CLIMATE CHANGE IN THE SOUTH WEST

A practical guide for woodland owners and agents

Introduction and General Factors:

Climate change is now widely accepted as being caused, at least in part, by increased emissions of carbon dioxide and other greenhouse gases (GHGs). These result from the activities of modern man. There is still much uncertainty but the effects in the SW region are likely to include:

- hotter, drier, longer summers;
- warmer, wetter winters;
- increased frequency, unpredictability and severity of extreme events including:
  - Winter storms, floods, increasing risks of wind damage and soil erosion;
  - summer droughts with increased risks of forest or heathland fires.

Research into the likely effects of climate change on woodlands and forests and on how we might best manage them, is ongoing and developing rapidly[1,2]. This leaflet should therefore be regarded as interim guidance only, which will evolve as our knowledge develops.

There are two ways in which we can address climate change. The first is through **mitigation** – reducing emissions of GHGs such as carbon dioxide and methane[3].

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1 Broadmeadow, M., Ray, D. (2005). Climate Change and British Woodland. Forestry Commission Information Note 69. Forestry Commission, Edinburgh. **2** Broadmeadow, M. (2002). Climate Change: Impacts on UK Forests, Bulletin 125. Forestry Commission, Edinburgh. (£25.00) **3** Broadmeadow, M., Matthews, R. (2003). Forests, Carbon and Climate Change: the UK Contribution. Forestry Commission Information Note 48. Forestry Commission, Edinburgh.

Above: Horner Woods, Exmoor, Somerset

Relevant areas for the woodland and forestry sector include:

- an increased use of woodfuel as a source of renewable energy;
- carbon sequestration in forest biomass through woodland expansion and growth;
- substituting wood and wood products for materials such as steel and concrete that generally have higher GHG emissions associated with their production;
- using more locally produced materials that reduce 'timber miles'.

The second is **adaptation** – changing the way that we do things to take account of the inevitable and unavoidable changes that have started and will happen during the coming decades.

This leaflet is about adaptation. It describes some of the current thinking about the most likely impacts of climate change on the woodlands and forests in our region. It also describes what actions we can take to minimise these impacts. A range of references are given which include much more detailed and technical information.

Effects on Woodlands:

Trees are already coming into leaf earlier in the year (oak flush is advanced by up to two weeks compared to the 1950s[4]) and becoming more vulnerable to late frosts. These changes to 'nature's calendar'[5] are now seen across the natural world and have the potential to affect the synchrony between species; for example the availability of caterpillars as food for later nesting birds such as blue tits and chaffinches. Many woodland-dwelling species will need to migrate northwards, or 'up the hill' to stay in their climatic niche but may be prevented from doing so by their own immobility (in the case of many woodland plants and invertebrates) or by barriers, either physical or ecological. For example, Exmoor upland oak-wood species are constrained by the absence of adjacent higher ground and the Bristol Channel.

There will also be changes in the ability of species, including tree species, to compete with each other on a particular site. Those currently near the southern edge of their ranges will be most disadvantaged, for example due to water stress in drier conditions. Similarly those with a long life cycle, such as trees, will be disadvantaged in relation to those with a short life cycle which may be better able to adapt to the changing conditions.

The incidence and severity of tree diseases and pest outbreaks may well be affected too, with the results being difficult to predict. Stressed trees are more susceptible to pathogens and many current and potential insect pests are expected to benefit from climate change. In future, outbreaks of current nuisance pests and diseases may be more severe and/or long lasting.

Wind patterns too may change, with an increased risk of wind damage to trees on waterlogged winter soils or from an increased frequency of extreme events.

Hotter, drier summers will increase the fire hazard in woodlands as vegetation dries and dies back before the winter rains begin[6].

Warmer winter temperatures may not meet the chilling requirements to break the dormancy of some tree species for successful germination, thus affecting natural regeneration. However, the viability of seeds of some species such as small leaved lime may well improve with increased summer warmth.

In most cases, the impacts of climate change will manifest themselves gradually and abrupt changes will not be apparent

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4 Broadmeadow, M., Ray, D. (2005). Climate Change and British Woodland. Forestry Commission Information Note 69. Forestry Commission, Edinburgh. **5** UK Phenology Network www.phenology.org.uk **6** Broadmeadow, M. (2004). The Potential Effects of Climate Change for Trees and Woodland in the South West. www.forestresearch.gov.uk/pdf/cchg_SW_climate_change.pdf/$FILE/cchg_SW_climate_change.pdf

though extreme events like storms and droughts will be more frequent. Trees are generally robust and simply following good practice guidance will provide some resilience against climate change. However, some rare woodland species and/or those with poor powers of dispersal, particularly those found in ancient woodland, will be under pressure. There are some 'no-regret' or 'win-win' adaptive actions that could be implemented from now on – some are suggested in the following sections. It should however be borne in mind that decisions and actions made now must be appropriate to the climate of both the present and the future and that, where possible, it will be beneficial to keep options open for as long as possible.

Above: Native woodland, North Cornwall PHOTO: GUY CRACKNELL

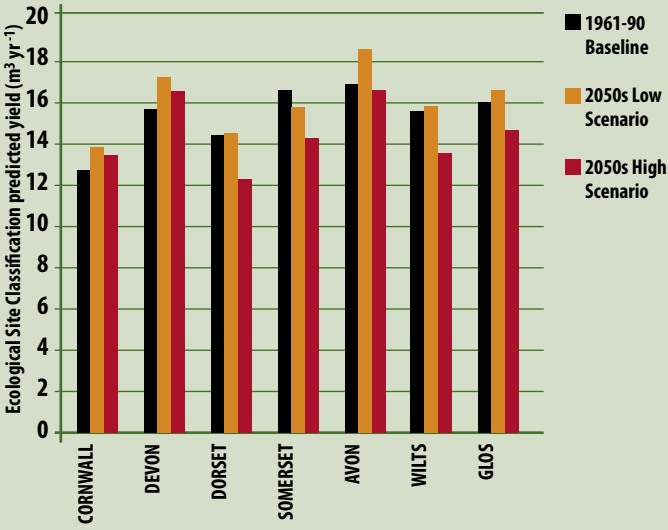
Species and Provenance Choice:

For commercial timber growing, judgements such as site suitability and timber marketing prospects govern species and provenance choice. It will now also be necessary to consider which species and/or provenance will be best able to cope both with existing conditions and with the changing climate expected over the rotation[7]. The commercially viable range of some species within the region may change, especially in the drier east, or they may require different site characteristics, such as sites with improved water retention, or a north-facing aspect.

For example, Douglas fir is predicted to become more suitable in the west but less suitable in the east of the region - see graph overleaf.

7 Future Species Suitability: www.forestresearch.gov.uk/fr/INFD-5ZXFSD

Douglas fir productivity in the South West



Source: Mark Broadmeadow, Forestry Commission

Pedunculate oak is predicted to become the most suitable species in much of the east of the region, in favour of beech, ash and sessile oak. Sweet chestnut is one broadleaved species for which productivity is predicted to rise, particularly in the east[8] of the region.

Research is suggesting however, that there is more genetic diversity within a provenance than was previously realised. This may mean that there is sufficient variation available to cope with the changing conditions.

When planting **new native woodlands**[9], a balance will have to be struck between the recommendation to use locally sourced native species[10] and the need to make woodlands more resilient to changing climatic conditions. This may, for example, justify the inclusion of a more southerly and drier provenance.

When extending or regenerating **ancient woodlands**, current policy[11] should guide actions. The use of provenances from outside the locality may be a valid way of building in adaptability to climate change. Care should be taken to ensure compatibility between the planting site and the site of seed origin. This should help ensure the seed is adapted to a particular site type.

8 Broadmeadow, M. (2004). The Potential Effects of Climate Change for Trees and Woodland in the South West.
9 Rodwell, J. and Patterson, G. (1994). Creating New Native Woodlands. Bulletin 112. Forestry Commission, Edinburgh.
10 Herbert, R., Samuel, S., Patterson. G. (1999). Using Local Stock for Planting Native Trees and Shrubs. Forestry Commission, Edinburgh.
11 Managing Ancient and Native Woodland (2006) Forestry Commission. In production.

Owners should therefore:

- Seek the latest advice from the Forestry Commission on species choice and mixtures;
- Ensure that where a species is already at the drier end of its climatic range it does not represent a major part of the species mixture;
- Carefully consider site characteristics when planning planting operations. For example, for species at the drier end of their climatic range, identify moisture retentive soils or more northerly aspects;
- Consider planting mixtures with at least three main species, rather than single species stands;
- Where appropriate, widen the genetic base used. Consider provenance mixtures including both local origin and more southerly and drier provenances but obtaining seed from similar site types where possible.

Size, Linkage and Buffering – Working at the Landscape Scale:

In order to enable species to survive, adapt and move across the landscape, it is important that core areas of woodland and other semi-natural habitats are protected and extended[12,13] . Woods and other habitat areas need to be bigger and better linked. It is therefore important to plan on a landscape scale, as well as managing, protecting and buffering existing individual woodlands, especially ancient ones, in order to maintain their integrity and ecological resilience. In the South West, the Nature Map is being developed to promote biodiversity on a landscape scale[14] and alongside this Ancient Woodland Priority Areas are being developed. Landscape scale management will mean working to make the largely agricultural land between woodlands and other habitats more sympathetic to species dispersal. Owners should therefore:

- Look to promote woodland creation adjacent to existing ancient woodland, and/or create other semi-natural habitats;
- Identify and develop 'habitat networks', enabling the targeting of woodland creation or the conversion to less intensive land uses to promote species dispersal.

12 Watts, K., Humphrey, J.W., Griffiths, M., Quine, C., Ray, D. (2005). Evaluating Biodiversity in Fragmented Landscapes: Principles. Forestry Commission Information Note 73. Forestry Commission, Edinburgh. **13** Woodland Trust. (2002). Space for Nature: Landscape Scale Action for Woodland Biodiversity. www.woodlandtrust.org/publications **14** www.swenvo.org.uk/nature_map/nature_map.asp#purpose

New Woodland, Water and Soils:

Woodland creation may have an important role to play in helping to limit some of the impacts of climate change. For example, floodplain woodland can help to alleviate downstream flooding, riparian woodland can help to protect fish populations by maintaining lower water temperatures[15]. Woodland can also reduce soil erosion[16] and pollution from agriculture. Owners should therefore:

- Consider flood alleviation benefits of new floodplain woodland and seek advice from the Environment Agency (Tel: 08708 506506);
- Consider pollution, shade and soil erosion control benefits of new riparian woodland.

Woodland and Forest Management:

The longer growing season, higher temperatures, and beneficial effects of higher carbon dioxide levels in the atmosphere are expected to lead to increased tree growth, at least over the coming 30-40 years and in the west of the region. Conversely, increased pest and disease risk and the greater likelihood of summer droughts, particularly in the east of the region, may increasingly counteract this effect as climate change progresses. The balance between the positive and negative effects on growth will need to be monitored, with management e.g. thinning frequency, responding as necessary.

The planting season may be shortened. The window for planting may be affected by spring/early summer drought and dormancy occurring later in the autumn. Early winter (after the onset of dormancy) planting may become increasingly beneficial and consideration may be needed for the use of containerised stock, i.e. plants grown from seed in 'plugs', rather than bare rooted.

Predictions of heavier winter rainfall and the increased likelihood of storms will mean that soils are waterlogged for longer periods, limiting access for management activity in order to protect soil structure. Bringing forward management activity to drier months may help protect heavy soils but will need to be balanced against possible impacts on wildlife. Drainage systems may need to be more robust to avoid flood damage.

Drier summers generally and the increased likelihood of summer droughts may increase fire risk, particularly in urban and peri-

15 Forests and Water Guidelines (4th Edition) (2003) Forestry Commission. Edinburgh
16 Nisbet, T., Broadmeadow, S., Orr, H. (2004) A Guide to using Woodland for Sediment Control. Forest Research. Farnham.

urban woods. The age structure of a woodland e.g. thicket stage conifer plantations, may be an equally important factor in fire susceptibility. Owners should therefore:

- Monitor increment and adjust management accordingly;
- Consider changing the annual cycle of management activity, limiting access of heavy machinery to summer/autumn, particularly on heavy soils;
- Follow existing good practice guidance;
- Adopt early winter planting if and when establishment losses are significant;
- Ensure that forest roads and culverts can accommodate predictions of higher winter rainfall and storms;
- Assess the risk of increased incidence of fire and take appropriate precautions.

Mammals:

It is likely that many mammals will benefit from both warmer winters and increased food supplies, two of the factors influencing their population. Deer, rabbits and voles are expected to benefit from the improved spring forage likely to be available and grey squirrels are likely to benefit from increased seed supplies in autumn. Owners should therefore keep protection measures[17,18,19] under review and adjust them as necessary to ensure that potentially damaging populations do not become established.

Above: Field Vole

17 Mayle, B., Pepper, H., Ferryman, M. (2004). Controlling grey squirrel damage to woodlands. Forestry Commission Practice Note 4 (Revised). Forestry Commission, Edinburgh. **18** Mayle, B. Managing Deer in the Countryside (1999) Forestry Commission Practice Note 6. Forestry Commission. Edinburgh. **19** Hodge, S. & Pepper, H. (1998). The prevention of mammal damage to trees in woodland. Forestry Commission Practice Note 3, Forestry Commission, Edinburgh.

Insect Pests:

Existing pests such as the green spruce aphid and some bark beetles are likely to benefit from milder winters and hotter summers. Species from warmer climates including the gypsy moth and Asian longhorn beetle are regularly being intercepted and could establish here. Emerald ash borer has appeared in the US from Asia and there is a risk of accidental introduction to the UK. Owners should therefore:

- Maintain awareness of current and potential future insect pests and diseases (see information and contacts on www.forestry.gov.uk/planthealth);
- Maintain vigilance and effective monitoring to ensure that potentially damaging populations do not become established;
- Inform the Forestry Commission of any suspected new and/or severe pest and disease outbreaks;
- Plant mixtures to maintain woodland cover in the event of pest or disease outbreaks specific to single tree species.

Above: Asian longhorn beetle

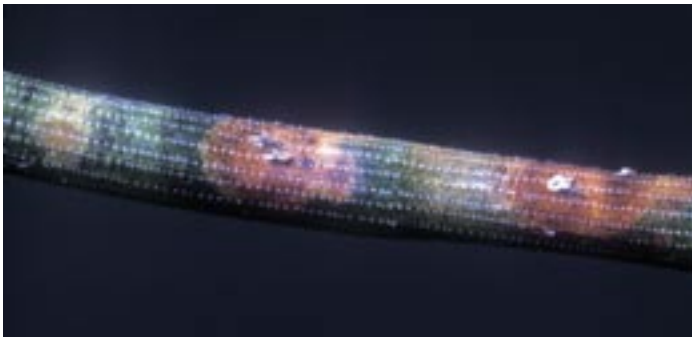
Pathogens (Bacteria, Viruses, Fungi):

Stressed trees are more vulnerable to pathogens and with summer droughts likely to become more severe and commonplace as a result of climate change, a range of existing fungal pathogens may become more damaging. Some pathogens may also extend their range into the South West due to climatic conditions. For example, infection by soil-borne Phytophthora species is promoted by fluctuating water tables,

while a range of opportunist pathogens such as sooty bark disease of sycamore are also likely to benefit.

Red band needle blight[20] affects many species of pine and infections often correlate with wet spring weather. This is a 'quarantine organism' and if suspected, the Forestry Commission's Plant Health Service must be contacted (plant.health@forestry.gsi.gov.uk).

Owners should maintain vigilance, and seek advice where unknown factors are affecting tree health. Forest Research operates the Tree Disease Diagnostic and Advisory Service (charges apply).



Above: Red band needle blight

Conclusion

The reality of climate change is becoming increasingly accepted. Our knowledge of the related impacts and how best to respond to them is developing rapidly. Advice given today may be superseded tomorrow – yet woodland and forest owners have always to think long-term.

Perhaps the best advice is to adopt the precautionary approach and to plan for several eventualities – the 'no regret' option. Most trees will continue to thrive; some may do particularly well, others may suffer. Prediction of the future is always a risky business. The prudent woodland owner will aim to reduce risks and stay well informed about the latest research.

If you require further information and guidance, please contact the Forestry Commission on 01626 890666. We will do our best to assist.

20 Brown, A., Rose, D,. Webber, J. (2003) Red Band Needle Blight of Pine. Forestry Commission Information Note FCIN 49. Forestry Commission. Edinburgh

General Sources of Information:

1) **www.forestresearch.gov.uk** – Particularly 'Woodland and the Environment' has a wide range of technical and non-technical data.
2) **www.forestry.gov.uk** – Information and links about establishment and management.
3) **www.defra.gov.uk/environment/climatechange/index.htm** – Defra's climate change information.
4) **www.ukcip.org.uk** – information on climate change scenarios for the UK; regional and sector reports.
5) **www.oursouthwest.com/climate** – Southwest Climate Change Impacts Partnership.
6) **www.defra.gov.uk/environment/climatechange/uk/adapt/policyframe.htm** Climate change adaptation policy framework – what we are doing in the UK to prepare ourselves for climate change.

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Working together

Forestry Commission England

FTA Forestry & Timber Association

Government Office for the South West

Dartmoor National Park

Natural England

RAC

Exmoor National Park

South West Climate Change Impacts Partnership (SWCCIP)

Environment Agency

Woodland Trust