

# Climate change action plan

2009-2011



There is still time  
to avoid the worst  
impacts of climate  
change, if we take  
strong action now.

*Stern Review 2006*



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## Preface and Introduction

**Climate change is one of the single biggest threats facing us all and a sense of urgency is needed if we are to tackle it effectively.**

As part of the Scottish Government's commitment to tackling climate change, we are preparing to deliver the challenging target of reducing Scotland's greenhouse gas emissions by 80% by 2050. We also want to see 50% of all Scotland's electricity produced from renewable sources by 2020. Furthermore, we must help Scotland adapt to climate change if we are to create a more successful country based on sustainable economic growth.

The 2006 Stern Review highlighted the potential role of forestry and the benefits of strong, early action. Forestry has a crucial role, with global deforestation being part of the problem, and reforestation and use of forest products being an important part of the solution at a national and international level. Forestry also has a key role in helping society adapt to unavoidable changes in our climate. As identified in the Scottish Forestry Strategy, Scotland's forests are one of our greatest natural assets and their potential in the fight against climate change is huge. To realise that potential to the full will require innovative and imaginative actions.

This action plan describes what Forestry Commission Scotland will do to increase the contribution and response of Scottish forestry to the challenges of climate change. It focuses on what needs to be done both as early actions and to increase future preparedness. But knowledge about climate change, and the evidence base for forestry's role in helping to tackle it, is advancing quickly. This action plan will therefore be reviewed in 2011.

**Michael Russell, Minister for Environment**  
January 2009

The 'Actions' listed in this plan are expected to be substantially delivered, or in the case of longer-term projects, substantially underway, by December 2011. Where an earlier completion date is envisaged this is indicated in brackets.



## Climate change predictions for Scotland

A *handbook of climate trends across Scotland* (SNIFFER<sup>1</sup>) gives a comprehensive account of climate change over the last century. During the last 40 years temperatures have increased in every season, in all parts of Scotland. In the north and west, rainfall has increased by almost 60% in winter months.

Climate change scenarios for the UK have been developed by the UK Climate Impacts Programme (UKCIP02)<sup>2</sup> up to the 2080s. Although currently based on averages rather than potential extremes, the projections for Scotland are:

- Warming of up to 0.5°C/decade, with the greatest warming in the autumn.
- An increase in the length of the growing season of between 20 and 60 days, greater in the east than the west.
- Although overall precipitation may show little change, there are likely to be more marked seasonal differences in precipitation between summer and winter, particularly in the east. Summers are likely to be drier and winters wetter.
- Winter snowfall may reduce by 50%, and up to 70% in eastern Scotland.
- An increasing number of very hot days and a decrease in the number of very cold days.
- Potential increases in severe storm and rainfall events, particularly in the east.
- Summer droughts, winter flooding and waterlogging to become more commonplace.
- Higher evapotranspiration than at present due to increased temperature.
- A declining number of frost days.

The Forestry Commission Information Note titled *Climate Change and British Woodlands*<sup>3</sup> explains how these environmental changes may affect the growth of trees, including the distribution of individual species, and the implications for woodland practice.

Revised climate change projections (UKCP09<sup>4</sup>) will soon be published and will provide probabilistic climate projections. This will enable a more sophisticated approach to risk management. The above predictions will be reviewed in the light of this new information.



<sup>1</sup>[www.sniffer.org.uk](http://www.sniffer.org.uk)

<sup>2</sup>[www.ukcip.org.uk](http://www.ukcip.org.uk)

<sup>3</sup>[www.forestry.gov.uk/publications](http://www.forestry.gov.uk/publications)

<sup>4</sup>[www.ukcip.org.uk/index.php?option=com\\_content&task=view&id=163](http://www.ukcip.org.uk/index.php?option=com_content&task=view&id=163)

# The role of forestry

The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) 2007<sup>5</sup> gave significant weight to the role of forestry in helping to tackle climate change. It stated:

“Forestry can make a very significant contribution to a low-cost global mitigation portfolio that provides synergies with adaptation and sustainable development.”

The world’s forest sector can help tackle climate change through six simple measures: protecting what we already have; reducing deforestation; restoring forest cover; using wood for energy; replacing other materials with wood; and planning to adapt to our changing climate.

This action plan lays out how forestry in Scotland can contribute to tackling climate change and will serve as a focus for Forestry Commission Scotland actions on:

- Protecting and managing existing forests through sustainable forest management, conserving carbon stocks, and minimising woodland removal;
- Creating new woodland to capture carbon, produce wood and help adaptation;
- Adapting to climate change by planning and managing forests and woodlands in a way that minimises future risks from climate change, for example through the creation of forest habitat networks, and using different timber species, including hardwoods, or silvicultural systems;
- Promoting the use of sustainably produced wood for energy and construction;
- Reducing the forestry sector’s carbon footprint;
- Raising awareness and understanding of climate change and how forestry can make a positive contribution; and
- Measuring progress.

In setting out the actions it will take to tackle climate change Forestry Commission Scotland recognises the pivotal role of the non-state forestry sector (which owns and manages two thirds of Scotland’s forest and woodland resource) in helping to achieve the plan’s purpose. Effective integration with other land use interests, particularly at regional and local level, will also be a crucial factor in the successful delivery of mitigation and adaptation measures for Scotland. The new generation of Indicative Forestry Strategies (see page 15), coupled with guidance from Regional Forestry Forums, can help steer this process.

Forestry Commission Scotland, Scottish Natural Heritage, the Scottish Environment Protection Agency and Historic Scotland will continue to work closely with each other to develop synergies during the development and implementation of their respective climate change action plans.



<sup>5</sup>[www.ipcc.ch](http://www.ipcc.ch)

# Protecting and managing existing forests





# Sustainable forest management

## Summary of priorities

- Support completion of the revised UK Forestry Standard and associated guidelines, ensuring that it provides a clear framework for forestry's contribution to the challenges of climate change.

Sustainable forest management in Scotland is defined by the UK Forestry Standard<sup>6</sup>. This sets out legal requirements and sets the standards of good forest practice. It is used to assess whether forestry proposals and management activities meet these requirements, and guides those managing forests. By implementing the Standard, managers can demonstrate that their forestry activity is both legal and sustainable. It is the basis by which the UK reports to international forestry processes and it underpins the Scottish Forestry Strategy. The UK Forestry Standard also provides a basis from which the independent UK Woodland Assurance Standard<sup>7</sup>, used for voluntary independent certification, was developed.

The UK Forestry Standard and associated guidelines are currently undergoing revision. This will draw out more clearly the legal obligations of forest managers and the management standards expected as part of good forestry practice. The revised Standard will also identify woodland management practices that can contribute to tackling the impacts of climate change. This will be set out in a new guideline on 'Forests and Climate Change'.



## Actions

- Help revise the UK Forestry Standard and associated guidelines and ensure they fully reflect forest management requirements in Scotland and lay out systematically how forestry can increase its contribution to tackling the impacts of climate change.

<sup>6</sup>[www.forestry.gov.uk/publications](http://www.forestry.gov.uk/publications)

<sup>7</sup>[www.ukwas.org.uk](http://www.ukwas.org.uk)

# Protecting and managing existing forests

## Minimising woodland removal

### Summary of priorities

- Implement measures to avoid inappropriate woodland removal in Scotland.
- Establish procedures to monitor woodland removal.



Globally, forest cover has reduced from 50% to 30% of the world's land area over the last century and now stands at about 4 billion hectares. Net annual forest loss between 2000-2005 has been 7.3Mha compared to 8.8Mha annually between 1990-2000. Deforestation now comprises 18% of the world's greenhouse gas emissions (compared to 25% from electricity and heat generation, 14% from transport and 13% from agriculture).

Concerns about climate change have strengthened the need to halt global deforestation, particularly in relation to tropical rainforests, and have also highlighted the need to better control woodland removal in countries undergoing reforestation, such as Scotland.

In Scotland, extensive deforestation has occurred since prehistoric times due to human actions, and by 1900 only about 5% of our land cover was woodland, of which less than one half comprised semi-natural woodland. Reforestation during the 20th century increased the resource to 17% of land area (1.3Mha) by 2005. About one third of this comprises native species. Since 1990 there have been significant woodland removals associated with landscape design, restoration of priority habitats, wind farms and other types of development. The National Forest Inventory of Great Britain<sup>8</sup> (2009/2010) will enable the scale of change to be assessed. More specifically, the Native Woodland Survey of Scotland<sup>9</sup> will give a firm baseline for native and ancient woodland, and will also estimate recent losses.

The Forestry Act 1967 (as amended) is the basis for the regulation of felling through the felling licence system. Other statutory powers apply to sites designated for their special interest and to development. 'Deforestation' also comes within the scope of the Environmental Impact Assessment (Forestry) (Scotland) Regulations 1999. Woodland removal resulting from a lack of active management, or from overgrazing, is managed primarily through advice and incentives rather than regulatory powers.

In 2008, Forestry Commission Scotland published its policy on the control of woodland removal<sup>10</sup> to provide a strategic framework for appropriate woodland removal, to support the maintenance and expansion of forest cover in Scotland, and to help achieve an appropriate balance between forested and non-forested land.

<sup>8</sup>[www.forestry.gov.uk/inventory](http://www.forestry.gov.uk/inventory)

<sup>9</sup>The Native Woodland Survey of Scotland commenced in November 2006 as a five-year project to determine the location, extent and condition of native woodlands in Scotland

<sup>10</sup>[www.forestry.gov.uk/woodlandremoval](http://www.forestry.gov.uk/woodlandremoval)



The policy identifies a number of guiding principles:

- There is a strong presumption in favour of protecting Scotland's woodland resources, with support for woodland removal only where, on balance, it would achieve significant and clearly defined additional public benefits. In appropriate cases, a proposal for compensatory planting may form part of that balance.
- Approval for woodland removal should be conditional on the undertaking of actions to ensure the full delivery of the defined, additional public benefits.
- The Scottish Government will encourage the application of planning conditions and agreements to mitigate the environmental impacts of development-related woodland removal.
- Where felling is permitted but woodland removal is not supported, conditions conducive to woodland regeneration should be maintained through adherence to good forestry practice as defined in the UK Forestry Standard.



## Actions

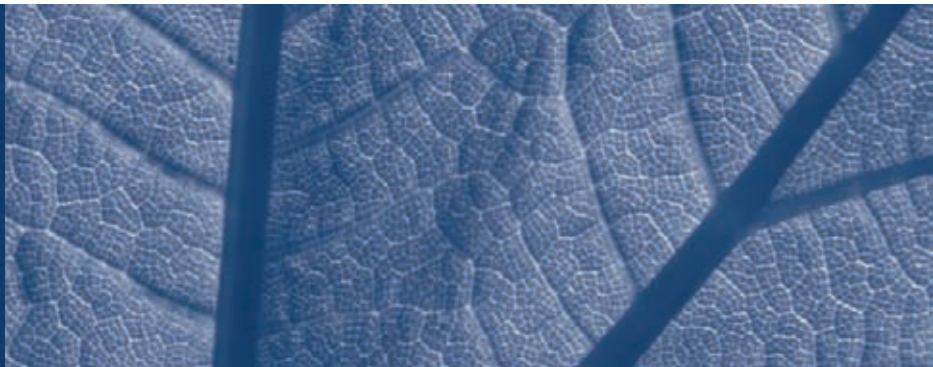
- Publish detailed guidance on implementing the policy on the control of woodland removal in Scotland (2009).
- Promote the policy on the control of woodland removal through the National Planning Framework, Scottish Planning Policy and associated guidance notes.
- Facilitate progress of the National Forest Inventory of Great Britain to provide updated information on woodland cover in Scotland.
- Establish a process for recording and monitoring known woodland losses (2009).

# Protecting and managing existing forests

## Conserving forest carbon stocks

### Summary of priorities

- Promote the use of silvicultural systems and practices that safeguard carbon stocks.
- Minimise civil engineering related carbon losses.



### Promoting the use of silvicultural systems and practices that safeguard carbon stocks

Carbon accumulating in forest biomass and soils is liberated through organic matter decomposition and, in some instances, by burning. As forests develop they tend to be net accumulators of carbon. Eventually, sometimes after several centuries, forests are thought to approach a steady state where emissions balance sequestration. Management interventions in forests alter this natural dynamic.

Within the wider context of sustainable forest management, the main silvicultural components of forest carbon conservation practice are:

- ground preparation and tree establishment, matched to site types, to conserve soil organic matter, this including the appropriate encouragement of natural regeneration;
- thinning, where possible, to maintain stand growth and long term carbon uptake; and
- harvesting and restocking practices that promote long term carbon storage.

In appropriate situations these components can be delivered through lower impact silvicultural systems (LISS) such as continuous cover forestry. In other situations, silvicultural practices associated with clear-felling systems can be modified readily to better safeguard forest carbon. The revised UK Forestry Standard and associated guidelines will describe management techniques for forest carbon conservation.

### Actions

- Publish the 'Forests and Climate Change' guidelines and revise the 'Forests and Soils' guidelines.
- Assist Scottish Government colleagues develop a Scottish Soils Framework.
- Summarise the key information on the stocks and fluxes of carbon in UK forests and how they are affected by forest dynamics and management practices (2009).
- Develop a carbon balance sheet methodology for Scottish forestry options consistent with established carbon accounting protocols (2009).
- Publish guidance on the role of LISS in Scotland as a climate change adaptation measure and encourage the alignment of land use incentives to support its expansion and management (see also page 22).
- Publish interim guidance on site selection for stump harvesting (2009).
- Establish good practice guidance for forest carbon conservation and incorporate in the revision of the UK Forestry Standard and associated guidelines.



## Minimising civil engineering related carbon losses

Forest road building, quarrying and other forest based civil engineering operations cause site disturbance, which can lead to locally accelerated breakdown of soil carbon. Planning and implementing civil engineering projects to minimise such site disturbance, for example through good forest road route planning or techniques to reduce road-stone requirements, can reduce carbon losses.

### Action

- Develop industry-wide guidance on minimising carbon losses in forest based civil engineering.

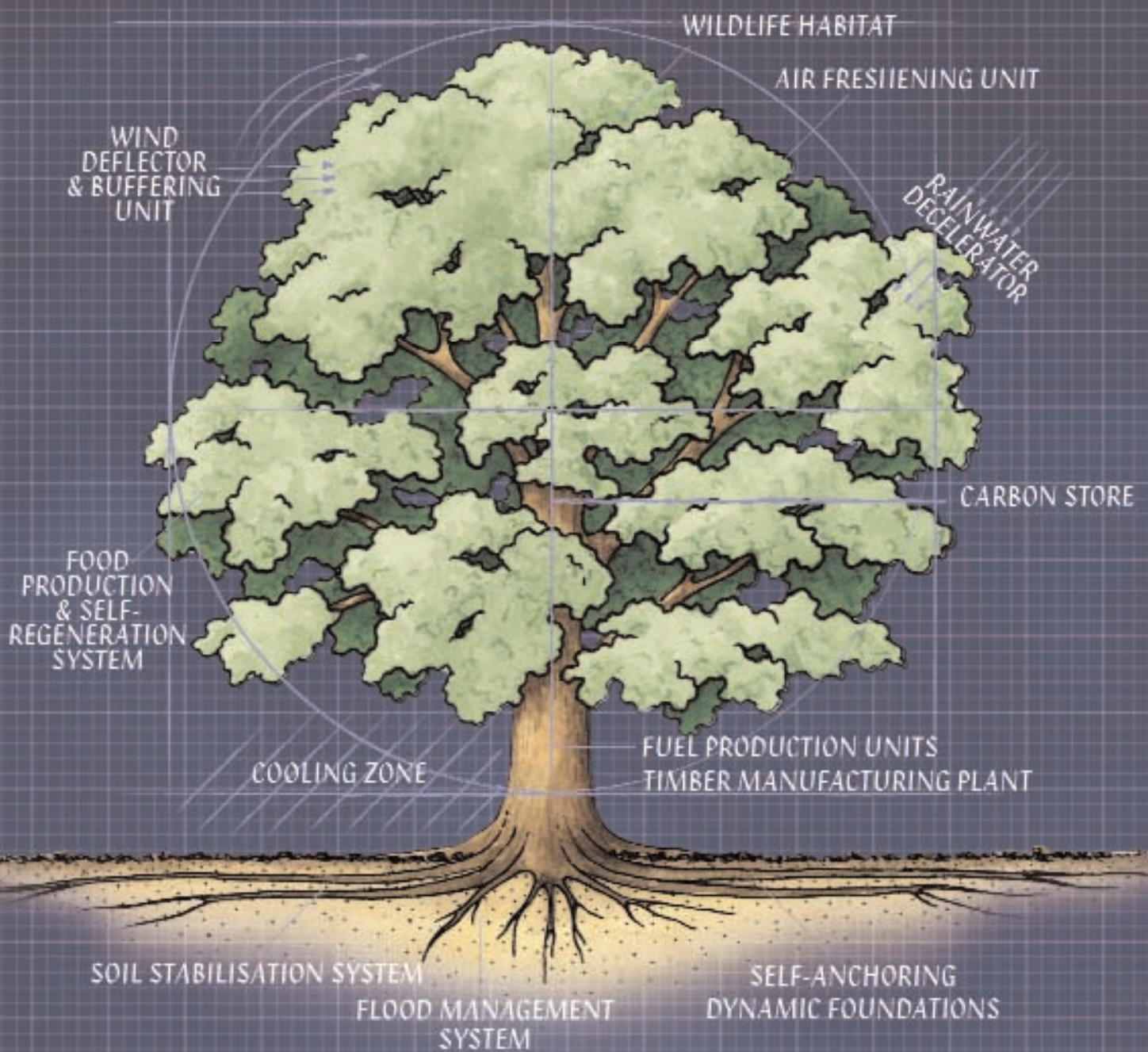


### Example of action

- The Forestry Commission's Science and Innovation Strategy for British Forestry (2005) made 'changing silviculture' one of eight strategic research priorities in recognition of the need to adapt silvicultural practices to changing climate and objectives. The resulting research programme supports a network of demonstration sites and forest transformation experiments on the national forest estate throughout Britain.



# Woodland creation





# Carbon sequestration through woodland creation

## Summary of priorities

- Encourage the creation of woodlands where this will contribute to carbon sequestration.
- Ensure guidance on woodland creation takes into account climate change considerations.
- Establish a robust carbon sequestration monitoring framework.



Managed sustainably, many types of woodland creation can contribute towards net emissions reduction in addition to their other well documented multi-purpose benefits. Scotland's Climate Change Programme recognises this contribution and the Scottish Forestry Strategy includes an aspiration to achieve 25% woodland cover in Scotland by the second half of this century. This will require the creation of about 10,000 ha of new woodlands each year.

Delivery mechanisms are being put in place to encourage woodland creation. The 2007 three-year spending review allocated resources to achieve this target, principally through the new Rural Development Contracts grant mechanism, and in part through increased planting activity on the national forest estate.

The Scottish Government's Rationale for Woodland Expansion<sup>11</sup> sets out a number of woodland creation priorities for Scotland that could deliver benefits for: climate change mitigation; economic and rural development; biodiversity and the wider environment; and community and urban regeneration.

The Rationale also sets out the wider land use challenges of woodland expansion, notably: the need to focus away from deep peats (organic soils in Scotland account for about 75% of the UK's total soil carbon stock); the probability that concerns about food security and affordability will lead forestry towards lower quality agricultural land; the need to plan and prioritise efforts to protect historic features and to create functional habitat networks in relation to woodland, open habitats and priority species; and the wider aspects of land use balance.

## Actions

- Clarify the drivers for new woodland creation in urban and rural areas as a contribution to the Scottish Government's wider Rural Land Use Study (2009).
- Promote national coverage of a new generation of Indicative Forestry Strategies<sup>12</sup> through revised national planning guidance (2009) and partnership support to local authorities, ensuring these fully reflect climate change adaptation and mitigation considerations, and catchment based approaches to water and flood management.

(Continued overleaf)

<sup>11</sup>[www.forestry.gov.uk/woodlandexpansion](http://www.forestry.gov.uk/woodlandexpansion)

<sup>12</sup>[www.scotland.gov.uk/publications/1999/04/circular-9-1999-root/circular-9-1999-strategy](http://www.scotland.gov.uk/publications/1999/04/circular-9-1999-root/circular-9-1999-strategy)



# Woodland creation

## Actions (continued)

- Help implement new woodland creation support measures through Rural Development Contracts, using regional prioritisation to focus resources on highest priority situations, including climate change considerations.
- Monitor uptake of Rural Development Contracts and, if necessary, suggest adjustments to promote creation of the desired range of woodland types.
- Purchase sufficient land to enable an annual programme of 2,000 ha of appropriate public benefit woodland creation on the national forest estate.
- Explore other complementary measures to facilitate the desired pace of forest expansion.
- Establish a robust carbon sequestration monitoring and reporting framework, working with CEH<sup>13</sup> over model refinement (2009).



## Example of action

In 2006, as part of the Forestry Commission Scotland carbon sequestration project, Forest Enterprise Scotland embarked on a three-year, 3,000 ha woodland creation programme. One of the first schemes was the purchase of 218 ha of better quality agricultural land at East Grange in Fife, this including 134 ha of arable land, and will result in some 125ha of planting on low carbon soils, as well as creation of an energy forestry research and demonstration facility.

<sup>13</sup>Centre for Ecology & Hydrology: [www.ceh.ac.uk](http://www.ceh.ac.uk)



# Establishment of energy crops

## Summary of priorities

- Through research, demonstration and grant support, encourage adoption of short rotation forestry and short rotation coppice for wood energy production.



In addition to wood fuel derived from thinnings, brash and co-products, interest in woody energy crops is increasing as part of the drive to reduce Scotland's dependency on fossil fuels. Use for heat, or for combined heat and power, is the most carbon-efficient way of utilising such crops. Establishment of short rotation coppice (SRC) has been on a small scale to date, and that is unlikely to change significantly with current agricultural economics. However, the emergence of functioning markets is expected to stimulate additional activity, particularly when higher Renewable Obligation Certificate (ROC) banding for electricity generation from energy crops is implemented in Scotland. This activity is likely to be focused on the more marginal improved ground where short rotation forestry (SRF) may provide a better alternative to SRC. While largely untried in the UK and Scottish energy crops context, SRF systems use well-established forestry knowledge and techniques.

The 2008 Wood Fuel Task Force report<sup>14</sup> identified a number of barriers to increasing wood fuel supply from energy crops. These were addressed in its recommendations:

- improve and disseminate knowledge on the potential for SRC, particularly on more marginal ground;
- develop support mechanisms, through grants and buyer contracts, to bridge the initial SRC establishment period;
- support favourable ROC banding for biomass and SRC in Scotland; and
- research short rotation forestry establishment, species choice, economics of production and environmental impacts, and demonstrate operational short rotation forestry production systems.

## Action

- Implement the agreed recommendations of the Wood Fuel Task Force to encourage adoption of SRF and SRC for wood energy production.
- Establish a network of energy forestry demonstration sites on the national forest estate.

<sup>14</sup>[www.forestry.gov.uk/woodfueltaskforce](http://www.forestry.gov.uk/woodfueltaskforce)

## Regularising the woodland carbon offsetting sector

### Summary of priorities

- Develop a consistent, verifiable and transparent framework for woodland carbon offsetting.

Companies and organisations with a commitment to the environment have long been involved with initiatives to create woodlands for delivering environmental and community benefits – part of a sphere of activity known as corporate and social responsibility (CSR). In recent years this interest has extended to include offsetting carbon emissions either corporately or on behalf of customers. There have been a wide variety of schemes, with varying offers and different carbon offset prices. Some schemes are opaque as to what precisely is being bought, the degree of additionality, and the approach to permanence issues.

Carbon offsetting through UK forestry can be of value when used in conjunction with strategies for reducing emissions. However, a consistent, verifiable and transparent framework is required for this activity and the Forestry Commission is therefore working with stakeholders to regularise the woodland carbon offsetting sector.

Actions defined in previous sections aim to:

- establish good practice for carbon conservation in forests within the context of sustainable forest management;
- facilitate development of a code of good practice for carbon offsetting using UK forestry; and
- establish a robust carbon sequestration monitoring and reporting framework.





## Action

- Revise the UK Forestry Standard and guidelines as a basis for the development of a code of good practice for woodland carbon offsetting.
- With stakeholders, develop and promote a code of practice for woodland carbon offsetting.



## Example of action

- In 2008 the Forestry Commission formed a Carbon Advisory Group with internal and external membership to provide expert advice to the Commission on developing a framework for woodland carbon management and emissions offsetting.



# Adapting to climate change





# Facilitating ecological adaptation

## Summary of priorities

- Promote effective woodland habitat connectivity to help increase ecological resilience.
- Promote appropriate woodland management in core habitat networks.
- Focus on the most vulnerable woodland types.
- Increase the contribution of plantation origin woodlands.
- Develop a better understanding of key species responses, and adapt priorities and management strategies accordingly.
- Improve understanding of the implications of climate change for genetic conservation.

## Promoting effective woodland habitat connectivity

Since prehistory, native woodland cover and other habitats have been fragmented by human actions – such as grazing of livestock, clearance for agriculture, timber exploitation, and urban expansion. Many remaining woodlands have become virtual ‘islands’, restricting the mobility of some specialist woodland species or their ability to adapt genetically, and therefore hindering ecosystem adjustments in response to climate change. A key need is to build their capacity to respond and adapt to change<sup>15</sup>, and to build their resilience to environmental incidents and natural hazards.

A key approach to help restore and maintain the ecological function of woodlands at the landscape scale is the development of forest habitat networks (FHNs). Forest habitat networks should encourage woodland species’ dispersal by providing a more permeable landscape and by increasing the area of available habitat. This should be particularly beneficial when networks are centred on woodlands of high biodiversity conservation value and they are designed to complement networks of other priority habitats. Network development should balance the current and future ecological needs of various key plant and animal communities, including priority species and priority open ground habitats, and enable altitudinal, as well as latitudinal, mobility. Not all needs can be accommodated in all places, and choices will sometimes have to be made.

The development of forest habitat networks should also provide adequate buffering around high quality core areas to increase their robustness and, in the long term, expand the area of high quality woodland.

Increasing woodland habitat connectivity will require co-operation between landowners, this being encouraged through support measures that encourage and enable joint applications.

## Actions

- Publish GIS-based analyses and maps of potential FHNs, based mainly on BEETLE<sup>16</sup> and adjusted in the light of any new evidence, at the national and regional scale, and encourage their incorporation into strategic land-use plans such as Indicative Forestry Strategies, Local Forestry Frameworks, River Basin Management Plans, long-term forest plans, and development planning.
- (Continued overleaf)

<sup>15</sup>For example see: ‘Conserving biodiversity in a changing climate: guidance on building capacity to adapt’: [www.ukbap.org.uk/library/brig/brigguidancewebpdf.pdf](http://www.ukbap.org.uk/library/brig/brigguidancewebpdf.pdf)

<sup>16</sup>Biological and Environmental Evaluation Tools for Landscape Ecology: [www.forestry.gov.uk/fr/infnd-69pla5](http://www.forestry.gov.uk/fr/infnd-69pla5)

# Adapting to climate change

## Actions (continued)

- Encourage FHN development through land use support measures.
- Monitor progress of woodland connectivity using woodland distribution spatial data.

## Promoting appropriate woodland management in core networks

Inappropriate management can disrupt the ecological integrity of habitat networks. Current guidance on appropriate silviculture for semi-natural woodlands is contained in the Forestry Commission suite of Forest Practice Guides (Numbers 1-8) titled *The Management of Semi-natural Woodlands*.<sup>17</sup>

Lower impact silvicultural systems (LISS) can be particularly appropriate for many (but not all) woodland types within core networks.

## Actions

- Define core FHNs.
- Review guidance on the use of appropriate silvicultural systems, including LISS, for core FHNs in Scotland (see also page 12).
- Include LISS considerations in long-term forest plans.
- Encourage LISS in core FHNs through land use support measures.



## Focus on the tree species and woodland types most vulnerable to change

The species assemblages in native woodlands will almost certainly change under the influence of climate change as individual species react differently to the subtle changes. We will need to accept this process and, where possible, facilitate adaptation through increased habitat connectivity and by allowing a dynamic interface between wooded and open habitats, particularly at high elevation. The most vulnerable woodland types are those which are most highly fragmented, have a narrow biophysical niche, and are dependent on narrow climatic characteristics. Research<sup>18</sup> has suggested the following trends associated with climate change:

<sup>17</sup>[www.forestry.gov.uk/publications](http://www.forestry.gov.uk/publications)

<sup>18</sup>'Impacts of climate change on forestry in Scotland' [www.forestresearch.gov.uk/climatechangescotland](http://www.forestresearch.gov.uk/climatechangescotland)

### Pinewoods

- Summer drought may favour drier sub-communities in the west and central Highlands.
- Warmer summers may encourage the colonisation of broadleaved species as well as vascular plants not currently associated with pinewood communities.
- Opportunities may occur for the development of higher elevation scrub communities above the current treeline.
- A potentially greater incidence of natural disturbance from fire, with positive as well as negative impacts.

### Oakwoods

- Milder winters, warmer/drier summers and more frequent winter gales may lead to the loss of lower plant assemblages, such as epiphytes, in Atlantic oakwoods.
- Increased disturbance through wind may allow the colonisation of other broadleaf species, including beech (west) and sycamore (east).

### Birchwoods

- This pioneer species is likely to become abundant in natural colonisation after disturbance.
- Together with other woodland types, birchwoods may be increasingly valued for their role in providing shade and shelter for livestock.

### Mixed broadleaf woodlands

- Increased storm damage, particularly on heavier soils, leading to shrubbier woodland.
- Fire damage may become more prevalent as many of these woodlands are used intensively by people.
- Beech and sycamore may increase as a component of these woodlands.
- Bramble may spread.

### Ashwoods

- Disturbance through wind may lead to a greater colonisation with other species, although ashwoods are likely to be a relatively resilient woodland type.
- Ash is likely to be planted increasingly for timber and wood fuel on improved ground.

### Wet woodlands

- More winter flooding may affect species mix and, in the east, may increasingly affect the lower floodplains of many river systems.
- Projected climate changes should help to maintain wet woodland in major valleys.
- There is likely to be an increasing demand for wet woodland as a natural flood, erosion and water quality management tool (see page 34).

### High elevation (montane) scrub

- Juniper, dwarf willows and other montane scrub communities may establish at higher elevation on suitable sites.

## Actions

- Following the publication of UKCP09, refine initial models on the potential impact of climate change on native woodland type and distribution.
- Through spatial modelling and the use of decision support tools like Ecological Site Classification, identify priority sites for woodland expansion or restoration.
- Promote vulnerable woodland types and their management requirements as regional priorities for land use support measures.
- Measure progress as part of the Scottish Biodiversity Strategy monitoring framework.



# Adapting to climate change

## Increase the contribution of plantation-origin woodlands

Plantation origin woodlands can acquire biodiversity quickly and make an important contribution to climate change adaptation. Management practices that enhance structural and species diversity will increase their usefulness as part of forest habitat networks as well as increasing their resilience to climate change. The designation and appropriate management of long term retentions offers opportunities to buffer woodland species, even if in 'new natural' ecological communities. These principles are embedded in currently recommended forest design and sustainable forest management practices.

### Actions

- Promote the adoption of guidance on enhancing plantation origin woodlands, including the designation and management of long term retentions and sites of minimal intervention.
- Promote the enhancement of plantation biodiversity, particularly the appropriate management of long term retentions and woods integral to forest habitat networks, as regional priorities for land use support measures.
- Promote the use of long-term forest plans as a basis for restructuring.

## Develop and use a better understanding of key species responses

Species level responses to climate change are likely to be complex and are, as yet, generally poorly understood. However, asynchronisation of conditions necessary for successful reproduction is emerging as a threat, most obviously for some woodland birds where climate change is desynchronising hatching date and peak insect food supply. Research is underway to better understand the requirements of the most rapidly declining species.

'Climatic release' of potentially invasive species is an indirect climate change threat to habitats and species, and may result in significant potential costs to land managers. Further work is needed to identify species that might be put at future risk by this aspect of climate change.

### Actions

- Promote and undertake research on species/climate change interactions and incorporate research findings into risk management systems and good practice guidance.





## Better understand the implications of climate change for genetic conservation in native woodlands

Forestry Commission Scotland has published guidance on seed sources for planting native trees and shrubs in Scotland<sup>19</sup>. This encourages the use of natural regeneration and colonisation where feasible. However, for silvicultural and climatic reasons, such as the potential risk that species requiring extensive periods of cold for seed viability may become restricted in range, direct planting may be required. In such cases the aim is to promote the sourcing and use of planting stock to:

- be both fit for purpose and ecologically adapted to the planting site;
- maintain or enhance genetic adaptation/fitness of our tree and shrub populations, and their capacity to adapt to changing environmental conditions;
- sustain sufficient genetic variation to provide for future uses of trees for all purposes;
- help to maintain and restore natural genetic processes in tree populations, especially gene flow and natural selection; and
- help conserve those patterns of the genetic structure of tree populations that reflect their evolutionary history

### Actions

- Help embed genetic resource guidance in forestry support measures.
- Update guidance as research understanding develops.



### Examples of action

- In 2003, Forestry Commission Scotland and Scottish Natural Heritage published guidance on 'habitat networks for wildlife and people'. More recently a number of Forest Habitat Networks (FHNs) have been published e.g. Edinburgh and the Lothians<sup>20</sup>.
- In 2005, Forestry Commission Scotland commissioned Macaulay Research Consultancy Services to investigate possible opportunities for future forest development in Scotland, including expansion to favour biodiversity<sup>21</sup>. This work was further developed by Forest Research in 2006 to look at policy priorities, including biodiversity enhancement focused on functional FHNs.
- In 2007, Forest Research published guidance on the role of forest genetic resources in helping British forests respond to climate change<sup>22</sup>.

<sup>19</sup>[www.forestry.gov.uk/seedsourcesscotland](http://www.forestry.gov.uk/seedsourcesscotland)

<sup>20</sup>[www.forestryresearch.gov.uk/fr/infd-6v4cwf](http://www.forestryresearch.gov.uk/fr/infd-6v4cwf)

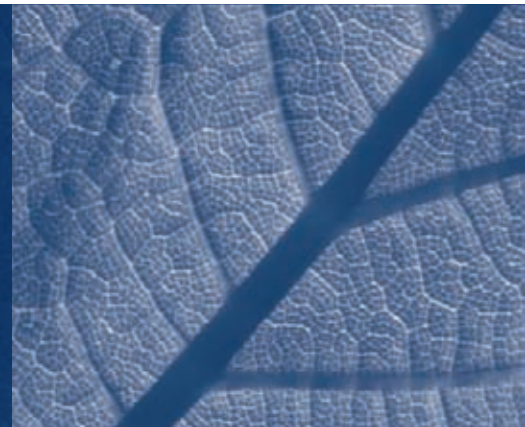
<sup>21</sup>[www.forestry.gov.uk/forestry/infd-6mgfky](http://www.forestry.gov.uk/forestry/infd-6mgfky)

<sup>22</sup>See Information Note 086 at: [www.forestry.gov.uk/publications](http://www.forestry.gov.uk/publications)

## Pests, diseases and weather threats

### Summary of priorities

- With Forestry Commission's Plant Health Service, secure research and seek stakeholder advice on pest/disease risks in Scotland and implement agreed precautionary actions.
- Monitor principal risks.
- Maintain emergency response readiness.
- Ensure that potential climate change interactions are considered in management plans.



Climate change is predicted to bring new and intensified threats to forestry and woodlands. Some existing benign species may undergo 'climatic release' and become problematic. New pests and diseases may reach Scotland either naturally or linked to human travel and transport. A warming climate is predicted to result in an increased frequency of intense and extreme weather events like storms and droughts. A risk management framework is used to review biological and weather threats and determine appropriate action. The focus here is on climate change aspects of threats to forestry and woodlands; only those threats that may have a significant climate change dimension are covered. By their nature many of the identified risks will require geographic responses across land ownership boundaries and will require effective partnerships if they are to be addressed.

By agreement with the devolved administrations, the Forestry Commission (through its Plant Health Service) develops and implements Plant Health regulations at EU and GB level. This has the vital task of protecting GB and EU forests from harmful pests and diseases.



Red band needle blight

A broad assessment of the main biological and weather threats to Scottish forestry lends itself to a tabular approach similar to that used in detailed risk assessments:

Risk	Impact	Likelihood	Response	Control	Action
Increased prevalence of Red band needle blight in Corsican pine, Lodgepole pine, Scots pine and other species.	High	High	Monitor and adapt forest practices such as early thinning.	None as yet. Planting of Corsican pine has been suspended due to the growing impacts of this disease. Similar precautions for other species may yet prove necessary.	Through further research, identify climate change interactions, alternative species and appropriate disease management strategies.
Spread of the pathogens <i>Phytophthora ramorum</i> (the agent of sudden oak death), and <i>P. kernoviae</i> .	Medium	High	Monitor	SGRPID <sup>23</sup> inspection programme of nursery visits and subsequent eradication measures if required.  SGRPID/Forestry Commission Plant Health Service have outbreak control procedures in place and undertake intensive surveys around outbreak areas.	Review control actions following feedback from the public consultation on the future management of risks from <i>P. ramorum</i> and <i>P. kernoviae</i> <sup>24</sup> .  Further, longer- term research is required to develop knowledge of climate change and species interactions for these pathogens.
Green spruce aphid impacts on stressed spruce.	Medium	High	Treat	Avoid vulnerable tree species on sites likely to lead to tree stress.	Undertake further research needed to develop specific guidance.
Increased over-winter survival of pine weevils - a major pest of newly planted trees	High	Medium	Treat	Implement Integrated Pest Management strategy currently in development <sup>25</sup> , with targeted, minimal use of insecticide treatment.	Promulgate good practice guidance.
Increased activity of tree damaging bark beetles e.g. <i>Ips cembrae</i> , <i>Dendroctonus micans</i> .	Medium	Medium	Monitor	Prevent ingress of new species into GB through import controls and, for existing species, implement pest management programmes.	Research climate change interactions.
Impact from new or previously benign pests and diseases	Low to High	Medium	Monitor	Maintain a pest monitoring and alert service through Forest Research, Forestry Commission Plant Health Service and SGRPID (tree imports).	Take immediate action on relevant alerts; hold periodic regional forest health days for practitioners; and amend import and/or domestic phytosanitary regulations as required.
Increased survival and fecundity of deer	Medium	High	Treat	Through existing, local deer management strategies (referenced to the Joint Agency Strategy for Wild Deer in Scotland <sup>26</sup> ).	Monitor deer impacts.
Spread of grey squirrels with increased competitive advantage over red squirrels and transmission of squirrel pox.	Medium	High	Treat	Existing squirrel strategies.	Develop and implement a grey squirrel control strategy, including tackling squirrel pox, and ensure climate change implications are built into squirrel research.

<sup>23</sup>Scottish Government Rural Payments and Inspections Directorate

<sup>24</sup>[www.scotland.gov.uk/publications/2008/07/15093841/0](http://www.scotland.gov.uk/publications/2008/07/15093841/0)

<sup>25</sup>[www.forestry.gov.uk/fr/infd-62wkg9](http://www.forestry.gov.uk/fr/infd-62wkg9)

<sup>26</sup>[www.dcs.gov.uk/info\\_strategy.aspx](http://www.dcs.gov.uk/info_strategy.aspx)



# Adapting to climate change

Risk	Impact	Likelihood	Response	Control	Action
Spread of new or existing invasive plant species	Low to High	Low to High	Treat	Identify species likely to experience climatic release. Monitor feedback from field staff on emergence of invasive plant species. Plan collaborative control strategies and early eradication where impacts are likely to be significant.	Work with partners through the Species Action Framework process <sup>27</sup> and the Scottish Working Group on Invasive Non-native Species.
Catastrophic windblow	Medium	Medium	Treat/ tolerate	Diversify forest age structures to reduce impact.  Ensure readiness through contingency plans	Develop, and maintain in readiness, a windblow contingency plan for Scotland.
Increased risk of forest fires, particularly in late summer.	Medium	Medium	Treat	Maintenance of fit-for-purpose, integrated fire plans and standard operating procedures in the forestry sector.	Review of forest fire preparedness, prevention, response, recovery and monitoring in Scotland – in partnership with Scottish Government Justice Directorate, Fire & Rescue Services, Scottish Wildfire Forum, private sector forestry interests, Forestry Commission Fire Forum, and the wider land management community.

## Actions

- Review listed risks and, where necessary, develop detailed risk management plans.
- Incorporate risk assessments within silvicultural models to guide appropriate species choice and management decisions.

## Examples of action

- Forestry Commission Operational Guidance Booklet (OGB) 17 'Planning for the Unexpected' was published in 2003 and revised in January 2008. It provides a preparation and response framework for a range of management risks including those relating to storms and fires. The intention is to make this, and the wider suite of OGBs, publicly available on the Forestry Commission website.
- A Contingency Plan for Serious Pest Outbreaks in British Trees has been prepared by the Forestry Commission's Plant Health Service.
- In 2006, in response to the increasing threat posed by Red band needle blight (RBNB), the Forestry Commission formed a RBNB Working Group. The Group identifies priority areas for survey/monitoring, and advises on research needs and management strategies in Forestry Commission and private forests across GB. In June 2008 a Research Note<sup>28</sup> about this disease was published.

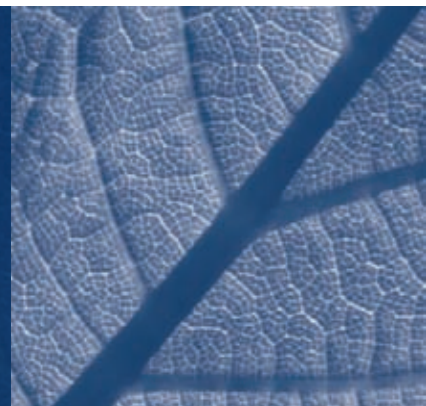
<sup>27</sup>[www.snh.org.uk/speciesactionframework/default.asp](http://www.snh.org.uk/speciesactionframework/default.asp)

<sup>28</sup>See Research note 'Red band needle blight of conifers in Britain' at: [www.forestry.gov.uk/publications](http://www.forestry.gov.uk/publications)

# Silviculture and forest operations

## Summary of priorities

- Identify where change of species, or increase in species or origin/provenance (as appropriate) diversity is advisable.
- Identify situations where climate change may affect choice of silvicultural system or practice.
- Identify appropriate modifications to civil engineering specifications and advice.



## Identify where change of species or increase in species or origin diversity is advisable

Commercial tree species have different site and climatic preferences depending on their origin. Some aspects of climate change and increasing atmospheric CO<sub>2</sub> concentrations may be beneficial to tree growth, but species with exacting requirements, or which are being used on the edge of their range, are more vulnerable to climate change. Likewise, species in locations and on soil types likely to be subject to greatest change are more vulnerable. Vulnerability may show as poor establishment, poor growth rates, susceptibility to pests and diseases, poor form or poor timber characteristics. While use of natural regeneration may increase site/species compatibility, this does not take into account future climate and is often influenced by a range of other factors.

Mixing species at stand and forest level, regardless of management system, will help to spread the risk associated with biotic and abiotic impacts. Where LISS is inappropriate, use of mixed species within stands can help spread risk under clearfelling-restocking management systems, including subsequent rotations. The implications of such mixtures need further evaluation and forecasting in relation to the timber processing industry.





# Adapting to climate change

More work is needed to identify situations where a deliberate change in species or origin may be advisable within a silvicultural time-scale. It is too early to give definitive recommendations but initial research<sup>29</sup> has provided the following pointers:

- Productivity is likely to increase (with another 2–4m<sup>3</sup>/ha/yr likely for Sitka spruce) as a result of warmer summers where nitrogen and water resources are not limited.
- The suitability distribution of Sitka spruce (and certain other species) will change in Scotland, with declining suitability in the east. Where Sitka spruce is used in Scotland, the choice of origin, predominantly Queen Charlotte Island, should not be changed.
- Initial investigations suggest that climate change is unlikely to have a significant effect on the proportion of structural-grade Sitka spruce timber in Scotland. However, it is uncertain whether an increase in leader breakage in winter months will have an impact on timber quality.
- Douglas fir origin should be reviewed for Scotland: some French provenances may prove to be well suited to future Scottish conditions.
- For most species, continental origins tend to be unsuitable in Britain, and will continue to be so. Although the climate will change, it will not become continental – just a little more Mediterranean, with warmer, drier summers and milder, wetter winters. However, more temperate origins may be vulnerable to frost damage as the growing season will lengthen, and for some tree species bud-burst will occur earlier, and dormancy will occur later.
- Using plant material from a wide range of ‘families’ will help maintain and improve the genetic diversity of forest material.
- Subject to wider environmental considerations, several alternative species for a warmer climate might become suited on specific site types in Scotland, like Monterey pine, Maritime pine, Southern beech (*Nothofagus*), walnut and some Eucalyptus species.

## Actions

- Through continued research, identify locations where species choice, and/or diversification of species or origin/provenance, should be considered for climate change reasons.
- Support the need for a programme of research and well distributed field trials to evaluate growth characteristics and disease susceptibility of alternative productive species and origins/provenances that may be more suited to Scotland’s future climate.

<sup>29</sup>‘Impacts of climate change on forests and forestry in Scotland’: [www.forestresearch.gov.uk/fr/infid-79rd4s](http://www.forestresearch.gov.uk/fr/infid-79rd4s)

## Identify situations where climate change may affect choice of silvicultural system or practice

Current climate predictions suggest that the climate will become more variable, with greater risk of extreme events, such as heavy winter rain, summer heat waves/drought, and more frequent, strong winds in winter. Therefore, a primary objective of silviculture and management should be to spread risk in a way that reduces the impact of damaging events and increases the resilience of Scottish forests.

Where exposure allows, LISS systems may become more appropriate where reducing the degree of change to the microclimate of woodland sites can increase the robustness of the forest system, and may also help to reduce the risk of wind damage, as will early and more frequent thinning interventions in other silvicultural systems.

The increasing variability of the wind climate is likely to reduce the productive potential of the most exposed areas of forest. In the future climate, the distribution of strong wind speeds will change and Scotland is likely to be exposed to an increased frequency of them. Therefore, the productive limit of exposure will need to be reviewed if evidence emerges of increased windthrow risk on exposed sites.

Increased winter rainfall may affect the ability to undertake repeated stand management (such as thinning) on some soils due to reduced accessibility for machinery and increased risk of windthrow. Research is needed to identify situations where thinning or continuous cover management opportunities can be maintained or sought, and other situations where they may become more limited. The impacts, positive and negative, on other resources, such as water quality, will need to be considered fully.

An increase in summer droughts is likely to increase fire hazard, particularly in the east of Scotland. This may require the use of additional fire precautions such as appropriate boundary vegetation management.

The window for lifting nursery stock could be reduced by lengthening growing seasons and wetter winter conditions. This will constrain the planting season for bare-rooted stock, as will the likelihood of spring drought in eastern areas. There is likely to be a much greater need for irrigation systems in Scotland's easterly tree nurseries.

### Actions

- Promote research and monitoring to identify situations where silvicultural practices are becoming inappropriate to Scotland's changing climate and to provide practical alternative systems.
- Promote research into developing greater resilience to environmental incidents such as fire and wind.





# Adapting to climate change

## Identify appropriate modifications to civil engineering specifications and advice

Increased intensity of rainfall needs to be taken into account when specifying forest civil engineering structures such as bridges and culverts, and in site-by-site application of specifications for roadside drains and batter slopes. There will also be an even greater need to consider water quality implications when planning and executing forest road construction and maintenance.

### Actions

- Following consultation with SEPA<sup>30</sup>, prepare and promote forest civil engineering guidance compliant with the spirit of the Water Environment and Water Services (Scotland) Act 2003.



## Examples of action

- In 2007, Forestry Commission Scotland and SEPA held a 'Controlled Activities Regulations' seminar for Forestry Commission Scotland and Forest Enterprise Scotland field staff.
- In January 2008, a Forest Research Note titled *Impacts of climate change on forestry in Scotland – a synopsis of spatial modelling research*<sup>31</sup> set out an initial assessment of how forestry in Scotland will be affected by climate change.

<sup>30</sup>Scottish Environment Protection Agency

<sup>31</sup>[www.forestresearch.gov.uk/fr/infd-79rd4s](http://www.forestresearch.gov.uk/fr/infd-79rd4s)

# Environmental protection

## Summary of priorities

- Help tackle slope instability issues in sensitive locations.
- Increase the contribution of woodlands in mitigating riverbank erosion.
- Establish the practical potential for forestry in flood risk management.
- Increase the contribution of trees and woodlands to climate control in urban areas.



Climate change predictions suggest a possible increase in extreme rainfall events. Water management is already a major feature of Scottish forestry practice and is subject to tried and tested Forests & Water guidelines. However, risks and opportunities may be accentuated by climate change.

## Tackle slope instability issues in sensitive locations

There is limited need for 'continental style' protection forestry which, in Europe, is used mainly to protect settlements from avalanches and rock fall. In Scotland, slope instability and landslides are greater problems. In sensitive locations, plantation forestry has sometimes been detrimental to slope stability by accelerating runoff from site drainage, a reduction in ground vegetation under tree canopies, and windthrow. Clearfelling, machine trafficking and in-forest civil engineering can also contribute to slope instability, with a subsequent risk of watercourse sedimentation.

Woodlands managed using lower impact silvicultural systems can aid slope stability compared to intensively grazed land. However, this appears unlikely to be more effective than lightly grazed or ungrazed swards, particularly given the long-term risk of soil disturbance by windthrow.

## Actions

- Co-operate with Local Authorities and Transport Scotland in monitoring the occurrence of landslides within, or directly associated with, forests past and present.
- Co-operate with Local Authorities and Transport Scotland to identify significant at-risk locations, particularly those impacting directly on communities or the transport network, and facilitate the implementation of local site management strategies to help combat slope instability.
- Support the need for further research to confirm the role of woodland in combating slope instability.



# Adapting to climate change

## Increase the contribution of woodland in mitigating riverbank erosion

Closed canopy conifer stands can sometimes be detrimental to riverbank stability. It has been established practice for many years to prevent such situations occurring and to rectify, at the appropriate intervention window, those sites currently at risk. Conversely, establishing native trees and shrubs, coupled with a vigorous ground flora, is one of the most effective ways of stabilising riverbanks, as well as giving wider biodiversity benefits. This approach should continue to be promoted as a sustainable, natural solution to undesirable riverbank erosion.

## Establish the practical potential for forestry in flood risk management

Current evidence suggests that forestry has an overall neutral affect on flood flows and is unlikely to have a major role in directly preventing large-scale flooding. However, trees, undergrowth and woody debris can increase the 'hydraulic roughness' of floodplains, slowing down the passage of flood flows and enhancing flood storage capacity. Computer modelling suggests that, by careful siting and distribution in critical catchments, 'floodplain woodland' may be able to help desynchronise peak flows sufficiently to delay and reduce downstream flood peaks. This needs to be tested empirically.

Floodplain woodland could therefore make a significant contribution to sustainable flood management in Scotland. If initial research findings are confirmed, there would be significant scope for using floodplain woodland in the middle and upper reaches of catchments to delay and reduce downstream flood flows. In larger catchments this strategy would complement other flood defences. In smaller catchments, floodplain woodlands could be the principal defence, and in urban areas woodland may also have a positive part to play in sustainable urban drainage systems (SUDS). While taking several decades to establish fully, this time scale is consistent with the rate of climate change.

### Action

- Through the River Basin Management Planning<sup>32</sup> process, help implement appropriate woodland management and woodland creation as part of wider erosion management strategies in vulnerable areas.

### Actions

- Continue to investigate the role of floodplain woodlands as a component of sustainable flood management, through the establishment of catchment-scale, integrated land use flood management studies in Scotland.
- Through Scotland's Flooding Bill Advisory Group and the River Basin Management Planning process advise on woodland related opportunities for sustainable flood management.
- Provide advice to Ministers on forestry related aspects of the Flood Risk Management (Scotland) Bill<sup>33</sup>.



<sup>32</sup>[www.sepa.org.uk/water/river\\_basin\\_planning.aspx](http://www.sepa.org.uk/water/river_basin_planning.aspx)

<sup>33</sup>[www.scotland.gov.uk/topics/environment/water/flooding/frmbill](http://www.scotland.gov.uk/topics/environment/water/flooding/frmbill)

## Increase the contribution of trees and woodlands to urban climate control

Trees and woodlands in urban areas bring many economic and social benefits such as encouraging inward investment, increasing house values, contributing to sustainable urban drainage systems, or the physical and mental health benefits from woodland recreation. They can also help improve air quality through intercepting pollutants, as well as reducing noise pollution.

The role of strategically sited trees and woodlands for urban 'climate control' is increasingly being recognised. Trees offer shelter from the harmful effects of the sun's rays. Research, mainly in the USA, has shown that, by reducing wind speed, trees can also help to reduce heat loss from buildings in winter. They can also significantly reduce the need for air-conditioning in summer by providing shade and also by the general air cooling effect of evapotranspiration. Shade can also significantly increase the life of road surfaces by reducing surface temperatures during heat waves. At a city level, modelling suggests that urban greening and increasing tree cover can offset temperature increases associated with climate change.

### Actions

- Support further research on, and promote the role of, trees and woodlands for urban climate control in Scotland.

### Examples of action

- Forestry Commission Scotland is a partner in the SAFER (Strategies and Actions for Flood Emergency Risk Management)<sup>34</sup> EU Interreg project. One project action is development of an emergency response plan for the community and stakeholders at risk from flooding by the river Enrick in Glen Urquhart, Highland. The plan uses a web-based automated emergency system that contacts stakeholders through a range of communication channels.
- Forestry Commission Scotland is a Responsible Authority under the Water Environment and Water Services (Scotland) Act 2003 {Designation of Responsible Authorities and Functions} Order 2006 and participates actively in River Basin Area Advisory Groups as well as the National Advisory Group for the Scotland River Basin District.

<sup>34</sup>[www.eu-safer.de](http://www.eu-safer.de)





# Increase wood use for renewable energy

## Summary of priorities

- Support the use of woody biomass for renewable energy, particularly heat or combined heat and power (CHP) schemes.
- Facilitate supply chain development for wood fuel.
- Support implementation of the framework for the development and deployment of renewables in Scotland (which includes a Renewable Heat Action Plan) and the agreed recommendations of the Wood Fuel Task Force.
- Act as an exemplar for the use of biomass heating in new developments.
- Serve as a point of expertise on biomass/bioenergy for the Scottish Government's Sustainable Procurement Action Plan.

## Supporting the use of wood for energy

The Scottish Government is committed to work towards achievement of 20% of total energy use coming from renewable sources by 2020, in line with the overall EU approach. It is also committed to increasing the contribution of wood fuel in tackling climate change, this also helping to address fuel poverty. Substitution of fossil fuel through the use of wood and forestry co-products is a key component of Scotland's forestry carbon saving target within Scotland's Climate Change Programme<sup>35</sup>. The Scottish Government, in co-operation with the Forum for Renewable Energy Development (FREDs), has consulted recently on a framework for the development and deployment of renewable energy in Scotland, which includes a Renewable Heat Action Plan.

The Scottish Government also has a crucial role in furthering sustainable development through its procurement of goods, services and buildings. The forthcoming Scottish Sustainable Procurement Action Plan will set out a stepped approach to delivering sustainability as part of public sector procurement policies, with Forestry Commission Scotland serving as a point of expertise on biomass/bioenergy procurement.

A suite of grant incentives has been designed to encourage installation of biomass energy systems, including the Scottish Community and Household Renewables Initiative<sup>36</sup>, the Scottish Biomass Heat Scheme<sup>37</sup>, and through Rural Development Contracts. Particular emphasis is being placed on the development of local and medium scale operations to support rural development and reduce transport distances. Forestry Commission Scotland is taking opportunities to install exemplar biomass heating schemes in its own new and refurbished offices and buildings.

New bio-energy technologies, including those for 'second generation' biofuels, are being developed and may offer significant opportunities for forestry to contribute still further to renewable energy production.

## Actions

- See next section.

<sup>35</sup>[www.scotland.gov.uk/publications/2006/03/30091039/0](http://www.scotland.gov.uk/publications/2006/03/30091039/0)

<sup>36</sup>[www.energysavingtrust.org.uk/schri](http://www.energysavingtrust.org.uk/schri)

<sup>37</sup>[www.usewoodfuel.co.uk/scottishbiomassheatscheme.stm](http://www.usewoodfuel.co.uk/scottishbiomassheatscheme.stm)



# Sustainably produced wood for energy & construction

## Examples of action

- Establishing a Regional Biomass Advice Network to provide a focus for regional development of wood fuel and other biomass markets.
- Developing an integrated 3-year support package through the Network to deliver a co-ordinated programme of information dissemination, development standards and best practice, and access to independent advice.
- Delivering the Scottish Biomass Support Scheme.
- Launching the one-stop-shop, "Wood Energy Scotland", web site in 2006.
- Forestry Commission Scotland has installed 4 biomass heating systems in its own new or refurbished buildings.

## Facilitating supply chain development for wood fuel

A Wood Fuel Task Force was established by the Environment Minister in 2007 to examine how to mobilise wood fuel resources from woodlands, energy crops, landscaping activity and waste streams. It reported in January 2008 (see page 17).

Forestry Commission Scotland is playing a significant role in the development of a sustainable wood fuel supply chain in which the private sector will have a major role. A network of Wood Fuel Information Officers has been established across Scotland and a wood fuel web site ([www.usewoodfuel.co.uk](http://www.usewoodfuel.co.uk)) provides a wealth of information. Regional events are held to promote biomass energy opportunities, and a network of energy forestry demonstration sites is being developed. Forestry Commission Scotland funds an annual survey of wood fuel use and is working to further develop production forecasting procedures to include wood fuel. Research and development plans are being prepared to improve or develop techniques for wood fuel production and recovery from forests, and through short rotation forestry and short rotation coppice systems.

The suite of measures outlined on page 15 is also designed to stimulate wood fuel supply chain development. In addition, an increasing amount of material suitable for wood fuel from the national forest estate is being put on the open market.

Good co-ordination between stakeholders, suppliers and end users will be essential to match supply and demand within geographic areas and to keep delivery distances to the minimum.

## Actions

- Take a leadership role for actions to develop Scotland's wood fuel supply chain as identified in the Scottish Forestry Strategy.
- Increase the supply of material suitable for wood fuel by implementing the agreed recommendations of the Wood Fuel Task Force.
- Review wood fuel market development by 2010.
- Increase environmentally sustainable wood fuel recovery from the national forest estate.
- Undertake regular wood fuel availability and usage surveys.
- Promote the development of a network of wood fuel suppliers to strengthen the role of local rural businesses in growing the wood fuel market.
- Publish an Energy Forestry Handbook and Practice Guides (2009).



## Examples of action

- Implementing an 'energy from woodland' pilot for wood energy supply-chain development, and incorporation into Rural Development Contracts.
- Convening the Wood Fuel Task Force.
- Tendering an additional 115,000 green tonnes in 2006 and a further 75,000 green tonnes in 2007 of material suitable for wood fuel from the national forest estate.



## Encouraging other forms of renewable energy

### Summary of priorities

- Encourage other forms of renewable energy production on forest land.

Given the Scottish Government's commitment to source 50% of Scotland's electricity demand from renewables by 2020, there may be significant opportunities to generate further income and community benefits on forest land, including forest crofts, from wind, hydro and micro power. Planning and environmental safeguards will need to be in place to ensure that such generation is compatible with sustainable forest management and the policy on the control of woodland removal in Scotland (see page 10).



### Action

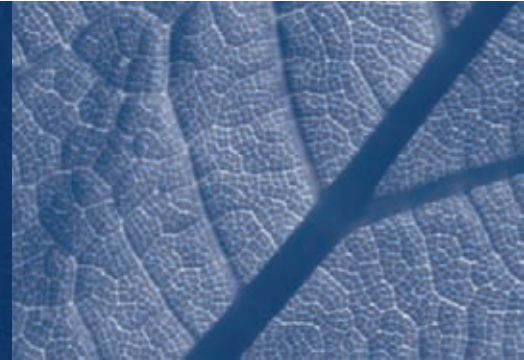
- Support the development of appropriate planning guidance on renewable energy.
- In co-operation with other organisations working to develop the use of renewable energy, promote the use of forest land for all forms of renewable energy production, subject to appropriate environmental and planning safeguards.



# Increase the use of timber

## Summary of priorities

- Increase the use of timber, and in particular local timber, as a substitute for more energy intensive materials.
- Promote the role of timber for long term carbon storage.
- Serve as a point of expertise on timber and paper for the Scottish Government's Sustainable Procurement Action Plan.



To help combat climate change there is an overarching, global need to promote the use of sustainably produced timber above other, more energy intensive materials used in construction. Recently, the UK Government committed to all new domestic and all new commercial buildings to be built to 'zero carbon' standards by 2016 and 2019 respectively. Further opportunities relate to the relatively low embodied energy characteristics of timber. Carbon storage in wood products also represents a major carbon sink in the UK.

As previously described, the Scottish Government's forthcoming Scottish Sustainable Procurement Action Plan will set out a stepped approach to delivering sustainability as part of public sector procurement policies. In addition to biomass/bioenergy expertise, Forestry Commission Scotland will also serve as a point of expertise on timber (and paper) procurement.





# Sustainably produced wood for energy & construction

Forestry Commission Scotland has published a Timber Development Programme<sup>38</sup> with a strategic ambition to improve the quality and value of, and access to the most appropriate markets for, home grown timber. It focuses on four objectives:

1. Promoting a predictable and stable timber supply.  
One aim is to produce a more accurate long-term forecast of timber production from the private sector. This will provide the industry with greater confidence to identify and plan for development and investment opportunities.
2. Encouraging more use of and variety in timber and timber products, including 'green chemistry', new composite materials and small dimension timber, through close co-ordination with industry, the construction sector, architects, timber specifiers and the wider public. A key output is to continue to support specific activities where there is a clear market opportunity for home-grown timber. Life Cycle Analysis (LCA) work is also to be commissioned to quantify the carbon advantage of wood compared with other materials in a range of building types.
3. Encouraging improvements to the timber supply chain efficiency. Initiatives such as the Strategic Timber Transport Scheme ( see page 45) are designed to minimise the impact of timber transport on the environment and rural communities. Encouraging haulage via rail or sea, and opening up access to landlocked forest areas, will allow more timber to be harvested. This flow of timber is essential for satisfying increasing demand for existing and emerging markets for wood products, including wood fuel.
4. Encouraging improvements to the quality of the growing stock through appropriate tree selection and better silviculture. A series of partnership projects will be carried out to improve the fitness-for-purpose of a variety of timbers including the more durable softwoods such as larch and Douglas fir, and encouragement for the growing of quality broadleaves for the domestic hardwood sector.

## Action

- Implement the Forestry Commission Scotland Timber Development Programme.

<sup>38</sup>[www.forestry.gov.uk/tdp](http://www.forestry.gov.uk/tdp)



## Examples of action

- The Forestry Commission Scotland Timber Development Programme (see footnote 38) was launched in December 2007 with 60 actions towards increasing value-added from Scottish timber and the competitiveness of Scotland's timber supply chain.
- The Centre for Timber Engineering (CTE)<sup>39</sup>, based at Napier University, was opened in January 2003 and serves as a focus for excellence in providing education, research and consultancy in the various constructional uses of timber.
- Wood for good ([www.woodforgood.com](http://www.woodforgood.com)) is a generic wood campaign started in 2000 and currently sponsored by the Confederation of Forest Industries (UK) Ltd, the Swedish Forest Industries Federation and the Forestry Commission. It is the largest timber promotional campaign ever undertaken in the UK.

<sup>39</sup>[www.cte.napier.ac.uk](http://www.cte.napier.ac.uk)



# Reducing the forestry sector's carbon footprint





# Timber transport

## Summary of priorities

- Promote measures that minimise roundwood road miles.
- Promote local processing and use of timber.

Currently, over 90% of all roundwood entering Scottish mills is moved by road, this accounting for 20-35 % of product cost. There could be significant social, environmental and economic benefits in reducing timber lorry miles by, for example, modal shifts to rail and sea. For unavoidable road transport, there remains scope to reduce emissions by improving the logistical efficiency of journeys and by implementing current developments in best practice such as the Safe and Fuel Efficient Driving (SAFED)<sup>40</sup> training scheme in Scotland. The substitution of fossil fuels with 'second generation' biofuels derived from woody biomass may also provide part of future emission reduction measures.

Investments in modern processing facilities have given the industry an ability to create and maintain global market share. If the scale of processing is too small such mills will become unable to compete with imported materials. Nevertheless, there would be significant social, environmental and economic benefits from encouraging the complementary development of local timber markets, particularly those based on wood fuel.

The Strategic Timber Transport Scheme<sup>41</sup> (and associated Fund) administered by Forestry Commission Scotland in association with the Timber Transport Forum, helps to support projects (such as 'Logistics in Forestry Transport') that reduce the impact of timber lorries on Scotland's rural roads. Other Scottish Government support measures<sup>42</sup> include the Freight Facilities Grant (FFG) and the Waterborne Freight Grant (WFG).



<sup>40</sup>[www.safed.org.uk/SAFED%20Scotland/news.htm](http://www.safed.org.uk/SAFED%20Scotland/news.htm)

<sup>41</sup>[www.forestry.gov.uk/sttf](http://www.forestry.gov.uk/sttf)

<sup>42</sup>[www.scotland.gov.uk/topics/transport/ft/freightgrants1](http://www.scotland.gov.uk/topics/transport/ft/freightgrants1)



# Reducing the forestry sector's carbon footprint

## Actions

- Establish a baseline index against which roundwood road transport miles per unit of timber can be monitored (2009).
- Continue to work with the forestry and transport sectors to investigate efficient and cost effective options for moving timber by sea and rail.
- Manage the Strategic Timber Transport Scheme to provide tangible social, economic and environmental benefits.
- Promote further research on practical transport techniques to reduce the environmental impact and net cost of road haulage.
- Promote local use and processing of timber through implementation of the Forestry Commission Scotland Timber Development Programme and Renewable Heat Action Plan.
- Collate information on the carbon balance of wood from different sources and origins.



## Example of Action

- Following a Public Service tender by Forestry Commission Scotland, the Timberlink Service was established to ship around 100,000 tonnes of timber annually from Argyll to Ayrshire. The service removes around 8,000 lorry journeys - or nearly one million lorry miles - each year from mainland routes.
- A driver training course was developed as an output of the Scottish Strategic Timber Transport Scheme. Initial findings from the pilot in south Scotland suggest an average of 11% saving on fuel consumption after training.
- Forestry Commission Scotland has been involved in partnership projects to assess the potential of Tyre Pressure Control systems (also known as Central Tyre Inflation systems) to improve timber transport efficiency and reduce the physical impact on forest and public roads. Initial results have been promising and some hauliers have already purchased this system.

# Forestry Commission Scotland corporate activity

## Summary of priorities

- Maintain a clear sector and corporate framework for responding to climate change.
- Reduce the carbon footprint of Forestry Commission Scotland.

The development of a forestry sector climate change action plan was a key need identified in the Scottish Forestry Strategy. This action plan is Forestry Commission Scotland's response to that need and will be kept under regular review, consulting with stakeholders to ensure it keeps pace with emerging priorities. At a corporate level, climate change considerations will be embodied in the Commission's Corporate Plans.

Forestry Commission Scotland will 'lead by example' in the way it manages its corporate management activities and by investigating and demonstrating opportunities for carbon footprint reductions in the management of the national forest estate.

## Actions

- Take a full and active role in the Greener Government Programme.
- Embody climate change considerations in the 08/09 - 10/11 Forestry Commission Scotland Corporate Plan.
- Develop and promote the exemplar role of the national forest estate in woodland creation, reducing the carbon footprint of forestry practices, and the siting of appropriate renewable energy developments.
- As part of the Forestry Commission's Corporate Sustainability Programme ('Greenerways') implement annual reductions, against a 2007/2008 baseline, of 3% for energy and 5% for travel.
- Help develop and implement an accredited Environmental Management System for the Forestry Commission.
- Review the use of bio-diesel in Forestry Commission Scotland vehicles in the light of current life-cycle analysis (LCA) evidence (2009).

## Examples of Action

- By 2007, the Forestry Commission had 115 vehicles (about 20% of its fleet) in Scotland using bio-diesel refined from vegetable oil, including used cooking oil. Subject to availability, the Commission's intention is to continue to expand the use of bio-diesel derived from sustainable sources.
- Forestry Commission Scotland's new Inverness District Office was opened in January 2007 and is recognised as one of the best examples of quality, sustainable construction in the country. It demonstrates what can be achieved with Scottish grown and certified timber, with every component of the building's structure and fabric green-book A rated. Additional heating, when required, is provided by a carbon-friendly wood fuel boiler.



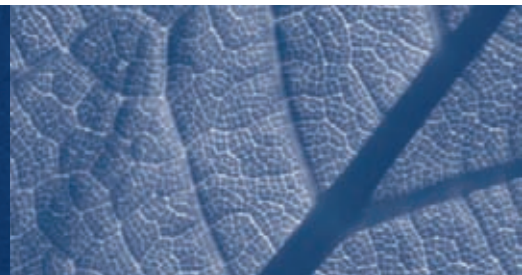
## Awareness raising



# Awareness raising

## Summary of priorities

- Build a sound evidence base for developing and monitoring forestry's contribution to tackling climate change.
- Raise awareness of the contribution that forests, woodlands and trees can make to tackling climate change in Scotland.



Scotland's Climate Change Programme identified forestry as having a key role in helping to tackle climate change. Developing and communicating that role further, based on a sound evidence base, is essential if forestry is to be fully assimilated in climate change policy and practice across the state, private and voluntary sectors in Scotland.

## Actions

- Provide advice to Ministers on forestry-related aspects of the Scottish Climate Change Bill.
- Promote forestry's role in tackling climate change through engagement with appropriate Government, sectoral and cross-sectoral forums.
- Recognise and support the key role of the non-state forestry sector through initiatives such as 'wood for good' and the Forest Education Initiative<sup>43</sup>.
- Extend awareness raising beyond the forestry sector through engagement with non-governmental organisations (NGOs), the voluntary sector and educational programmes for schools and communities.
- Commission or support relevant research through the Forestry Commission Scotland and Scottish Government research commissioning processes.
- Support the development of the Forestry and Climate Change Centre as a focus for Forestry Commission expertise (2009).

- Enhance the dissemination of clear forestry & climate change information relevant to Scotland through the Forestry Commission Communications Managers' Group, and the continued development of the Forestry Commission climate change web site.
- Through Forest Research and best practice seminars, promote understanding and delivery of climate change actions in the forestry sector.
- Embed Climate change action plan directions in the Forest Enterprise Scotland Framework Strategic Plan and Forest District Strategic Plans.
- Stimulate regional focus on the Climate change action plan through the Regional Forestry Forums and publish regional actions in the Scottish Forestry Strategy Implementation Plans.
- Through regular 'Public Opinion of Forestry Surveys'<sup>44</sup> monitor public awareness of forestry's role in helping to combat climate change.

## Examples of action

- To promote the role of forestry in helping to tackle climate change, the Forestry Commission has produced an innovative DVD entitled "Forests and climate change: a convenient truth?"
- The Forestry Commission launched its 'Forests and climate change' web-site in 2006.

<sup>43</sup>[www.foresteducation.org](http://www.foresteducation.org)

<sup>44</sup>[www.forestry.gov.uk/statistics](http://www.forestry.gov.uk/statistics)



# Measuring progress



# Measuring progress

## Summary of priorities

- Monitor forestry's contribution to tackling climate change.

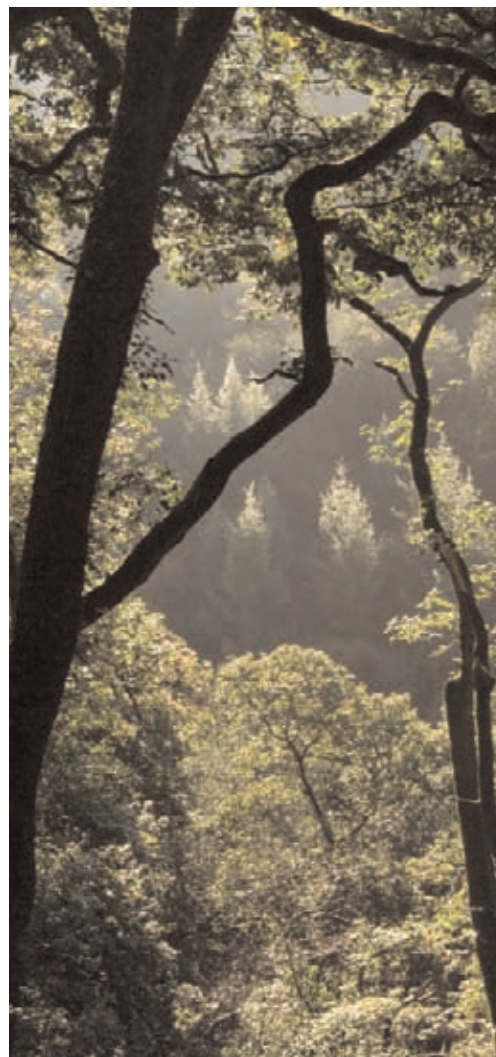
To track progress and allow the periodic reassessment of priorities, a corporate and sectoral monitoring framework for forestry & climate change will be established through the Scottish Forestry Strategy Implementation Plan process. This will include quantitative and qualitative assessments.

## Actions

- Review the Forestry Commission Scotland Climate change action plan in 2011.
- Establish and maintain an appropriate climate change & forestry monitoring framework for the forestry sector as part of the Scottish Forestry Strategy Implementation Plan<sup>45</sup> process (2009).
- Work with other partners to ensure the UK LULUCF<sup>46</sup> inventory adequately captures carbon fluxes in Scottish forestry.
- Report progress on climate change actions in Forestry Commission Scotland's Annual Reports.

## Example of Action

- The Scottish Forestry Strategy 2006 included a suite of indicators for each of the seven key themes, including climate change. These were developed, and baseline assessments initiated, as a key component of the Scottish Forestry Strategy Implementation Plan 2008-2011.



<sup>45</sup>[www.forestry.gov.uk/sfs](http://www.forestry.gov.uk/sfs)

<sup>46</sup>[www.edinburgh.ceh.ac.uk/ukcarbon](http://www.edinburgh.ceh.ac.uk/ukcarbon)



Forestry Commission Scotland serves as the forestry directorate of the Scottish Government and is responsible to Scottish Ministers.

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