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AN ROINN COMHSHAOIL, ODHREACHTA AGUS RIALTAIS ÁITIÚIL

**DEPARTMENT OF THE ENVIRONMENT, HERITAGE
AND LOCAL GOVERNMENT**

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INTRODUCTION

A meeting was organised to allow interested parties get up to speed on the latest developments in red squirrel research and conservation. The meeting was held in NUI Galway, and funded by NPWS. The forum was addressed by experts from Ireland, Italy and the UK. The abstracts from these talks are provided below, together with a list of relevant publications.

The talks were followed by a vibrant discussion which encompassed, amongst other things, forestry's biodiversity policy, grey squirrel control mechanisms, the legal status of the red squirrel, refuge areas, parapox virus, research requirements and woodland management. These discussions will be used to inform elements of a proposed All-Ireland Species Action Plan for red squirrel and a discussion paper on grey squirrels being prepared jointly with the UK and Italy for the Bern Standing Committee. The summary of discussions below was prepared by Dr Colin Lawton [NUIG], organiser of the Squirrel Symposium.

Ferdia Marnell [NPWS]

ABSTRACTS

The European Squirrel Initiative

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The European Squirrel Initiative was founded in June 2002 and is a privately funded group with no affiliation to any government organisation. Its aim is to create, develop and maintain a campaign to win the support and commitment of governments throughout Europe in securing the future of the red squirrel through the effective control of the grey squirrel. To date the ESI has provided focus and awareness for British red squirrel conservation projects, tabled questions at British, Irish and European Parliaments, and worked in northern Italy, where grey squirrels have recently been introduced. ESI is working closely with researchers on a number of issues including the use of Warfarin, the impact of squirrel pox, and immunocontraceptive control.

Morphological divergence within the Irish red squirrel (*Sciurus vulgaris*) population.

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The Eurasian red squirrel (*Sciurus vulgaris*) is considered native to Ireland, and has been classified as a separate subspecies, *S.v.leucourus*, the light tailed squirrel. However, due to reintroductions of the species into Ireland over the course of the 1800s, there may be two populations of red squirrels in Ireland – native Irish red squirrels and those descended from the reintroductions. In this study we examined any possible regional divergence between populations and also any phenotypic evidence for the existence of two separate lineages of red squirrel in Ireland.

Information was collected from red squirrels trapped and found dead countrywide. Weight, sex, length of shin bone, colour of tail and site type was recorded for each squirrel. Results show neither a significant relationship between the area, nor the habitat type where the squirrel was trapped, and squirrel morphology. Also, although tail bleaching seen in Irish squirrels has been suggested to be a result of increased sunlight in the summer, there was no relationship between the lighter tail colour morphs and the season (winter/summer) when the squirrel was caught/killed. Further study is underway utilising molecular techniques.

Action Plan for red squirrels in Northern Ireland

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A survey of Northern Ireland's squirrels in 1995 and 1996 by D. O'Teangana showed red squirrel distribution was widespread but patchy and the grey squirrel was present in all counties. In 1996 the Northern Ireland Squirrel Forum was established to bring together statutory and non-statutory organisations dedicated to protecting the red squirrel in Northern Ireland. The Forum is jointly chaired by the Environment and Heritage Service and the Forest Service, Northern Ireland. In 1999 the Squirrel Forum developed a Northern Ireland Red Squirrel Action Plan based on the UK Red Squirrel Strategy to cover the main aims and appropriate targets for the various organisations involved in Northern Ireland. This covered the period from 1999-2004, and was published by the EHS. The EHS commissioned a second Northern Ireland squirrel survey, carried out by K. O'Neill of Queen's University, Belfast. This showed the grey squirrel had undergone continuous range expansion, replacing the red squirrel in many woodlands. Grey squirrels now were present in many previously unoccupied areas.

The Northern Ireland Squirrel Forum has agreed that a new 10 year Action Plan should be devised which concentrates on identifying woodland which supports red squirrels only and were realistically defendable against the influx of grey squirrels. Government Departments must be persuaded to provide resources to carry out targeted control of grey squirrels in and around these areas as it is the only chance of ensuring the long term survival of the red squirrel in Northern Ireland. Discussions are presently underway to develop an All-Ireland Species Action Plan for the Red Squirrel.

The Use of Translocation to Augment Red Squirrel Distribution in Ireland

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In Ireland, the native red squirrel (*Sciurus vulgaris*) is in decline due to the spread of the introduced grey squirrel (*Sciurus carolinensis*). Distribution surveys have found that the red squirrel is widespread in the area west of the river Shannon, with the exception of the western halves of counties Galway and Mayo. Grey squirrels were not recorded west of the river Shannon. Suitable red squirrel habitat which is currently uninhabited has been identified in the Connemara area of west county Galway. This project aims to introduce red squirrels to a woodland in Connemara, thereby creating a long-term refuge for the red squirrel.

A suitable red squirrel source woodland has been identified and monthly monitoring indicates that this population can safely sustain the removal of red squirrels. Derryclare woodland has been selected as the target woodland using criteria such as detachment from greys, woodland size and tree species composition. In summer 2005 it is planned to move a small population of red squirrels from east Galway to Derryclare using soft release techniques. Once released, the population will be monitored through a combination of radio-tracking and other field studies. Monitoring will also continue at the source woodland to investigate the effect of the removal of squirrels on that population. On completion, this project aims to produce practical guidelines on translocation and establish a red squirrel population in Connemara.

Throughout this project, collaboration is taking place with Coillte and the appropriate licences have been obtained from NPWS. This project is funded by the Embark Initiative of the IRCSET.

Problems with introduced grey squirrels in Italy and consequences for red squirrel conservation.

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The grey squirrel (*Sciurus carolinensis*) was introduced in 1948 near Turin and started to expand its range in the north-west of Italy. In 1997, when the range of the grey squirrel was about 300 km², the National Wildlife Institute and the University of Turin experimented control methods to test the possibility of eradicating the alien species. After 8 days, almost 50% of the population was removed but some animal rights groups took the case to court, which halted the experiment. Since then, no other control actions have been carried out and, consequently, the spread of grey squirrels continued, reaching about 800 km² in 1999. In an attempt to convince politicians about the threats of future expansion of the grey squirrel population, spatially explicit population models were used to predict grey squirrel spread from the current Piedmont distribution area into the Italian, France and Swiss Alps, and from Ticino park to Switzerland. Concomitantly, similar models were also applied to determine the most suitable red squirrel (*Sciurus vulgaris*) habitats capable of sustaining viable populations in the long-term. Models predict that without control, the grey squirrels will reach France and Switzerland in 20-40 years, threatening persistence of native red squirrels throughout submountain, mountain and subalpine forests of the Alps; ecosystems with high biodiversity. Modelling control scenarios suggest that to ensure red squirrel survival, at least 50% of grey squirrels must be removed yearly, while an 80% annual removal-rate in the Ticino population is likely to result in total eradication, if started immediately. We believe that at present, eradication is still biologically feasible (at least for Ticino and Genova populations) but that political pressure from other countries and at European level will be essential to convince Italian national and local authorities, responsible for wildlife management and conservation, to take immediate action.

Red squirrel ecology in Irish commercial forests - A GIS approach

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Red squirrel (*Sciurus vulgaris*) populations have been observed to be in decline in various areas of the country, most noticeably in areas where the introduced grey squirrel (*S. carolinensis*) has been longest established. Since the eradication of the grey squirrel is unfeasible, it is likely that the preservation of the red squirrel will depend on the future management of various forestry blocks to provide reds with some advantage over the spreading greys. The commercial plantations throughout upland Wicklow are an area where such management may be considered, thus making them ideal study sites. Research set out to assess the effects of habitat variation upon the ecology of the red squirrel, between and within commercial stands of coniferous woodland. Data was gathered from an intensive trapping and tagging scheme in a range of habitat types selected from Coillte's GIS system. Records concerning body weight, fecundity, sex ratios and so on were compared between squirrel populations resident in the various habitats. Information garnered from tagged and radio-collared animals concerning home range, habitat utilisation, social interaction and dispersal was also combined with GIS data to allow further investigation into the effects of different forest development and management strategies upon squirrel populations.

Overview of red squirrel research: the Kielder experience

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A brief overview of 14 years of red squirrel research and conservation efforts in the North of England, focused on Kielder Forest District was presented. This gave an indication of local patterns of expansion and detailed the ecological research on red squirrels in the production conifer plantations typical of the north of England. The conclusions of this work were summarised and it was explained how the limitations of fieldwork led to the GIS modelling approach (using Kielder and Kielder Forest as examples). The resulting management advice has led to the establishment of notified conservation areas. However, recent findings with regard to the squirrel pox virus, illustrated by an analysis of Cumbrian records suggest that the virus could represent a serious threat to red squirrel refuges of all forest composition types. Results of an assessment of the potential risks and a contingency plan were discussed.

The use of distance sampling in calculating red squirrel population density

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Red squirrel numbers and range are declining in Ireland and the U.K. as grey squirrel numbers and range increase. An effective, indirect method of calculating red squirrel population densities would, therefore, be useful. Distance sampling is one indirect method of calculating red squirrel population density. It involves locating transects at random in the study area, walking these transects noting each red squirrel seen and the perpendicular distance from the red squirrel to the transect, and then using this distance data to calculate red squirrel population density. The use of distance sampling in calculating red squirrel population density was evaluated, to determine if the four key assumptions underlying distance sampling theory could be met. Surveys were conducted along transects in 3 Scots Pine and 3 Sitka Spruce study sites. It was concluded that the key assumptions underlying distance sampling theory could be met when using this method to census red squirrels. However, the method also had a number of drawbacks, which greatly limit its usefulness. Firstly, the visibility required to conduct observation counts is only ever likely to be adequate in extensively thinned, conifer woodlands or in deciduous woodlands in winter. Secondly, a sample size of at least 60-80 observations/distance measurements is needed to model the detection function. The effort required to achieve this would usually be prohibitive as red squirrel population densities tend to be low, visibility in woodlands is often poor and therefore, the encounter rate (number of red squirrels seen per unit effort) is low.

Coillte's role in red squirrel conservation

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Coillte Teoranta, established under the Forestry Act of 1998, owns and manages Irish State forests (58% of national forest area). 80% of the 444,700 ha of land owned by Coillte is coniferous high forest; over half of the coniferous trees are Sitka Spruce. Coillte are under pressure to increase the level of broadleaved trees in its forests - and this may potentially be a major threat to the red squirrel. In recent years there has been a general restructuring of Coillte forests to diversify tree species and age of stand. The Coillte Biodiversity Programme ensures 15% of the estate is to be managed with the conservation of biodiversity as a primary management objective. Priority is given to key nature conservation issues. The red squirrel is not included as it is not listed in the Red Data Book or Habitat Directives. Biodiversity areas for the red squirrel have not been identified to date. Habitat and species guidelines have been devised to provide forestry practitioners with clear, concise, factual accounts of habitats and species of nature conservation value - again this does not include the red squirrel. The red squirrel however is considered by Coillte in a number of ways: It is a popular species, and is often cited in support of protests to felling and land sales; Coillte actively supports red squirrel research conducted by researchers from NUI Galway and Trinity College Dublin; Bark stripping damage, although usually associated with grey squirrels, can be carried out by red squirrels; Scots pine stands are sometimes recommended retained for red squirrel populations. Much consideration of red squirrels is ad hoc, and site-based. Key national and regional issues may need to be identified and a systematic effective strategy devised.

KEYNOTE ADDRESS:

Competition and coexistence in tree squirrels with particular reference to red and grey squirrels in Europe

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In tropical habitats, many species of squirrel coexist within the same forest community and the reasons for coexistence were briefly considered. The converse to coexistence is competition, and this is particularly seen when species are introduced into new regions.

Invasive species constitute a serious threat to biodiversity in the region where they have been introduced, causing the extinction or decline of native species through competition or predation. A good example is the widescale replacement of the native Eurasian red squirrel (*Sciurus vulgaris*) by the introduced North American grey squirrel (*Sciurus carolinensis*) on the British Isles and parts of northern Italy. Up until about five years ago, the reasons for this replacement were unclear despite considerable research into habitat loss, behaviour patterns and feeding habits. However, recent studies carried out in the North of England and North Italy have made some progress towards understanding the processes involved. In the talk these findings were reviewed and the insights they offer into how we might conserve the red squirrel in these countries were considered.

IRISH RED SQUIRREL CONSERVATION SYMPOSIUM – DISCUSSION FORUM REPORT

Since its introduction to Ireland, the grey squirrel (*Sciurus carolinensis*) has caused problems on two fronts. Firstly it has directly contributed to the reduction in numbers, and retraction of distribution, of the native red squirrel (*Sciurus vulgaris*). Secondly it causes severe damage to woodland, through its habit of stripping bark from trees. This bark stripping damage can reduce the timber value of trees, and also has a devastating effect on the woodland ecosystem. In order to tackle these two problems they need to be considered separately. Different tactics are required depending on the issue at hand.

Bark stripping damage

Bark stripping damage is a major concern of woodland owners, as the damage exposes the tree to infection from arthropods and fungus, and leads to discolouration of the wood. This results in the timber value being reduced considerably. The most severe damage can lead to the death of a number of trees in an area, and this can also have major consequences for the ecosystem of the area as a whole. Damage varies with age of tree crop, tree species, time of year and woodland.

Control of damage can concentrate on one of two factors: control of the squirrels, or reducing the risk of damage in a woodland.

Grey squirrel densities recover very quickly from even the most intensive control programmes (6 - 10 weeks in most areas), but even this brief reduction in numbers can be sufficient in reducing damage during the worst affected times of year. A targeted, intensive control programme in a specific woodland, and its neighbouring area, in February - April may be sufficient to protect a vulnerable crop. Although squirrel numbers will be reduced for only a short time, there is some evidence that other population dynamics such as reproduction rates may be affected for longer.

Warfarin, used as a poison, is strictly controlled by legislation in the UK, but is not covered in Ireland (although new EU regulations may be coming into force in this area soon). Recommendations from the UK should be followed here though - specifically it should not be used if red squirrels are found in the area. This makes it impractical for use over much of Ireland, as the current distribution of the two species requires further research (see below). There is also some debate about the effects of Warfarin on the ecosystem as a whole. A more suitable method of controlling grey squirrels is through the use of live trapping.

Alternatively, or as well as controlling grey squirrels, other strategies may be employed in keeping damage levels to a minimum such as avoiding species particularly prone to damage (e.g. sycamore and beech) and planting small seeded tree species that sustain a reduced grey squirrel population.

Further advice can be found at
<http://www.coford.ie/reports/acrobat-pdfs/GreySquirrel.pdf>

Red Squirrel Conservation

The purpose of the Irish red squirrel conservation symposium held in NUI Galway was to consider a strategy to stop the decline of the red squirrel in Ireland. To this end grey squirrel control is an important tool which, when applied in a targeted way, can help protect red squirrel populations. Grey squirrel control may be undertaken in areas where both species are found, and in these areas Warfarin use is not appropriate. Therefore, Warfarin will have only a subsidiary role in the conservation of the red squirrel in Ireland. At present, live trapping is the best method available for widescale control.

It is important that the presence of grey squirrels in Ireland is accepted when considering a long term strategy. Eradicating grey squirrels from Ireland is not feasible with current technology. Instead efforts must be concentrated on keeping the two species separate, either geographically or by habitat. Co-existence of the two species is usually only a temporary situation, with one species (usually the grey squirrel) outcompeting the other in a short time.

A - Refuge Areas

In Britain a number of sites have been selected as 'red squirrel refuges' - woodlands that will be managed in a manner most beneficial to the red squirrel population therein. Hopes are that some of these will remain grey squirrel free and red squirrel strongholds in the long term.

In Ireland the decline of the red squirrel is not as advanced as in Britain, and larger regions of the island can be set aside as red squirrel refuges. One such region is west of the river Shannon, in Cos. Clare, Galway, Mayo, Roscommon and Sligo. To date this region has remained grey squirrel free, with the River Shannon acting as a considerable barrier to grey squirrel spread.

The greys may eventually cross into this region either through Co. Sligo north of the river, or by crossing the river (pressure on young animals to move west across the river may increase now dispersal opportunities to the east, south and north are decreasing). It is likely however that this region of the island will be the last area to remain grey squirrel free, and as such offers the best opportunity to conserve the red squirrel. Red squirrel populations in the region are thriving to date, and the opportunity exists for the translocation of red squirrel populations to uninhabited woodlands further west. Some woodlands in this region contain habitats suitable for red squirrels, but have remained empty to date due to their relative isolation from inhabited areas. It is this isolation that will further protect the red squirrel

populations, if, or when, the Shannon barrier is breached. A distribution survey of the Shannon region is currently underway at NUI Galway, which will further identify the current status of both species in this area.

A second possible region is in the south west of the island including Cos. Cork and Kerry. Grey squirrel spread may be much slower into these regions due to mountains blocking certain routes in. Further investigation is required in this region to identify its potential as a red squirrel refuge, and probable incursion points by the grey squirrel.

In Northern Ireland, red squirrels are in need of urgent conservation action. While isolated populations in Co. Fermanagh and Co. Down remain, remoter woodlands in Co. Antrim may offer the best potential refuge. Efforts to protect the red squirrel should be focused around these remaining strongholds.

There may also be suitable islands which could sustain a red squirrel population that are much more likely to stay free from grey squirrel incursion. It is essential however that these island woodlands are of a sufficient size to sustain a healthy red squirrel population, given that dispersal in and out of the area by the red squirrels would be impossible.

Once suitable areas are designated as refuge areas, everything possible must be done to boost red squirrel populations therein. This includes maintaining woodland types that benefit red squirrel populations, and are unsuitable for grey squirrels, and carrying out exercises such as targeted grey squirrel control, supplementary feeding of the red squirrels, and further translocation programmes (see below).

B - Woodland Management

The Forest Service, Coillte and other woodland owners have a number of issues to consider when protecting the biodiversity of an area, and Ireland as a whole. What suits one vulnerable species, may not be ideal for another. It is obviously not possible to develop/maintain every woodland in Ireland (or even the red squirrel refuge areas) in a manner best suited for the red squirrel. It is hoped however that some woodlands could be maintained in this way.

Although geographical separation of red and grey squirrels may only be partially successful in the long term, it may be possible to keep the species separate through habitat. Red squirrel densities are highest in woodlands containing a good mix of large seeded coniferous and broadleaved trees. Unfortunately, however, in these areas they are unable to compete with the greys and quickly disappear. In other areas such as pure coniferous woodlands, with small seeded species such as Sitka spruce, the red squirrels are found at lower densities. Crucially, however, the trees do not provide sufficient nutrition for the larger grey squirrel, and so the red squirrel population will survive. So although the areas are not ideal for red squirrels, they are completely unsuitable for greys.

Forest Service policy dictates that all woodland owners must plant at least 10% broadleaved trees in their woodlands (a figure due to raise to 30% in 2006). Coillte however are not bound to plant 10% in every woodland, and may be able to leave some woodlands as purely coniferous, providing the overall figure of 10% (or 30%) is maintained. If broadleaved must be planted, they should be small seeded trees such as ash and birch, which again will not provide sufficient sustenance for the grey squirrels. Large seeded tree species such as oak and hazel must be avoided.

C - Legislation

The red squirrel is not listed in the EU Habitats Directive, or the Red Data Book, though it is protected nationally in the Wildlife Acts of 1976 and 2000. It is debatable as to whether it is necessary for the species to be listed in order to install a national red squirrel conservation programme.

It would be beneficial if the red squirrel received addition protection as it would increase its profile in the country, and push it to the forefront of planning priorities for groups such as the Forest Service and Coillte. The National Development Plan could be used in pushing the conservation programme forward. The push for greater levels of broadleaved trees in every woodland is in response to certain biodiversity issues, and currently the red squirrel's demise is not thought to be of sufficient merit to be considered. Some wooded areas in the west of Ireland (the proposed red squirrel refuge region) lack potential as commercial woodland, and pressure exists to not replant and to set these areas aside for blanket bog restoration. Red squirrels can survive, however, in lodgepole pine on boggy land, so these woodlands may still be of use in protecting the red squirrel. With red squirrels not listed in relevant legislation it is harder to make the case for woodland retention.

On the other hand it can take a long time to change legislation, and the problem will not wait for the EU Habitats Directive to be changed. Red squirrels may not (yet) be endangered on an international level, but with the species being extremely vulnerable nationally, the need exists to push ahead with a conservation programme regardless. The current red squirrel population was probably reintroduced to the country in the nineteenth century and this makes it more difficult to get it listed as a priority species. As a once native species, however, the onus is on us, under the Bern Convention, to re-establish the population in the country.

D - Research required

There are several gaps in our current knowledge of red squirrel ecology in Ireland, and it is absolutely essential that these areas are funded and investigated as soon as possible. The holes in our current understanding are to the detriment of the species and are holding back the installation of a suitable red squirrel conservation programme.

1) The squirrel poxvirus (SQPV) - This virus has significantly contributed to the loss of the red squirrel in England. It kills red squirrels within two weeks of transmission, and is carried by the grey squirrel, though the disease does not cause symptoms to the greys that carry it. The rate of decline in red squirrel populations in the UK is 17 to 25 times faster when SQPV is a factor. Infected red squirrels have not been recorded to date in Ireland, though antibodies of the virus have been recorded in grey squirrels in Northern Ireland.

A full study on SQPV in Ireland must be instigated straight away. Its incidence in both red and grey squirrels in the country will have major repercussions on both the continued spread of the grey and loss of the red, as well as potential conservation strategies that can be employed. If SQPV is present in Ireland the risk of disease transmission will have implications for translocation projects and the introduction of supplementary feeders; any occasion when red squirrels will be congregating in a small area. There are large gaps in our knowledge of SQPV in general also. For example the mode of spread of the disease (via excretions/secretions/ectoparasites?) is unknown.

b) Squirrel distribution - The most recent distribution survey of red and grey squirrels in Ireland was carried out in the mid 1990s and reported in 2000 (O'Teangana *et al*, 2000). The rate of spread of the grey squirrel was listed in this study as being 0 km/year to 13.4 km/year, so the potential change in squirrel distribution since this study was started is very large. It is also necessary that much finer detail is used to determine the lack of red squirrels in an area before a Warfarin control program can be used.

c) General ecology - Modelling of future trends has proved a very useful tool in predicting the future spread of grey squirrels (and the loss of reds) in Britain and from Italy into the rest of Europe. These models require information on squirrel population dynamics such as mortality rates, reproductive rates etc. If these models are to be applied accurately in Ireland more information is required on Irish squirrel population dynamics. Until more data has been recorded it will be necessary to rely on reported details from studies in the UK and Europe and the resulting models may not be as accurate as they could possibly be.

d) Supplementary feeding - In the event that SQPV is not significant in Ireland, supplementary feeding may be of great use in supporting red squirrel populations. The design of the feeding hoppers has only been of mixed success in Britain and Ireland, and further study is required in this and other practical elements of a conservation programme.

The source of funding for these and other squirrel research projects must be determined, and the individuals suited to carry out the research identified.

E - Public perception

If a red squirrel conservation programme is to succeed it will require the backing of the general public, conservation groups, government agencies and the scientific

community of Ireland. To this end it is very important that the profile of the red squirrel is increased and red squirrel conservation becomes a popular goal. The intricacies of red squirrel ecology must reach a wider audience in order, for example, to explain that mixed coniferous/broadleaved woodlands do not necessarily suit all species.

The effort of volunteers was important in helping SQPV surveys in the UK and similar help could be useful in Ireland as well. The participation of the public in distribution surveys could also be of limited use. A central data base for both red squirrel distribution and SQPV incidence could be established that will encourage public participation and be of use to all involved in the conservation issue.

The conservation of red squirrels is not a forlorn hope and practical steps can be taken to protect this important native species. It will, however, require considerable effort and funds from a large collection of government bodies, and special interest groups. It is up to the governmental bodies to change the legislation, develop the policy, co-ordinate the programme and sign up to a way forward. The scientific community can simply provide the information that will be of use to reaching the goal of red squirrel conservation.

Dr. Colin Lawton,
Symposium Co-ordinator,
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The forum report was compiled following contributions from and discussion with:

Caitriona Carlin, English Nature;
John Griffin, Forest Service, DARD, N. Ireland;
John Gurnell, Queen Mary University of London;
Donal Keegan, Forest Service;
Liam Kelly, Teagasc;
Peter Lurz, University of Newcastle upon Tyne;
Ferdia Marnell, National Parks and Wildlife Service;
Robbie McDonald, Quercus, Queen's University, Belfast;
Michéal McGoldrick, Trinity College, Dublin;
John Milburne, Environment & Heritage Service, N. Ireland;
Aileen O'Sullivan, Coillte;
Alan Poole, NUI Galway;
John Rochford, Trinity College, Dublin;
Paddy Sleeman, University College, Cork.

and other delegates of the Irish Red Squirrel Conservation Symposium.

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