Case Study on the Ecosystem Approach to Sustainable Forest Management

Conservation and Use of Forest Genetic Resources in the UK

1. Introduction

This case study examines the recent development of the UK approach to genetic conservation of native tree species.

2. Background to Sustainable Forest Management in the UK

The UK is committed to implementing the CBD, the Forest Principles agreed at the Earth Summit and the Helsinki Guidelines and subsequent pan-European criteria and indicators. Sustainable forestry policies and practices in the UK are set out in the UK Forestry Standard (FC 1998).

The UK has a long history of forest clearance for agriculture, timber exploitation and industrialization such that natural forest cover declined from around 80% in post-glacial times to 3% by 1900. Although tree planting has occurred on a significant scale since the 18th century, most reforestation has taken place since 1920 and total forest cover is now 12%.

Until about 1990 most of this expansion was achieved by planting exotic species primarily for their timber yields, in plantation forests which were normally confined to land considered marginal for agriculture. But the increasing emphasis on securing recreational, cultural and environmental benefits since the 1980s has resulted in native species forming the majority of trees planted in recent afforestation schemes.

Modern forestry in the UK includes a range of types of woodland. It includes planted forests based mainly on exotic species but managed for multiple benefits, planted native woods planted for biodiversity and social benefits and the conservation and restoration of ancient semi-natural woodlands on sites which are remnants of the original forest cover. These remnants comprise about 2% of land cover and are typically small and fragmented so that a major aim of policy is to restore their ecological condition and expand and link them together. In these semi-natural woods natural regeneration or planting native species is normal practice.

3. Conservation and sustainable use of genetic resources

This case study focuses on the ways in which the UK is developing an appropriate balance between conservation and sustainable use of genetic diversity of native tree species as a key component of forest biodiversity. This relates to principle 10 of the Ecosystem Approach.

Genetic conservation has generally received less attention so far than species and habitat level biodiversity conservation in the UK's Biodiversity Action Plan, and this is also true for forestry. But the topic is currently gathering more momentum. In forestry we need to develop policies to balance the potentially conflicting demands of

tree breeding and genetic conservation, and ways of mitigating or reversing the effects of past fragmentation and current forest management practices upon genetic diversity.

There is only one commercial native conifer tree in the UK, the Scots pine (Pinus sylvestris). So almost all the softwood species used commercially in the UK are imported. Of the native broadleaved species, oak, beech, ash and wild cherry are the main commercial timber species. Scots pine, oaks and beech have been widely planted by landowners over the last 250 years. Although most of the planting stock of these species has probably originated within the UK, substantial amounts of oak and beech have also been imported from suitable provenances in North-western parts of continental Europe since Napoleonic times. This history of planting will have affected the pattern of genetic variation for these species and makes it difficult to locate genuinely local origins with confidence. For many other non-commercial species however, it is less likely that significant translocation of genes has occurred through planting, although very little is known with certainty about this. Traditional management of semi-natural woods was to regenerate them by coppicing or promoting natural regeneration of saplings.

Policy development

The Helsinki Guidelines contain the following statements:

- H1,D: Sustainable management means the stewardship and use of forests and forest lands in a way, and at a rate ,that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfil now and in the future, relevant ecological, economic and social functions at local national and global levels, and that does not cause damage to other ecosystems..'

- H1,7: … Forest management practices should aim at maintaining and if possible improving the adaptive capability of forest ecosystems towards stresses …

- H1, 8 .. Tree species should be well suited to local conditions and be capable of tolerating other stresses ands potential climate changes……Genetic selection which is commonly practised in Europe should not favour performance traits at the expense of adaptive ones…

- H1, 9 ..Native species and local provenances should be preferred where appropriate. The use of species, provenances, varieties or ecotypes outside their natural range should be discouraged where their introduction would endanger important/valuable indigenous ecosystems, flora and fauna.

- H2, 5. . Signatory states recognise the importance of…conservation of genetic resources of forest taxa, both those currently exploited for economic purposes and those considered secondary or rare.

- H4 (Climate change) States commit themselves to support research and collaboration on the impact of possible climate change on forest ecosystems and forestry, the possible adaptation of forest ecosystems and forestry to climate change.

UK Forestry Policy

At present there is not a distinct genetic conservation policy document in UK forestry. However the UK Biodiversity Action Plan and UK Forestry Standard contain statements encouraging genetic conservation:

- by promoting natural regeneration as the preferred means of regenerating semi-natural woods
- by encouraging use of local seed origins for all planting in and around semi-natural woods and in new native woods where the aim is to develop a natural type woodland.
- 'maintaining genetic integrity' is one of the policy aims for management of semi-natural woodlands and management guidance encourages removal of known non-local genotypes, where this would not compromise other functions of the woodland
- for native pinewoods there is a special incentive scheme to promote the use of local origin material which has been in place since 1989
- native woodland expansion should be targeted to reverse fragmentation with the intention of increasing gene-flows of native species as well as movements of species themselves.

There is also recognition in UK policy documents however that the evidence for the advantages of local genotypes for adaptation of the trees and the effects on associated wildlife is not strong or at least not clear, and that this hinders the development of policies.

As part of policies for improving economic value of forests, the development and use of improved genetic stock to enhance timber quality and improve productivity is promoted in UK forestry policy statements (Sustainable Forestry: the UK programme, HMSO 1994).

Regulation

Some native timber species are subject to regulation under the EC Directive on Forest Reproductive Materials Regulations. The current Directive dates from 1977 and the emphasis is on ensuring that seed is only sold from high quality stands in terms of timber. Beech, oaks, Scots pine are the main UK native species included. A revised Directive is now being implemented in all EU member states which could stimulate production of local origin material by assisting the regulation of marketing and use of seed. It will:

- make it easier to collect seed from local UK sources by allowing collection from 'source-identified' material, which will be labeled using a common system.
- provide each state with more control over the use of reproductive material which it considers is not suitably adapted for its territory. Source-identified material could be prevented from being sold for use in all or part of the UK if there were sound evidence suggesting that it would be poorly adapted.

The regulations can apply to a wider range of species than before and member states can add other species for regulation within the country.

In the UK there are 4 provenance regions which are used to guide sourcing of stock of all species.

Native pinewoods have a separate regulatory scheme based upon scientific research carried out in the 1980s into patterns of genetic variation amongst the remnant Caledonian pinewoods of the Scottish Highlands. This demonstrated distinct regional population histories and allowed derogation from the EC regulations so that local unregistered material could be used for conservation purposes. A scheme to promote local native pine stock was started in 1989, backed by increased incentives and has been very successful, with over 25,000 hectares of new pinewood planted using local stock.

4. Developing the UK approach to the conservation and use of genetic resources

The current policy framework has developed in a gradual incremental way over the last twenty years in response to increasing interest in using native species and native woodland rehabilitation. This has happened against the backdrop of an overall switch of emphasis in forestry objectives way from dominance by timber production towards multi-functionality and a high importance for biodiversity conservation.

However, although there are important measures in place, genetic conservation still tends to be overshadowed by species and habitat conservation. It suffers from lack of clarity and consensus about concepts and goals as well as a paucity of good evidence upon which to base policies and practice.

With this in mind the UK Forestry Commission has taken several steps over the last 2 years to review and strengthen our approach. In 1998 we commissioned a review of current concepts, knowledge, policies and practices which made recommendations on policy development, mechanisms and research priorities in relation to genetic conservation of native trees and shrubs in Britain. This was published in August 2000 as a FC Technical Paper (Ennos et al, 2000).

This review recommended four main aims for genetic conservation:

- To maintain and enhance genetic adaptation, fitness and the long term potential for evolution in tree and shrub species;
- To safeguard the continued supply of genetic variation for use in all aspects of forestry, from woodland conservation to genetic improvement programmes;
- To conserve those aspects of the genetic structure of populations which reflect their unique evolutionary history;
- To maintain and as far as possible restore natural genetic processes, especially gene flow and natural selection.

Genetic conservation and the exploitation of genetic variation by selection and tree breeding need to be balanced as part of ‘genetic management’.

A series of issues relevant to research, policies and mechanisms have been recommended for attention, including :

- Adaptation and choice of seed origins for planting stock
- Effects of introduced genetic material in native woodlands
- Conservation of small, isolated and rare populations
- The effects of past exploitation upon current genetic composition
- In situ conservation: the role of genetic reserves
- Ex-situ conservation: gene banks
- Forest design to aid genetic processes
- Effects of use of genetically improved material on genetic conservation
- Adapting to climate change
- Influence of tree genotype upon other associated biota.

The review has proposed the development of a genetic conservation strategy which would include:

- a policy statement in national forestry policy and guidance documents on a range of policy and technical issues
- some additional regulation
- a major and sustained research input
- a programme of promotional events, training and awareness-raising.

This last element is proposed partly in response to the 'problem of low levels of understanding of basic concepts and issues amongst practitioners' which the review revealed.

Current action

The FC is consulting other parts of government, NGOs and other interests on the review before developing a full response to the proposals. However the broad direction is likely to be accepted.

FC have started to strengthen research programmes on genetic conservation and also genetic selection of native species. FC have also contributed to a cross-sectoral research needs analysis on genetic conservation and related issues under the UK Biodiversity Action Plan. In this exercise a wide range of research funders and practitioners contributed to a workshop and made recommendations on research priorities. The FC research programme is focusing on improving our basic knowledge of genetic variation and its adaptive significance amongst tree species because this is fundamental to policy development. Studies of gene flows are also underway, partly funded under EU collaborative projects.

In 1999 FC published an Information Note designed to meet the demands of growers for consistent guidance on local seed origins which could stimulate use of local seed on a voluntary basis (Herbert et al, 1999). The note provided the first attempt at a map showing zones for 'local' seed collection and initiated a labelling and registration system which enables participants to identify which zone might be suitable for sourcing native species of trees and shrubs. However the map needs to be validated by future research, as it is based on climatic regions rather than direct knowledge of significant adaptive genetic differences.

In 1999 the UK joined EUFORGEN, the European network of forest genetic researchers and FC is leading the UK representation. This is already yielding benefits in developing common understandings and sharing work, for example basic genetic resource inventory.

Inventory of populations of native trees which are thought to be autochthonous is proceeding throughout Scotland and Wales, and England will be completed over the next two years. This is a key building block.

5. Lessons learnt

We are at an early stage of developing a comprehensive distinct genetic conservation and genetic management strategy for forest resources, but some important elements have been put in place over the last few years.

One of the key lessons is that genetic conservation concepts and issues are poorly understood by the general public and by practitioners and for progress to be made it will need considerable effort over a significant period to develop shared understandings and agreed objectives. This is possibly even more necessary in a state such as UK with a history of severe loss and degradation of native forest areas and unrecorded planting of non-local genotypes over a prolonged period.

It would be interesting to share experiences with other countries in this area.

Gordon Patterson,
Forestry Commission,
United Kingdom

September 2000.

References

Anon (1994). Sustainable Forestry:the UK Programme. Cm 2429, HMSO London.
Anon (1994). Biodiversity: the UK Action Plan. Cm 2428, HMSO, London.
Ennos R., Worrell R., Arkle P., Malcolm D. (2000). Genetic variation and conservation of British native trees and shrubs. Forestry Commission Technical Paper 31, Edinburgh.
Forestry Commission, (1998). The UK Forestry Standard. Forestry Commission, Edinburgh.
Herbert R.,Samuel S.,Patterson G. (1999). Using local stock for planting native trees and shrubs. Forestry Commission, Edinburgh.