated, and many woodland species (which tend to be poor dispersers) find it hard to cross the intervening space such as intensive agricultural land. Improved resilience of native woodlands could be improved in future by creating habitat networks, linking many of these small woodlands together. Natural disturbances will become a more prominent feature of priority native woodlands: wind, fire, and changes in pest and disease ecology are likely to affect native woodland habitats as well as non-native plantation forests. There may well be changes in the frequency of seed years for many broadleaved species leading to impacts on natural regeneration and changes in food abundance for seed eating species. However, except under the high-emissions scenario, oak and ash suitability will remain high into this century providing some security for native woodland habitats in Wales.

Photo: Dafydd Fryer

2.4.2 Woodlands, climate change adaptation and mitigation

Woodland has a long-term and sustainable role to play in helping society adapt to the impacts of a changing climate[98], including in urban environments, by providing shelter, cooling and shade. Woodlands across the wider landscape will help with runoff control, soil conservation and flood amelioration. New woodland creation will bring gains for biodiversity such as increasing the area of wet woodland in the flood plain to slow water flow. Trees, woodlands, their soils and timber are a store of carbon and through photosynthesis remove carbon from the atmosphere (refer to **Figure 14**). As a general principle, sequestration by forests secures most carbon during the more active biomass accumulation stage (growth season) and eventually releases CO_2 through decomposition processes. While they are growing trees significantly store more carbon than they release.

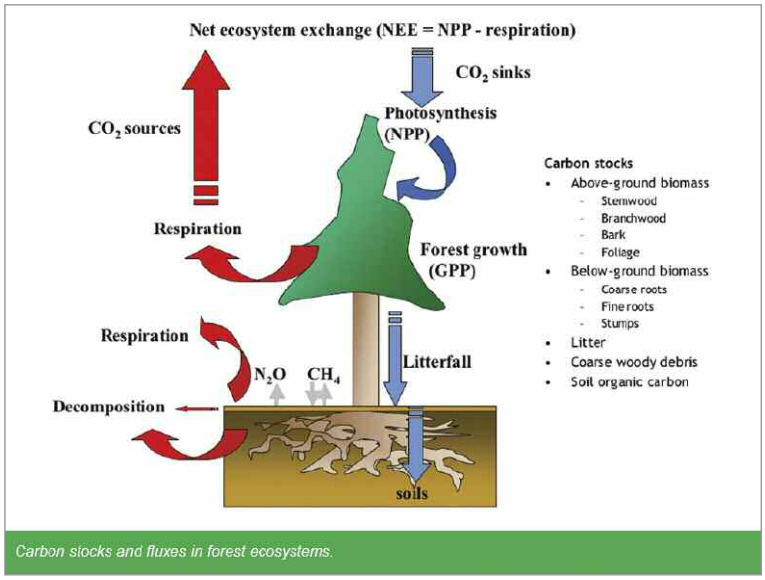
However trees and timber have a valuable roll to play in climate change mitigation - not only through sequestration but also through substitution. Substitution, in the context of climate change mitigation, is the use of wood products to substitute for CO_2 emissions either directly by replacing the use of oil, gas or coal with wood for fuel, or indirectly by using wood to replace materials that rely on fossil fuels for their manufacture such as plastic, steel, or concrete. This dynamic for different woodland management options is illustrated by the CARBINE model in **Figure 15**.

Abatement is maximised when sequestration and substitution strategies are optimised. Almost half of Welsh woodlands are currently actively managed for wood products, so the potential for further optimisation of sequestration and substitution from these woodlands is limited. The remaining woodlands that aren't currently managed could deliver additional substitution impacts - but if they remain unmanaged they will generally be at equilibrium in terms of ongoing abatement through sequestration i.e. decomposition equals sequestration in CO_2 terms.

For these reasons, the highest impact policy option is to create new woodlands that can deliver new abatement into the future via both active sequestration and substitution.


Photo: Dafydd Fryer

Figure 14: Carbon stocks and fluxes in forest ecosystems and UK forest carbon stocks



Carbon stocks and fluxes in forest ecosystems.

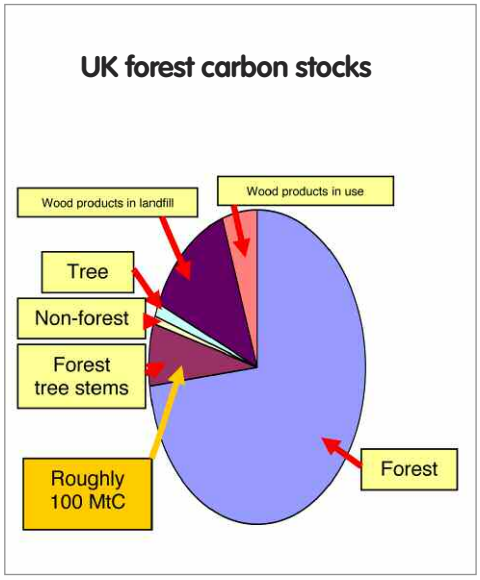
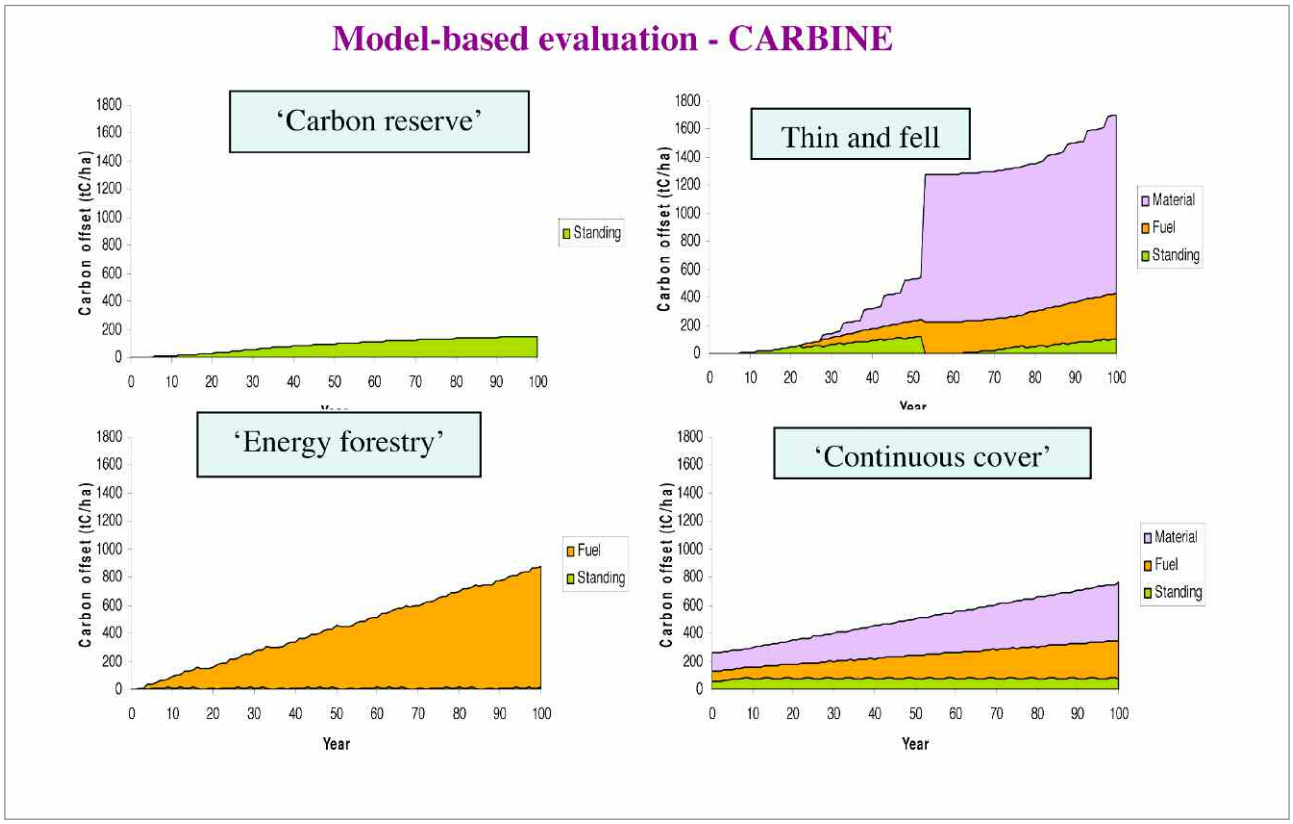


Figure 15: CARBINE model for different silvicultural systems[99]



2.5 Timber, wood products and forest sector development

The management and harvesting of wood products remains at the core of sustainable forest management and will remain an objective even in many of the ancient and native woodlands we bring into management. Continued and improved management and utilisation of timber is core to delivery of wider public policy benefits. The wood processing industry is continually improving its use of recycled fibre and reclaimed and low-grade timber. Residues from processing are increasingly being utilised in biomass markets to produce heat and energy. Markets will need to further develop for low-grade hardwood and softwood where the need to add value is a priority[100].

Wales is heavily reliant on imported timber, a small percentage of which is not guaranteed as being sourced from sustainably managed forests[101]. In future due to increasing world demand and the costs and carbon implications of importing timber long distances it is possible that supplies of imported timber will become more expensive and supply less reliable. There is currently a significant reliance in Wales on spruce for our homegrown timber supply. Spruce comprises 37% of the woodland cover[102] and supplies 65% of the Welsh timber market rising to 71% by 2022 - 2026[103]. Forest planning for the next twenty years aims to stabilise conifer timber production and there will be increased availability of broadleaf timber. Ancient and native woodlands have produced renewable products such as fuel and timber for generations and have enormous potential to continue to do so in the future.

The use of wood for fuel is very limited within Wales at the moment with relatively low levels of firewood production occurring at a local level. On a larger scale the Wood Energy Business Scheme (WEBS) commenced in Wales in 2004[104] and was set up to develop wood fuel heating schemes, small scale electricity generation using wood [Combined Heat and Power (CHP)], and the wood fuel supply businesses.

> 'Within the next five years sustainably produced wood fuel has the potential to save the equivalent of approximately 7 $MtCO_2$ emissions per year by replacing fossil fuels in the UK. This contribution could be increased further as bioenergy, including energy derived from woody biomass, makes an increasing contribution to UK targets for renewable heat, power and liquid fuels. The use of biomass for heating provides one of the most cost-effective and environmentally acceptable ways of decreasing UK Greenhouse gas emissions.'[105]

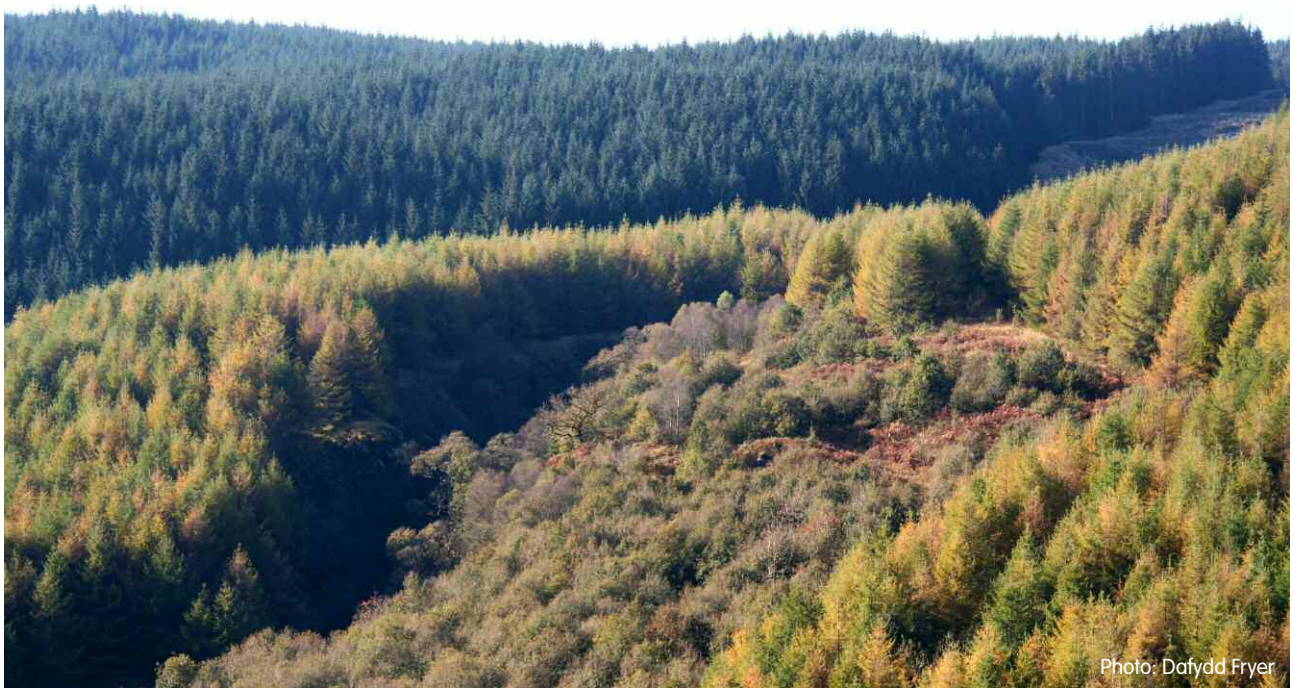


Photo: Dafydd Fryer

3: Agenda for Action

3.1 Woodland protection and management

There are three main areas for improvement:

- The implementation of statutory obligations for woodlands and trees
- Effective implementation of the UKFS for all woodlands in Wales
- Sustained action and co-operation for plant health and tree protection measures

Statutory duties

Of over-riding importance is the undertaking of statutory duties by all organisations concerned with woodlands and, where woodland management is undertaken, that all legal obligations are understood and fulfilled. The sector requires clear and accessible advice on Forestry Regulations, controls related to exports and imports of timber, Plant Health Regulations, issues and controls[106] and the control of invasive non-native species. Included is action for special sites designated for their nature conservation interest such as Special Areas of Conservation (SACs) and Sites of Special scientific Interest (SSSIs), those with heritage protection such as Scheduled Ancient Monuments (SAMs) and special landscape character such as Areas of Outstanding Natural Beauty (AONB). Owners and managers require easy access to their obligations under the Water Framework Directive and local action planning in Wales. We will continue to work with Local Authorities to improve the protection measures for trees and woodlands in Planning Policy Wales and seek a mechanism for compensatory planting when woodland is lost to development.

Sustainable forest management

We require better and more effective implementation of the UKFS and application of the UK Forest Guidelines to achieve sustainable forest management across all of Wales' woodlands. The AGWE will continue to be managed according to the principles of sustainable forest management based on the UKFS and be assessed and monitored through Forest Certification. The requirements for entry into BWW has been based on the requirements of the UKFS and form the basis for owners and managers to apply for Forest Certification. The standards as set within the UKFS Guidelines must be seen within the forestry industry as the minimum environmental standard.

Photo: Dafydd Fryer

Woodland protection and plant health measures

Protecting our forests from a range of pests and diseases is essential if we are to improve timber quality, maintain our productivity and improve the condition of our woodland ecosystems. Plant health issues will become increasingly problematic in the predicted changing climate and Wales will support current and future research into existing and emerging plant health issues. We will increasingly use plant health awareness days for forest managers and owners. We will work with the FC GB's Plant Health Service (PHS), WAG's Plant Health and Biotechnology Unit and others to ensure that effective rapid reaction plans are put into place if necessary. We will continue to develop integrated forest management approaches and non-chemical methods, such as the use of nemotodes, for the control of pests. We will adopt use of an increased range of species (including species not currently in widespread use in Wales), increased use of mixed stands and using a wider range of silvicultural techniques. We will work with Forest Research (FR) and others to identify genetic conservation measures and make appropriate provenance choices to increase woodland resilience. Using plant material from a wide range of provenances will help maintain and improve genetic diversity.

Sustained action, investment and co-operation across woodland ownership is required in particular for deer and grey squirrel management. We will work with FR and others on protection issues and the potential for damage under proposed future management scenarios. We will develop and implement a Wildlife Management Strategy for the AGWE and work with the partners to develop a Wales-wide strategy and action plan for deer management. A grey squirrel control action plan will be finalised to minimise their impact in Wales.

We will develop guidance to increase the resilience of the woodland resource in Wales for the potential increase in occurrence of catastrophic wind damage, fire, and pest or disease outbreaks.

3.2 Improved silviculture leading to increased resilience

Three basic strategies are likely to provide the basis for secure adaptation through increased resilience[107] for our woodlands:

- Reduce the reliance on clearfelling systems and the use of natural processes as the basis of stand management is increased (i.e. increase the use of non-clearfell systems together with the use of mixtures)
- Where management regimes other than non-clearfell are used - a wider range of species and genetic material within a species will increase resilience
- Acceptance of natural colonisation of some non-native but naturalised tree species (e.g. beech, sycamore, red oak), dependent on woodland type and location, and plant a wider range of species not currently in widespread use in Wales

Improved silviculture

We will provide guidance for owners, managers and planners on the selection and management of sites for the use of a range of non-clearfell systems such as:

a) the gradual transformation to such systems

b) when it may be appropriate to clearfell initially to ensure diversification can be achieved

c) for other systems such as Short Rotation Forestry and where Natural Reserves and minimum intervention are appropriate

The selection of sites for management by continuous cover systems and the choice of system should always be driven by strategic objectives, climatic zone, exposure, soil type and site conditions. An assessment of the current tree species diversity or the ability to increase that diversity will be a key factor in assessing the suitability of sites for transformation using non-clearfell systems. The AGWE will continue to identify and plan all sites appropriate for management by non-clearfell systems and continue to implement these sysyems. BWW and subsequent woodland grant schemes will provide strong incentives for others to do so. We will provide associated guidance on establishment methods to support these systems including the use of natural regeneration, planting and enrichment.

Tree species choice

Owners, managers and planners will have guidance on achieving more diverse woodlands through tree species choice to achieve the right tree in the right place for the right reasons and at the right time. Mixing species in stands (or within the woodland), regardless of management system, will help to increase resilience to changing site conditions, for example an increasing incidence of drought, and risk from pests and pathogens. We will make better use of the range of species we already consider suitable to the climate and site conditions in Wales. Planting of a wider range of tree species, including greater acceptance of 'naturalised' species and those not currently in widespread use, will be implemented on the AGWE and encouraged through BWW and subsequent woodland grant schemes.

Increasing the range of species will yield a wider range of products and improve market resilience if opportunities are taken - a clear link will be made to the development of timber marketing and enterprise. The environmental and social benefits of creating more diverse woodlands are widely accepted and tree species diversity measures will be undertaken across rural and urban woodlands as site conditions allow. Our ancient woodlands and priority native woodlands are likely to see climate-driven changes to species assemblage, woodland type and ecosystem. Tree species choice within the management of these woodlands will be informed by research and working with others towards the best adaptation strategies including greater acceptance of 'naturalised' species, where appropriate, and the impact of natural disturbances from, for example, wind damage. The suitability of drought sensitive species will continue to decline in southern and eastern Wales changing current distribution of native woodland types. Site and climate matching tools will be developed to confirm species suitability.

The scale at which tree species diversity can be achieved will be matched to site suitability and inform where intimate mixtures within a stand are appropriate and where diversity should be achieved at coarser scales. Our principles will be drawn from '... it is better to aim for small clumps of single species ('mosaic' mixtures) rather than to try and create stem by stem or line by line mixtures of species or provenances ('intimate' mixtures). Intimate mixtures are most likely to be successful where the site conditions are suboptimal for all the species being considered for planting; in all other situations mosaic mixtures are likely to prove more reliable[108].' We will recognise that certain types of mixtures, such as line mixtures, can be detrimental in areas where visual appearance of the woodland is important.

Genetic diversity

Creating diversity through choice of provenance and the genetic diversity within species is an important strategy that will be taken forward through further research and the provision of guidance to the sector. A further action is required to clarify suitable measures for matching, for example, more drought-tolerant provenances for many of our tree species including the management of our native woodlands. Site and climate matching tools will be developed to confirm provenance suitability. We will work closely with others to develop the infrastructure required to undertake our tree species choice and genetic diversity actions, supporting seed collection, nursery supply, tree breeding and genetic improvements.

3.3 Maintaining potential national wood production

Woodland productivity is the capacity to produce forest goods and services and is a site level measure to ensure sustainability. We will employ three main strategies to maintain the potential national wood production from our woodlands:

- The creation of new woodland
- Bringing more woodland into management
- Permanent tree removal and change of land use will be a last resort

New woodland creation

We will increase the net area of woodland in Wales through the BWW woodland grant scheme, Plant! scheme and Glastir- our new land management scheme. Glastir will play a vital role in new woodland creation following the announcement in March 2010 of an ambitious tree planting programme under the Glastir Woodland Creation Scheme and the targeted element of Glastir, aimed at expanding the area of woodland in Wales by 100,000 hectares over the next 20 years.

We will welcome all new woodland which meets the UKFS but will encourage spatial targeting of woodland where people need them and which contributes to, for example, the production of fibre, habitat connectivity and deliver solutions to flood management. We will increase in the size of existing woodlands and encourage links between existing small fragmented woodlands and other semi-natural habitats. There will be a better integration of woodland with other land uses. We will encourage the planting of trees and new woodland in urban and peri-urban locations to help mitigate the effects of climate change. We will promote the use and benefit of woodland in new developments and the restoration of brownfield sites.

Bring more woodland into management

We will continue to bring more woodland into BWW and BWW Small Woods. We will look for ways to further develop grant schemes, including Glastir, to attract more farm woodlands into management and those which are managed for income streams beyond timber such as game and woodland recreational activities. We will continue to look for ways to better integrate woodland policy and programmes with that of other land uses such as water management, agriculture and renewable energy. Access and infrastructure to some of our smaller woodlands is often difficult or non-existent. We will continue to support technical developments and look for ways of supporting investment in access provision for management.

We will continue to investigate the opportunities and support mechanisms for the management of smaller, lower value woodlands and increasing the supply of woodfuel products particularly for on-farm benefit. Awareness, training and education in woodland management for the wider agricultural sector will be undertaken in partnership with others to realise the economic potential of this woodland resource and bring more of our native woodland into management.

It is generally accepted that managing non-clearfell systems and the actions we seek for tree species choice requires more intensive planning and management yet this must be balanced against a simple approach to woodland management planning which supports bringing more woodland into active management. We will build on the progress made within the BWW grant scheme and develop fit for purpose strategic and operational planning across the AGWE and for woodland in other ownership. Strategic planning will be indicative, based on the approach of Forest Type (refer to **Appendix 5**) to identify the range of species suited to the site, a suitable silvicultural management system and the objectives for the site. Management planning at the site level will be standard practice to give us the best opportunities for managing more diverse woodlands.

Woodland removal

There will be a strong presumption against permanent woodland removal where landscape or habitat improvements can be made by modification of the management system or a change in the woodland character. We will continue to develop decision support to guide forest land use change.

3.4 Research

We will identify our priorities for research and modelling related to the 'Agenda for Action' for improved silviculture and increased resilience and continue to work in partnership with Forest Research, Forestry Commission Technical Development Branch, academic institutions and others, including:

- Developing suitability analysis to target new woodland creation for, for example, flood risk management, soil conservation and woodlands for people
- Improving the production forecast from the AGWE and private sector
- Identifying the impacts of different management systems on all woodland habitats, soils and water resources
- Increasing our knowledge of the site suitability of tree species, particularly those not currently in widespread use in Wales
- Supporting long-term research schemes such as the National Forest Inventory[109], the intensive long term monitoring plots[110] and long term experiments[111]
- Expanding the 'real' forest non-clearfell system trials in the UK and particularly in Wales to develop new trial sites and test harvesting systems on marginal sites such as steep terrain, examine the regeneration dynamics of transformation and non-clearfell systems, improve the predictability of natural regeneration, better understand costs, plan the development of permanent management infrastructure and improve planning processes
- Improving wind risk modelling that can be applied to any stand structure
- Modelling for the potential of SRF in Wales
- Extending the technical developments required for operational management
- Supporting and promoting the change management research work that is being carried out by Forest Research with the aim to explore how organisational, professional culture, structure and information flow affect the implementation of non-clearfell management systems

Photo: Dafydd Fryer

4: Methods of delivery

As stated in the introduction it is hoped that all organisations responsible for delivery of government policy, in addition to FCW, will develop a corporate response to collectively deliver this 'Agenda for Action'. The main mechanisms for delivery will be by:

- Direct delivery on the AGWE
- Deployment of grant funding via BWW and other schemes to other woodland owners
- Supporting, influencing and enabling others to develop programmes from this 'Agenda for Action', particularly wider use of new woodland creation as a legitimate public policy solution
- Identification of key partners to help us deliver and implement the requirements for education, training, skills and knowledge transfer
- Improved communication and decision support for all woodland owners and managers to help make better local decisions

5: Monitoring and evaluation

5.1 Monitoring

The Woodlands for Wales Strategy is accompanied by an action plan, which is monitored annually.

In addition, FCW has developed a Corporate Programme (Programme 1 - Managing More Diverse Woodlands) to support the implementation of this policy, and there is a monitoring protocol accompanying this programme. A brief Action Monitoring report will be produced **every six months**, coinciding with the meetings of several supporting Policy Implementation Groups (PIG) (e.g. species diversity PIG and Continuous Cover Management Systems PIG).

5.2 Evaluation

Formal policy evaluation will take place **every three years**, to assess how effective it has been, and what lessons can be learnt for the future. The success of the policy will be assessed in terms of its delivery of the outcomes listed in this document. The first evaluation is planned for April 2013.

The evaluation will draw on a range of evidence. Useful to the evaluation will be information from the following **Woodlands for Wales strategy Indicators (Table 4)** which will also, to some extent, have established an ex-ante baseline. The FC Production Forecast is also an important monitoring tool, since the goal of the policy is to diversify but ultimately maintain productive potential of the Welsh woodland resource.

Table 4: Wales Woodland Strategy Indicators relevant to this policy position

ID of indicator	Performance Measures	Reporting frequency	Desired Trend
FC Production forecast	Forecasted volume of softwood and hardwood available for harvest in future years	Every 5 yrs - next due 2011	STABLE OR INCREASING
Woodlands for Wales Indicator 1: Woodlands and Trees	Area of woodland in Wales, and area of woodland creation	Annual	Increasing area of woodland cover, and increasing rate of woodland creation
Woodlands for Wales Indicator 2: Diversification of woodlands	Proposed measures (tbc) include: • Tree species diversity in non-native woodland: proportion of 0.25 ha non-native sample squares with 1, 2, 3, 4 and 5+ species (intimate mixtures) • Habitat diversity index of non-native 1 ha sample squares (stand level diversity) • Diversity of broad woodland types at the river catchment scale (landscape scale diversity) (variety of size and type of forest block) • Proportion of woodland area that is mixed conifer/broadleaf (where conifer canopy cover is between 20 and 80%)	Baseline from 1998. Updates every 5 years from 2014	Change is expected to happen slowly. Long term targets are to see gradual increases in these measures over the 1998 baseline. It is not appropriate to set targets for these measures at this stage - more modelling is required before we can understand the proportion of the resource that would be suited to diversification at particular scales.
Woodlands for Wales Indicator 3: Sustainable woodland management	Area of woodland known to be managed to the UK Forestry Standard, including area of woodland certified by FSC or PEFC	Annual	Increasing area known to be managed to the UK Forestry Standard, and increasing area certified to the UK Woodland Assurance Standard

Table 4 continued: Wales Woodland Strategy Indicators relevant to this policy position

ID of indicator	Performance Measures	Reporting frequency	Desired Trend
Woodlands for Wales Indicator 4: Management System	Area of woodland managed for timber by (i) clearfell, (ii) non clearfell, and area managed as a natural reserve	Annual	Decreasing area managed through clearfell where an alternative management systems would make a better contribution to ecosystem services. Increasing area of woodland actively managed for timber using alternative management systems.
Woodlands for Wales Indicator 5: Farm woodland	Area of farm woodland actively managed for timber products	Estimates annually, survey every three years	Increasing area managed for timber products
Woodlands for Wales Indicator 14: Use of Welsh Wood	Proportion of available wood that is harvested	Annual	Stable harvest of softwood (10 yr rolling average of c. 86% with each year within 77-98%). Increasing harvest of hardwood increment, with long term target to increase hardwood harvest to 25%.

There are a number of contextual indicators supporting this framework which are found in other sources such as FCW Corporate Programmes and cover issues such as tree health and native woodland condition

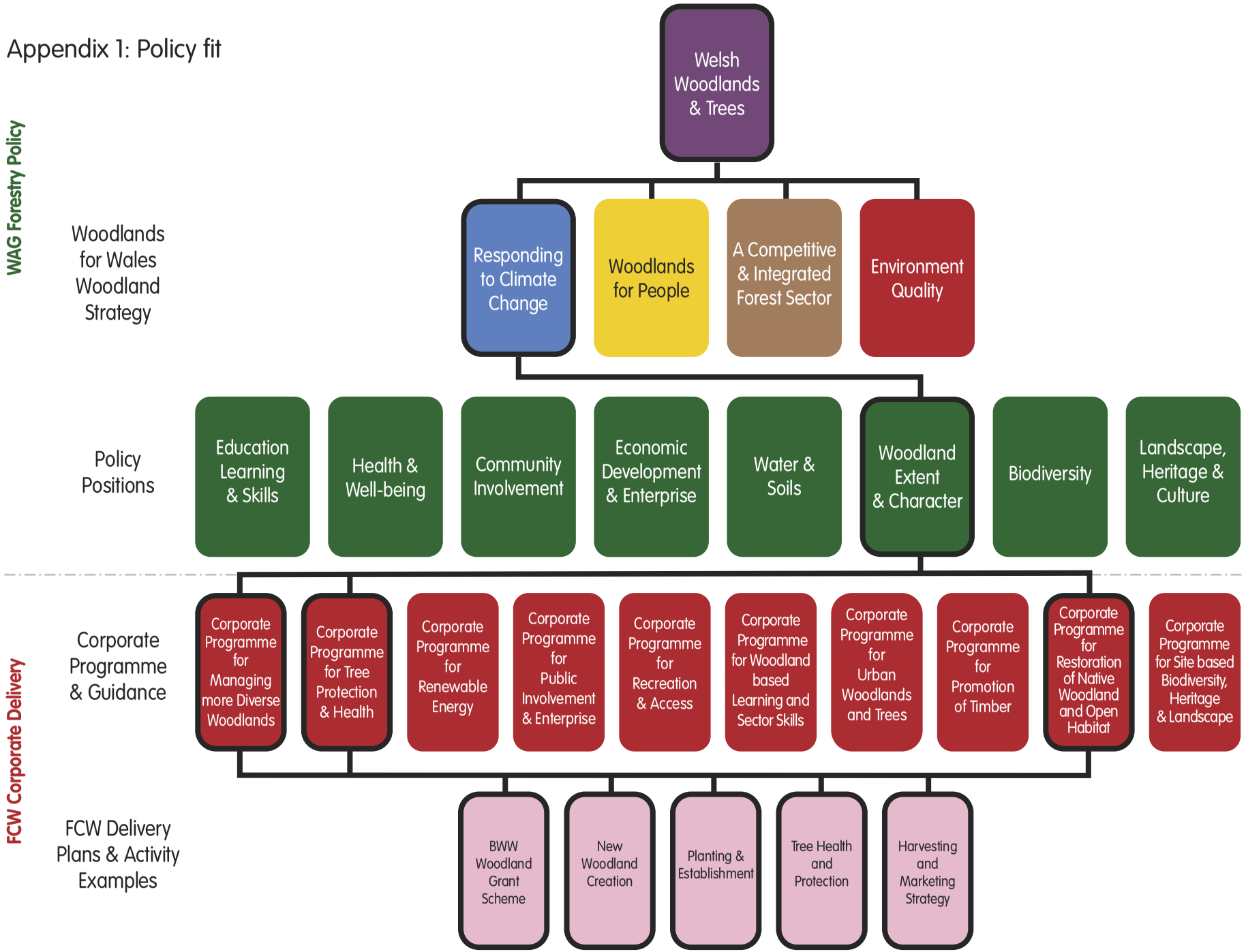
Consistent and appropriate monitoring systems need to be further developed and applied to better understand achievement against objectives and assist in future management decisions.

A lot has been achieved by the recently developed National Forest Inventory (NFI), which over the next 5 years will greatly improve our understanding of the extent, diversity, condition and productive potential of the Welsh Woodland Resource.

We still need to improve our ability to monitor and report on the range of species being planted within restocked or new areas, particularly on our ability to record intimate mixtures.

We have also been improving our understanding of the nature of the private woodland resource, and how it is currently managed through surveys of private woodland owners. The NFI will also help with this via field survey.

Appendix 1: Policy fit



Appendix 2: Equality and Diversity Evidence

The aims of this high-level policy will have positive benefits for all people in Wales including those included in the six diversity strands. There is no evidence that there will be any specific negative impact on any of these groups.

This policy identifies positive benefits of woodlands and trees in both rural and urban areas including - the contribution they make to the landscape character of Wales, biodiversity, addressing climate change and their economic value to the timber industry and the wider Welsh economy. Extending woodland cover and increasing the sustainable management of existing woodlands as advocated by this policy will increase these benefits provide.

Improving access to woodlands will be beneficial to the health and well-being of those who visit them. Access for all abilities will need consideration when developing facilities. Woodlands and trees in the landscape will provide attractive settings and features, which will also contribute to feelings of well-being.

However, specific projects which arise through the Woodlands for Wales Action Plan may require more focused EqIAs to consider any impacts and give opportunities to promote diversity. Local consultations may be appropriate in some instances.

This policy position has been developed to provide more detail, background and an agenda for action take forward strategic themes of the Woodlands for Wales strategy. A full equality impact assessment was undertaken during the preparation of Woodlands for Wales.

Photo: Dafydd Fryer

Appendix 3: UKFS & relationship to policy positions

The requirements of the UKFS are set out in eight key aspects representing the basic resources of forestry in Wales. This table shows where each aspect is considered in the eight Policy Positions supporting Woodlands for Wales.

Aspect of sustainable management	Requirements of sustainable forest management	Policy Position
Forest soil condition	Forest soil condition is stable or improving towards a more stable condition (and the improvement is not to the detriment of important semi-natural habitats).	Water & soils
Water quality, yield and water discharge patterns	Water quality is protected or improved, water yields are maintained above any critical level and water discharge patterns are disturbed only when unavoidable, and all options have been explored.	Water & soils
Net carbon sequestration and air pollution	The values of forests as sinks and stores of carbon are recognised in policies and protected and enhanced in practice. Pollution is avoided by using the best available techniques which do not entail excessive costs.	Water & soils Welsh woodlands - their extent, nature and character
Timber production, other production, contribution to the economy	The supply of timber and other forest produce for industrial use is available at the levels indicated in long-term forecasts, or is increased without reducing the annual increment potential of future crops.	Welsh woodlands - their extent, nature and character, Economic development and enterprise
Nature conservation	Bio-diversity in and around woods and forests is conserved or enhanced, and: - species and habitats subject to EU Directives or priorities of the UK Biodiversity Action Plan are conserved or enhanced; - important, but previously disturbed, semi-natural habitats are restored, where practicable.	Biodiversity
Forestry workforce, competency and safety	Safe and efficient practices are promoted and their effectiveness kept under review.	Welsh woodlands - their extent, nature and character, Economic development and enterprise, Education, learning and skills
Rural development, access and recreation, quality of life in and around forests, increased awareness and participation, community involvement and other land-uses	Opportunities are enhanced for: - rural development; - access and recreation; - quality of life; - increased awareness and participation; - community involvement; - skills training. Important agricultural resources are protected.	Community involvement, Health and wellbeing
Conservation of heritage features and landscape quality	Important heritage features are protected. Due account is taken of cultural, historic or designed landscapes.	Landscape and heritage

Appendix 4: Summary planting figures from the AGWE

Common name	1999/2000		2004/2005		2009/2010		2010/2011		2011/2012	
	Number of trees (k)	%	Number of trees (k)	%	Number of trees (k)	%	Number of trees (k)	%	Number of trees (k)	%
QSSi (from 2004 onwards)	1538.80	27.51	48.30	1.37	440.30	13.75	373.00	11.30	324.00	8.82
Washington Sitka spruce	1699.60	30.39	782.70	22.19	300.00	9.37	276.00	8.36	364.00	10.03
CVP Sitka spruce	0.00	0.00	957.02	27.14	889.60	27.78	979.60	29.69	1045.50	31.68
Norway spruce	303.70	5.43	264.60	7.50	236.70	7.39	225.60	6.84	343.40	10.41
Corsican pine	181.00	3.24	40.50	1.15	0.00	0.00	0.00	0.00	0.00	0.00
Scots pine	120.00	2.15	39.90	1.13	173.90	5.43	165.40	5.01	110.40	3.35
Lodgepole pine	6.00	0.11	24.00	0.68	0.00	0.00	3.70	0.11	0.00	0.00
Hybrid larch	97.66	1.75	493.10	13.98	270.00	8.43	344.00	10.42	144.10	4.37
Japanese larch	1020.00	18.24	71.30	2.02	124.00	3.87	124.00	3.76	185.50	5.62
Douglas fir	298.45	5.34	257.40	7.30	114.60	3.58	114.60	3.47	184.40	5.29
Other conifer	241.96	4.33	10.80	0.31	3.70	0.12	0.00	0.00	0.00	0.00
Total Conifer	**5507.17**	**98.46**	**2989.62**	**84.77**	**2552.80**	**79.71**	**2605.90**	**78.97**	**2701.30**	**81.86**
Pedunculate Oak	0.00	0.00	11.05	0.31	8.90	0.28	27.50	0.83	7.00	0.21
Sessile Oak	25.50	0.46	241.35	6.84	264.90	8.27	267.90	8.12	267.90	7.08
Alder	5.50	0.10	16.40	0.47	5.40	0.17	5.40	0.16	5.40	0.16
Ash	4.00	0.07	123.60	3.50	72.50	2.26	84.00	2.55	101.00	3.06
Beech	11.70	0.21	0.00	0.00	9.80	0.31	6.60	0.20	3.00	0.09
Birch	22.50	0.40	49.32	1.40	137.20	4.28	137.20	4.16	130.40	3.95
Cherry	1.00	0.02	27.50	0.78	10.90	0.34	10.90	0.33	15.70	0.48
Rowan	5.50	0.10	0.00	0.00	100.30	3.13	100.30	3.04	86.90	2.63
Sweet Chestnut	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50	0.05
Willow	0.00	0.00	19.00	0.54	5.50	0.17	5.50	0.17	14.70	0.45
Other Broadleaves	10.30	0.18	48.73	1.38	34.40	1.07	48.70	1.48	75.10	2.28
Total Broadleaf	**86.00**	**1.54**	**536.95**	**15.23**	**649.80**	**20.29**	**694.00**	**21.03**	**708.60**	**20.43**
Total	**5593.17**	**100.00**	**3526.57**	**100.00**	**3202.60**	**100.00**	**3299.90**	**100.00**	**3409.90**	**100.00**

Appendix 5: Note on the use of Forest Type

The concept of 'Forest Types'[112] is common throughout Europe and the world in identifying broad forest ecosystems that occur naturally within certain climatic zones and on certain site types (soils). It is normally defined as the native habitat for the particular geographic location. In Wales all habitats have been subject to anthropogenic impact and many of the managed forests in Wales contain significant or in some cases entirely non-native forest tree species. In Wales for the purposes of ecological classification for restoration of native woodlands, there are identified five priority woodland types of which only small remnants of these woodlands still exist.

In the European context the climate of Wales could be identified as suitable for hemiboreal forest and nemoral coniferous and mixed broadleaved-coniferous forest, mesophytic deciduous through to beech forest[113], giving us a wider range of species than are currently considered as native but does include our five priority native habitat types commonly associated to Wales. We also need to recognise the range of species out-with Europe that have potential or are currently being used. Using this principle we will identify specific forest types and a range of primary and secondary species that could be planted within each forest type according to the desired objectives. This will not replace existing priority habitats but can be used in conjunction with these habitat types in the decision making process where conversion or restoration is not a desired objective. Using the Forestry Commissions Ecological Site Classification (ESC)[114] in conjunction with these principles we can identify the full range of potential species available to us.

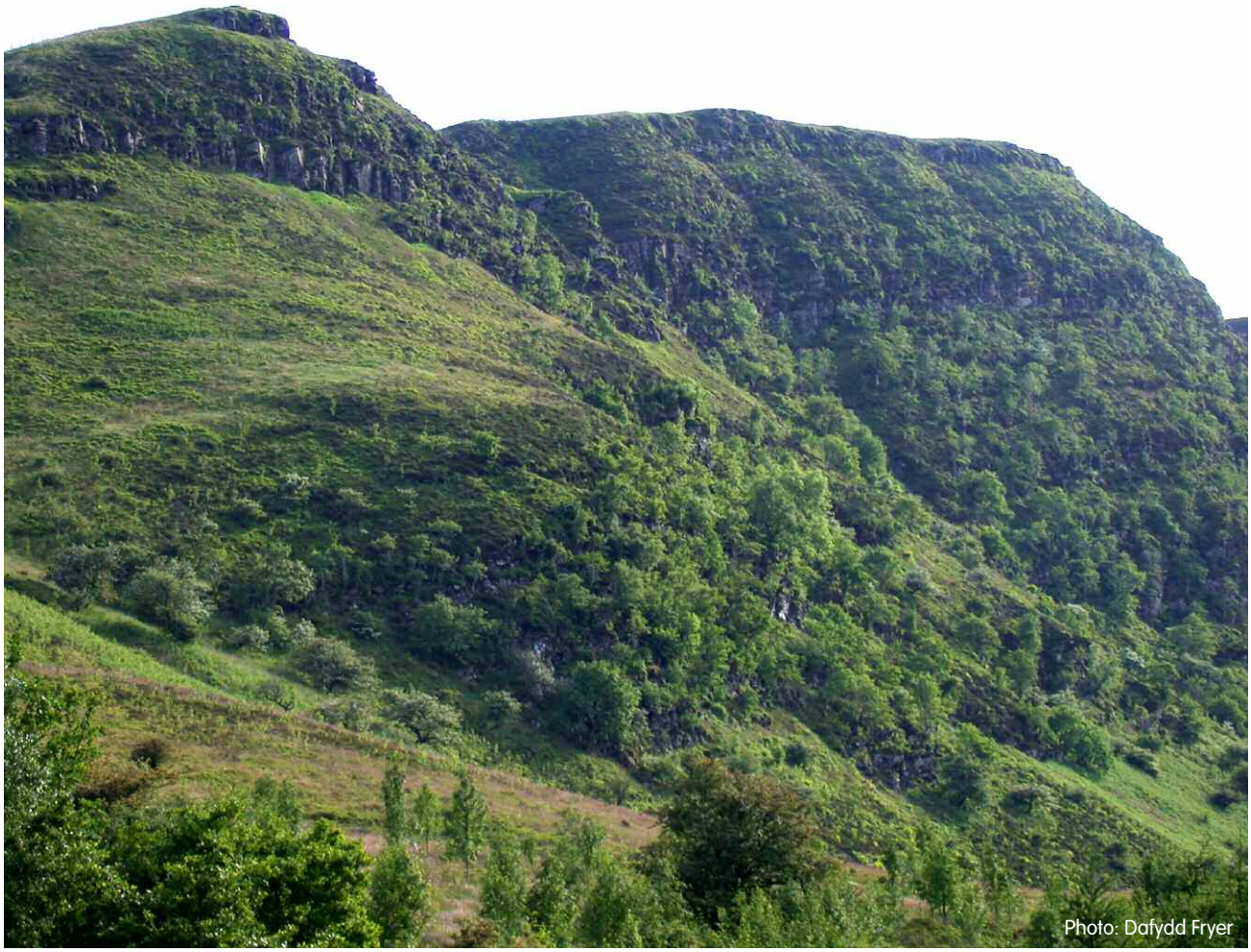


Photo: Dafydd Fryer

Appendix 6: Notes and references

1 National Assembly for Wales (2009) Woodlands for Wales: The National Assembly for Wales strategy for trees and woodlands. Forestry Commission, March 2009, 49 pp

2 More Information on the Ministerial Conference on the Protection of Forests in Europe (MCPFE) now known as FOREST EUROPE can be found here: http://www.mcpfe.org/

3 More Information on the Convention on Biological Diversity can be found here: http://www.biodiv.org/default.shtml

4 More Information on the United Nations Framework Convention on Climate Change can be found here: http://unfccc.int/2860.php

5 The proceedings and publications arising from the Second Ministerial Conference on the Protection of Forests in Europe (MCPFE), Helsinki; 1993 can be found here: http://www.mcpfe.org/eng/Commitments/Ministerial_Conferences/Helsinki_1993/

6 It was recognised in the UKFS response to the MCPFE that the nature of much of the UK's timber resource was not native to the UK and hence it would be necessary to give greater emphasis to the values differences that these "non-native" species bring to the principles of sustainable forestry. This is expressed as "The use of native species is also an area of different emphasis: only one native conifer species (Pinus sylvestris) is commercially utilisable for timber, and as a consequence, non-native trees play a major part in UK forestry. Hence, the UK Forestry Standard has less to say about fire and forests for soil protection, and more about non-native species, than might be expected in other European countries"

7 For access to information on the 2009/2010 revision of the UKFS and Guidelines see http://www.forestry.gov.uk/ukfs

8 Forestry Commission (2004) The UK Forestry Standard (2nd edition) Forestry Commission, Edinburgh http://www.forestry.gov.uk/pdf/fcfc001.pdf/$FILE/fcfc001.pdf p38

9 Forestry Commission (2004) The UK Forestry Standard (2nd edition) Forestry Commission, Edinburgh http://www.forestry.gov.uk/pdf/fcfc001.pdf/$FILE/fcfc001.pdf p39

10 European Water Framework Directive http://www.euwfd.com/html/water_framework_directive.html

11 European Soil Framework Directive http://ec.europa.eu/environment/soil/index_en.htm

12 For more information on the Plant Health Directive and UK Regulations see:
Plant Health Act 1967
The Plant Health (Forestry) Order 2005
The Watermark Disease (Local Authorities) Order 1974 The Dutch Elm Disease (Local Authorities) Order 1984
The Plant Health (Forestry) (Phytophthora ramoruma) Great Britain) Order 2002
The Plant Health (Forestry) (Wood Packaging Material Marking) Order 2006
The Plant Health (Forestry) (Amendment) Order 2006
The Plant Health (Fees) (Forestry) Regulations 2006
The Plant Health (Forestry)(Amendment) Order 2008
The Plant Health (Fees) (Forestry)(Amendment) Regulations 2008

13 For more information on the Forest Reproductive Material Directive and UK Regulations http://www.forestry.gov.uk/frm

14 For more information on the Strategic Environmental Assessment Directive and its transposition to UK Regulations see: http://www.sea-info.net/

15 For more information on the Environmental Impact Assessment Directive and its transposition to UK Regulations see: http://www.opsi.gov.uk/si/si1999/19990293.htm

16 More information on international conventions, European Directives and UK Regulations concerning nature conservation (including the Habitats Directive and the Birds Directive) is available from: http://www.jncc.gov.uk/page-1359

17 For more information and a summary of the EU Forest Action Plan see: http://europa.eu/legislation_summaries/agriculture/environment/l24277_en.htm

18 National Assembly for Wales (2007) One Wales: A progressive agenda for the government of Wales. An agreement between the Labour and Plaid Cymru Groups in the National Assembly 27th June 2007. http://new.wales.gov.uk/about/strategy/strategypublications/strategypubs/onewales/?lang=en

19 Plant! a tree for every child in Wales - more information available from http://new.wales.gov.uk/topics/environmentcountryside/forestry/plantatree/?lang=en

20 One Wales: One Planet, a new Sustainable Development Scheme for Wales (2009) Welsh Assembly Government. Available from: http://wales.gov.uk/topics/sustainabledevelopment/publications/onewalesoneplanet/?lang=en

21 Welsh Assembly Government (2006) Environment Strategy for Wales. http://new.wales.gov.uk/topics/environmentcountryside/epq/Envstratforwales/?lang=en

22 Further information on the UK and Welsh Assembly Government policy and programme response to climate change is available from: http://wales.gov.uk/topics/environmentcountryside/climatechange/tacklingchange/strategy/?lang=en

23 Welsh Assembly Government (2008) Renewable Energy Route Map for Wales: Consultation on way forward to a leaner, greener and cleaner Wales. Welsh Assembly Government, February 2008, 58 pp. http://new.wales.gov.uk/consultations/closed/envandcouncloscons/renewenergymap/?lang=en

The calculations in the draft Renewable Energy Route Map for home-grown wood fuel and based on an estimate of the amount of 'waste' wood (that is, thinnings, harvest residues) currently available. There is undoubtedly an opportunity to increase the contribution to the biomass feedstock arising from better harvesting of private woodlands. We also propose to explore how the Better Woodlands for Wales grant scheme could be more closely targeted or arrangements made to encourage co-operative action on the part of groups of farmers to identify and source biomass material for specific initiatives

24 A Low Carbon Revolution - The Welsh Assembly Government Energy Policy Statement, March 2010: http://new.wales.gov.uk/topics/environmentcountryside/energy/renewable/policy/lowcarbonrevolution/;jsessionid=wH8pLjcJHTY7nF0M1TvQK4ptJ1rYZymVlqhLhjJJWnxQWrJtQy6Q!1719244923?lang=en

25 implementation programmes such as the Wood Energy Business Scheme

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27 Welsh Assembly Government consultation document (closed) on the proposed Welsh Soils Action Plan: http://new.wales.gov.uk/consultations/closed/envandcouncloscons/130308welshsoilsactionplan/?lang=en

[28] For example research showing role of woodland in mitigating flooding includes:
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Can forestry reduce flooding? Forest Research summary.
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http://www.forestresearch.gov.uk/pdf/FR_report_2004-5_floodplain.pdf/$FILE/FR_report_2004-5_floodplain.pdf

[29] For more information on River Basin Management Plans, Catchment Flood Management Plans and other Environment Agency Wales publications see:
EAW web link to CFMPs http://www.environment-agency.gov.uk/subjects/flood/1217883/1217968/907676/

Water for people and the environment - Water resources strategy for England and Wales
http://publications.environment-agency.gov.uk/pdf/GEHO0309BPKX-E-E.pdf

EAW Water Resources for the Future March 2001
http://www.environment-agency.gov.uk/regions/wales/858612/1317944/1319586/?version=1&lang=_e

EAW web link to CAMs
http://www.environment-agency.gov.uk/regions/wales/858612/1317944/1325232/?version=1&lang=_e

Environment Agency soil action plan Soil: a precious resource October 2007
http://publications.environment-agency.gov.uk/pdf/GEHO1007BNDB-e-e.pdf?lang=_e

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Watts, K., Ray, D., Quine, C.P., Humphrey, J.W. and Griffiths, M (2007) Evaluating Biodiversity in Fragmented Landscapes: Applications of landscape ecology tools, Forestry Commission Information Note March 2007.
http://www.forestry.gov.uk/pdf/FCIN085.pdf/$FILE/FCIN085.pdf

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Hopkins et al. (2007) Conserving Biodiversity in a changing climate: guidance on building capacity to adapt. Defra for UKBAP. http://www.ukbap.org.uk/Library/BRIG/CBCCGuidance.pdf

[31] Defra, Conserving Biodiversity - The UK Approach (October 2007)
http://www.defra.gov.uk/wildlife-countryside/pdfs/biodiversity/conbiouk-oct2007.pdf

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33 More information on the Biodiversity Framework for Wales can be found at:
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O'Brien, L. (2006) Strengthening heart and mind: using woodlands to improve mental and physical well-being. Unasylva - Forests and human health. Issue 224 (Volume 57, 2006/2), a publication of the Food and Agriculture Organisation of the United Nations. http://www.fao.org/docrep/009/a0789e/a0789e14.htm

Tabbush, P., & O'Brien, L. (2002) Health and well-being: Trees, woodlands and natural spaces. Forestry Commission. http://www.forestresearch.gov.uk/website/forestresearch.nsf/

35 Examples of Welsh Assembly Government Strategies and programmes for learning, skills include:

Welsh Assembly Government (2007) National Strategic Framework for Community Development in Wales. Welsh Assembly Government, January 2007

Welsh Assembly Government (nd) The Learning Country: vision into action, WELSH ASSEMBLY GOVERNMENT, Cardiff

Welsh Assembly Government (2008) Skills that work for Wales: a skills and employment strategy and action plan. WELSH ASSEMBLY GOVERNMENT, Cardiff

Welsh Assembly Government (2007) Out of classroom learning: making the most of first hand experiences of the natural environment. WELSH ASSEMBLY GOVERNMENT, Cardiff

36 Forestry Commission (2009) Forestry Facts and Figures 2009 percentage quoted for EU 27 countries (excluding Russian Federation) http://www.forestry.gov.uk/pdf/fcfs209.pdf/$FILE/fcfs209.pdf

37 Based on average over last 5 years made up of 349 ha from WGS/BWW and Tir Gofal woodland creation for woods less than 0.5ha) c. 30 ha per year. New woodland created by the Plant! Scheme accounts for roughly 21 ha per annum and is excluded from the total

38 National Forest Inventory Map 2008 (based on aerial photographs from 2006)

39 Mixed woodland definition Conifer >50%%-80% 6110 ha and Broadleaved >50%-80%, NIWT II figures, 2008

40 NIWT1 survey 2002

41 UK 2005 Forecast of softwood availability

42 NIWT, 2002

43 Forestry Statistics data on hardwood removals

44 NIWT, 2002. 55% of the High Forest area in 1998 was accounted for by eight conifer species, largely in single-species, single aged stands

45 UK 2005 Forecast of softwood availability

46 Our understanding of the currently state of management practices in non-Assembly woodlands includes the following:

Less than half of the 178,000 hectares of non-Assembly woodlands have ever been part of the old Woodland Grant Scheme (Forestry Commission data)

An estimated 23% (42,000 hectares) of non-Assembly woodland in Wales has no obvious management (Gilbert, J. (2007) National Inventory of Woodland and Trees 1995-1999: Analysis of management and biodiversity data. Forestry Commission. http://www.forestry.gov.uk/inventory)

In 2005, Native Woodland plans covered only 3,028 hectares of farm woodlands (Forestry Commission Wales (2006) Woodlands for Wales Progress Report 2001-2005, Forestry Commission. 160 pp.http://www.forestry.gov.uk/forestry/infd-5nlkt7)

47 Mixed woodland definition Conifer >50%%-80% 6110 ha and Broadleaved >50%-80%, NFI figures, 2008 based on 2006 aerial photography

48 Data for Wales from the National Inventory of Woodlands and Trees (NIWT) 2000 and the Survey of Small Woodland and Trees (SSWT) 2000 (http://www.forestry.gov.uk/inventory) suggest that around 68% of native woodland in Wales is in blocks of <20 hectares, with 38% < 10 ha and 12% in blocks <2 hectares

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49 NIWT 1 survey 2002

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52 For example see: Keith, S.A., Newton, A.C., Morecroft, M.D., Bealey, C.E. and Bullock, J.M. (2009) Taxonomic homogenization of woodland plant communities over 70 years. Proceedings of the Royal Society B (doi:10.1098/rspb.2009.0938)

53 Countryside Survey, Wales results from 2007

54 Exegesis (2009) Ancient Woodland in Wales: Pilot study to assess the impact of changing the mapping basis for the Ancient Woodland Inventory. Report to the Forestry Commission, January 2009.

55 Castle, G., Latham, J. and Mileto, R. (2008) Identifying Ancient Woodland in Wales - The role of the Ancient Woodland Inventory, historical maps and indicator species. Countryside Council for Wales, Bangor.

56 Former ASNW that has been more or less completely replanted with native or non-native species and the ecological value has been degraded. The degree of loss of biodiversity varies markedly with species planted and subsequent management.

57 The result of the analysis was the production of a series of maps that showed the potential extent of habitat networks for ancient and broadleaf woodland, which are considered a high priority for conservation in Wales. The networks are divided into Core Networks (large woodland patches which are closely connected) and Focal Networks (containing smaller habitat patches and a more extensive network). Future management actions are proposed to link back to these network components. The actions reflect the need to expand action from existing Core Networks, into Focal Networks. For more information see http://www.forestresearch.gov.uk/fr/INFD-6A5BNW

58 Urban heat islands form in cities because concrete and tarmac surfaces absorb - rather than reflect - the sun's heat, causing surface temperatures and overall ambient temperatures to rise. Research demonstrating the cooling effect of green space and trees includes:

Gill, S.E. et al. (2007) Adapting Cities for Climate Change:
The Role of the Green Infrastructure. Built Environment, 33 (1) pages 115-133.
http://www.atyponlink.com/ALEX/doi/abs/10.2148/benv.33.1.115

U.S. Climate Change Technology Program (2005) Technology Options for the Near and Long Term.
A compendium (dated September 2005) of technology profiles and ongoing research and development at participating Federal agencies. Chapter 1.2.4 Urban Heat Island Technologies. Page 1.2-9.
http://www.climatetechnology.gov/library/2005/tech-options/tor2005-124.pdf

Akbari H.1; Pomerantz M.; Taha H. (2001) Cool surfaces and shade trees to reduce energy use and improve air quality in urban areas. Solar Energy, Volume 70, Number 3, 2001 , pp. 295-310(16)

Forestry Commission is planning further research on this area.
http://www.forestry.gov.uk/newsrele.nsf/WebPressReleases/B42C6B6182C73554802573910050D32C

59 Refer to the trees and Action Design Group reports including No Tree No future Nov 2008 at:
http://www.forestry.gov.uk/forestry/INFD-7KDEHU

60 Environment Agency and Forestry Commission (in press) Woodland and the Water Framework Directive (FR and ADAS)

61 Sources of further information include:
New toolkit measures the health benefits of urban trees available from:
http://www.forestry.gov.uk/fr/INFD-7MCF8G and for information on people, trees and woodlands see:
http://www.forestry.gov.uk/fr/INFD-5STBZ2

Borough Tree Strategies Published by The London Tree and Woodland Framework. Guidance for Local Authorities on Producing a Comprehensive Tree Strategy available from: http://www.forestry.gov.uk/pdf/london-tree-strategy-guidance-draft.pdf/$FILE/london-tree-strategy-guidance-draft.pdf

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A report for the Forestry Commission Wales, November 2009.

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64 Sources of further information include:

Treegeneration is an urban forestry initiative developed by Forestry Commission Wales with representatives from the Countryside Council for Wales, Wrexham County Borough Council, Flintshire County Council, Welsh Development Agency and local branches of environmental organisations including the British Trust for Conservation Volunteers and Groundwork Trust. The project aims to help improve urban areas by providing support and funding for tree planting schemes. More information on the Treegeneration project can be found here: http://www.treegeneration.org.uk/Forest Research Land Regeneration Unit - Research and advice on establishing greenspace / woodlands on brownfield land. http://www.forestresearch.gov.uk/landreclamation

Links to useful publications including downloads http://www.forestresearch.gov.uk/fr/INFD-5WPKNB

The Opportunities of Woodland on Contaminated Land, Research information note (September 2002). http://www.forestresearch.gov.uk/pdf/fcin44.pdf/$FILE/fcin44.pdf

65 Clearfelling is generally regarded as for coupes over 0.25 ha, below this threshold it can be considered that the operation could be part of a NON-CLEARFELL SYSTEMS system, group or strip felling.

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72 Hardcastle et al. (2006) A review of the potential impacts of Short Rotation Forestry LTS International. A copy of the Final Report on SRF is available from: http://www.forestresearch.gov.uk/pdf/SRFFinalReport27Feb.pdf/$FILE/SRFFinalReport27Feb.pdf

73 Ralph Harmer and Robin Gill (July 2000) Natural Regeneration in Broadleaved Woodlands: Deer Browsing and the Establishment of Advance Regeneration, FCIN 35

74 Types of mammal damage to trees and woodland (Forest Research) http://www.forestresearch.gov.uk/fr/INFD-6K4KAF

75 First found in the UK in 1953. By 1955, about 95% of rabbits in the UK were dead.

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http://www.forestresearch.gov.uk/website/forestresearch.nsf/ByUnique/INFD-678DFH

Forest Research website on Pesticide resources and information.
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Forestry Commission Edinburgh http://www.forestresearch.gov.uk/pdf/fcpg015.pdf/$FILE/fcpg015.pdf

For information on nematode treatment for pine weevil control and tree protection see:
http://www.forestresearch.gov.uk/fr/infd-6s8ggt

For information on tree protection and control of Heterobasidion annosum by PG suspension see:
http://www.forestresearch.gov.uk/website/forestresearch.nsf/ByUnique/INFD-66RFCW

79 For more information on the newly established FC GB Biosecurity Programme Board including its Membership, Terms of Reference and meeting Minutes http://www.forestry.gov.uk/website/forestry.nsf/byunique/infd-7xugl2

80 Further information on Phytophthora diseases can be found in various Forestry Commission publications including:

Brasier, C. (Oct 1999) Forestry Commission Information Note 30 Phytophera Pathogens of Trees: their rising profile
http://www.forestresearch.gov.uk/pdf/fcin30.pdf/$FILE/fcin30.pdf

Webber et al (Dec 2004) Forestry Commission Information Note 6 (revised) Phytophera Disease of Alder
http://www.forestresearch.gov.uk/pdf/fcin6.pdf/$FILE/fcin6.pdf

Brasier et al (2006) Phytophera Diseases of forest trees Forest Research - IUFRO publication.
http://www.forestresearch.gov.uk/fr/INFD-72ZDTE

81 For more information on UK pests and diseases, research programmes and their management see:
Get more from here http://www.forestresearch.gov.uk/protectingtrees

82 Brown, A and J, Webber FCRN02 June 2008 Red band needle blight of conifers in Britain
http://www.forestresearch.gov.uk/pdf/fcrn002.pdf/$FILE/fcrn002.pdf

83 Ray, D. et al. (June 2008) Impacts of Climate Change on Forests in Wales,
Forestry Commission Research Information Note 301, Forestry Commission

84 You can find more information here: UKWAS 2nd edition (2006, amended Nov 2008)
http://www.ukwas.org.uk/standard/certification_standard/index.html 3rd edition revision timetable
http://www.ukwas.org.uk/standard/revision/index.html

Data on the current area of certified woodland in Wales comes from Indicator V6 in:
Forestry Commission Wales (2006) Woodlands for Wales Progress Report 2001-2005, Forestry Commission. 160 pp.
http://www.forestry.gov.uk/forestry/infd-5nlkt7

85 This includes BWW, WGS or dedication scheme.

86 Environmental Impact Assessment (Forestry) (England and Wales) Regulations 1999
http://www.forestry.gov.uk/pdf/EIAGeneral09.pdf/$FILE/EIAGeneral09.pdf

87 For more information on the Glastir scheme, its development and progress see: http://wales.gov.uk/topics/environmentcountryside/farmingandcountryside/ruraldevelopment/axis2/glastir/glastirallwaleselement/?lang=en

88 Wavehill Consulting (2009) A survey of farmers with woodland on their land. A report for the Forestry Commission Wales, November 2009.

89 National Assembly for Wales (2009) Woodlands for Wales: The National Assembly for Wales strategy for trees and woodlands. Forestry Commission, March 2009

90 Forest Research are key partners in several European research projects including:

MOTIVE "MOdels for AdapTIVE Forest Management" - an EU-funded Seventh Framework environmental project addressing forest management and climate change. The research will develop methodologies to help foresters adapt current management practices to balance multiple-objectives under a changing climate. One of the main deliverables of MOTIVE will be an Adaptive Forest Management (AFM) toolbox. The toolbox will provide up-to-date methods for planning and decision making in AFM for use by forest managers and policy makers in strategic and tactical forest management planning. Forest Research activities are focused on a 'Regional case study' of forest areas of Wales. This is one of 10 regional case-studies across Europe that cover major forest types and bioclimatic regions within the EU. This case study will initially concentrate on using available tools and models to help integrate climate change adaptation into local forest planning in Gwydr and Clocaenog forests in North Wales. http://www.forestresearch.gov.uk/fr/INFD-7UCBJW

ForeStClim - an EU-funded environmental project addressing forests and climate change. The short name stands for "Transnational Forestry Management Strategies in Response to Regional Climate Change Impacts". http://www.forestresearch.gov.uk/fr/INFD-7PNFBV

REsource INFrastructure for monitoring and adapting European Atlantic FORests under Changing climatE (REINFFORCE) - pooling the capacity of 12 institutes to face a transnational issue, namely adaptation to climate change impacts on Atlantic forests. The project will set up tools for monitoring climate change and its impact on the Atlantic coast and test the efficiency of adaptive measures. http://www.forestresearch.gov.uk/fr/INFD-7YTC93

91 Currently 65% of timber available is Spruce. Ref. United Kingdom 2005 forecast of softwood availability all woodlands.

92 Note: Figures 1 and 2 show average climatic conditions projected for 30-year periods in the future, centred on 2050. The projections suggest a significant change in summer rainfall and evaporation in eastern and southern Wales, leading to drier summer conditions and more frequent summer drought. For many parts of west and north Wales, summer rainfall projections for 2050 are expected to maintain soil moisture through the growing season. Both figures are based on projections from the UKCIP 2002 Low- and High-emissions scenarios.

93 Note: These maps are based on the UKCIP 2002 Low- and High-emissions scenarios, and are indicative maps using low resolution soil-quality data derived from Soil Survey of England and Wales digital data at a scale of 1:250 000. For projected climatic conditions for 2080 see www.forestresearch.gsi.gov.uk/climatechangewales

94 Table summarised from Research indicating the likely impact of climate change on woodlands in Wales and the UK including:

Read, D.J. et al (2009) The Read Report The Stationary Office, Edinburgh.

Ray, D. et al. (June 2008) Impacts of Climate Change on Forests in Wales, Forestry Commission Research Information Note 301, Forestry Commission.

Broadmeadow, M. & Ray, D. (2005) Climate Change and British Woodland, Forestry Commission Information Note, June 2005, Forestry Commission. http://www.forestry.gov.uk/pdf/fcin069.pdf/$FILE/fcin069.pdf

Broadmeadow, M. (2004) A review of the potential effects of climate change for trees and woodland in Wales. Report prepared for Working Group 4 of the Wales Woodland Forum. Forest Commission.

Broadmeadow, M., (2002) Climate change - Impacts on UK forests. Forestry Commission Bulletin 125, Forestry Commission. http://www.forestresearch.gov.uk/website/forestresearch.nsf/ByUnique/INFD-5ZYHMC

Broadmeadow, M. & Ray, D. (2005) Climate Change and British Woodland, Forestry Commission Information Note, June 2005, Forestry Commission. http://www.forestry.gov.uk/pdf/fcin069.pdf/$FILE/fcin069.pdf

Broadmeadow, M., and Matthews, R. (2003) Forests, Carbon and Climate Change: the UK Contribution. Forestry Commission Information Note, June 2003. http://www.forestry.gov.uk/pdf/fcin048.pdf/$FILE/fcin048.pdf

95 All predictions on suitability are based on Ecological Site Classifications, ESC

96 Information on the conservation of forest genetic resources in a changing climate include:

Hubert & Cottrell (2007) The role of forest genetic resources in helping British forests respond to climate change. Forestry Commission Information Note no.086, June 2007. http://www.forestry.gov.uk/pdf/fcin086.pdf/$FILE/fcin086.pdf

Cottrell, J (2008) Do seed zones conserve adaptive variation? In Forest Research newsletter Ecotype no 40 Jan 2008, p.7. http://www.forestresearch.gov.uk/pdf/Ecotype40.pdf/$FILE/Ecotype40.pdf

Broadmeadow, M. & Ray, D. (2005) Climate Change and British Woodland, Forestry Commission Information Note, June 2005, Forestry Commission. http://www.forestry.gov.uk/pdf/fcin069.pdf/$FILE/fcin069.pdf

97 Extract from: Ray, D. et al. (June 2008) Impacts of Climate Change on Forests in Wales, Forestry Commission Research Information Note 301, Forestry Commission

98 Read, D.J. et al (2009) The Read Report The Stationary Office, Edinburgh.

99 The CARBINE carbon accounting model has two main objectives: i) To estimate the carbon stocks of stands and forests (in living and dead biomass and soil), and any associated harvested wood products, and ii) To estimate the greenhouse gas emissions avoided through the use of wood products that displace fossil fuels and fossil-fuel intensive materials. For more information see: http://www.forestresearch.gov.uk/fr/INFD-633DXB

100 Jaakko Pöyry Consulting (2004) Welsh Forest Industry: Mapping and benchmarking the forest industry. A report c ommissioned by the Wales Woodland Forum. http://www.forestry.gov.uk/pdf/walesjpcexecsummary.pdf/$FILE/walesjpcexecsummary.pdf

101 "From the results of the survey conducted to provide a measure of imported certified material available for sale in the UK, it is estimated that: 6.4 million cubic metres, or 55.8% of import volume is certified under the schemes named here". Measuring Timber Certification INDUSTRY SECTOR: TIMBER IMPORTING & TRADING NOVEMBER, 2006 Hence 46% is not.

102 NIWT 1 survey 2002

103 United Kingdom 2005 Forecast of softwood availability Forestry Commission Estate, FS and Private Sector

104 The Wood Energy Business Scheme 2 (WEBS 2) is a £17 million pound capital grant scheme which draws down its funding from European ERDF funds via the Welsh European Funding Office (WEFO), and will run until 2013. WEBS 2 will build upon the achievements of WEBS Objective 1 and 2 (2004/08). Its prime aim is to provide capital grant support to micro-businesses, SMEs and social enterprises to further develop the sustainable and renewable wood heat market across Wales.

105 Read, D.J. et al (2009) The Read Report The Stationary Office, Edinburgh.

106 For more information on forest plant health & protection refer to: http://www.forestry.gov.uk/forestry/infd-5azlca

107 Emerging recommendations for climate change adaptation from: Ray, D. et al. (June 2008) Impacts of Climate Change on Forests in Wales, Forestry Commission Research Information Note 301, Forestry Commission

108 Read, D.J. et al (2009) The Read Report The Stationary Office, Edinburgh

109 Valuable long-term data sets that help us to monitor trends in the environmental quality of Wales's woodlands includes National Inventory of Trees and Woodlands. http://www.forestry.gov.uk/inventory

110 EU Forest Monitoring and Forest Focus programme
http://www.forestresearch.gov.uk/website/forestresearch.nsf/ByUnique/INFD-63JHPZ
Intensive Long Term Monitoring of Forest Ecosystems Programme.
The Level II intensive monitoring programme is a vital resource to detect environmental change in UK forests and to provide the means of explaining changes in forest growth. In order to gain a better understanding of the effects of air pollution and other stress factors affecting UK forest ecosystems, long-term intensive monitoring plots covering five tree species have been established. Opportunities have been taken to build on this research network, eg to document change due to management practices, support other environmental research programmes and to provide information for wider Forestry Commission objectives, such as sustainability, soil and water quality. Of 20 intensive long term monitoring plots, three are located in Wales, at Brechfa (beech), Clocaenog (Norway spruce) and Llyn Brianne (Sitka spruce).http://www.forestresearch.gov.uk/fr/INFD-67MEVC and http://www.forestresearch.gov.uk/website/forestresearch.nsf/ByUnique/INFD-67MFFB

111 Mason, W.L., Jinks, R.L. and Harrison, A.J. 2008. An Overview of Long-term Forest Experiments in Great Britain managed by Forest Research. In: Karlsson, Kristian (eds.). 2008. Long-Term Field Experiments in Forest Research. Metlan työraportteja / Working Papers of the Finnish Forest Research Institute 105. 47 s. ISBN 978-951-40-2144-2 (PDF).

112 A forest type can be generally defined as: 'A category of forest defined by its composition, and/or site factors (locality), as categorised by each country in a system suitable to its situation' (The Montreal Process, 1998).

113 Forest types as recognised by the Ministerial Conference on the Protection of Forests in Europe (MCPFE)

114 FC Ecological Site Classification: http://www.forestresearch.gov.uk/esc

Llywodraeth Cynulliad Cymru
Welsh Assembly Government

www.cymru.gov.uk

Further information

This is one of a series of Policy Positions providing additional detail and background to the overriding themes of the Woodlands for Wales strategy. Each also contains an agenda for action which set out methods for delivering strategic aims and objectives.

You can get this publication in large print and other forms (e.g. Braille, audio tape) by contacting Forestry Commission Wales at the phone number or email address below:

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