

SCOTTISH RED SQUIRREL ACTION PLAN 2006-2011



Forestry Commission
Scotland



SCOTTISH EXECUTIVE

**SCOTTISH
NATURAL
HERITAGE**



**SCOTTISH RED SQUIRREL
ACTION PLAN
2006-2011**

JULY 2006

Contents

Executive summary

1	INTRODUCTION	1
1.1	Background	1
1.2	Action Plan Working Group	1
1.3	Issues affecting the conservation of the red squirrel	1
1.3.1	Grey squirrels	1
1.3.2	Habitat management	2
1.3.3	Monitoring	2
2	THE ACTION PLAN	3
2.1	Plan format	3
2.2	Timescale and partnership working	3
2.3	Rationale	3
2.4	Key actions	4
2.4.1	Establish and monitor the red squirrel populations	4
2.4.2	Prioritise woods where conservation work will be focused	4
2.4.3	Improve woodlands for red squirrels	5
2.4.4	Minimise or reduce the threat from grey squirrels	5
2.4.5	Contribute to research into red squirrel conservation	6
2.4.6	Implement the strategy locally with central support	7
2.4.7	Promote the strategy and raise awareness of red squirrel conservation	7
2.4.8	Monitor and assess progress of the plan	7
3	EVALUATION OF OPTIONS FOR DELIVERY OF THE PLAN	8
4	OPTIONS FOR ACTION DELIVERY	9
4.1	Option descriptions	9
4.2	Comparison of options	11
5	CURRENT DELIVERY	13
6	RECOMMENDATION	15
Annex 1	Selection of potential red squirrel stronghold areas	16
Annex 2	Criteria for the delivery of Action Plan objectives	17
Annex 3	Evaluation of options for delivering targets	18
Annex 4	Identification of outputs for delivery options	23
Annex 5	Cost of options	25
Annex 6	Red Squirrel management under Option 3	27

List of tables

Table 1	Criteria for the delivery of Action Plan objectives	17
Table 2	Evaluation of options for delivering targets	18
Table 3	Identification of outputs for different delivery options	23
Table 4	Costs of options	25

Executive summary

The Scottish Red Squirrel Action Plan 2006–2011 was prepared by a Working Group comprising Scottish Natural Heritage, Forestry Commission Scotland and The Scottish Executive in response to a request from the Deputy Minister for Environment and Rural Development, Ms Rhona Brankin MSP. It presents an integrated and effective approach to the long-term conservation of red squirrels in Scotland. Costs are also presented for delivery of the Plan.

The Plan is prepared under the auspices of the UK Biodiversity Action Plan and the Scottish Biodiversity Strategy and addresses the primary issues affecting red squirrel conservation in Scotland. These are; the spread of grey squirrels and the associated squirrelpox virus, the need for monitoring to measure and detect changes in red and grey squirrel populations and guidance and implementation of habitat management to favour red squirrels over the non-native grey squirrels.

The Plan identifies the impact of the grey squirrel as the primary threat. However, it acknowledges that total eradication of this species from Scotland is unlikely to be achieved. Under these conditions, the Plan focuses on action which is sustainable and effective for long-term conservation management of the red squirrel.

Monitoring of both red and grey squirrels is currently patchy and ineffective for conservation management. The Plan addresses this through implementation of a targeted and fully resourced approach to survey, data collection and management.

The diversification of conifer forests, to include more broadleaf species, can benefit red squirrel conservation. However, in situations where large-seeded broadleaved trees are also present, this can also encourage the spread of grey squirrels. Habitat management under these conditions requires difficult decisions to balance the requirements of red squirrels with other management objectives linked to the expansion and management of native woodlands. The Plan addresses this through the targeted management of woodlands to optimise the conservation of red squirrels whilst taking into account other biodiversity and management objectives.

Actions set out in the Plan are SMART (Specific, Measurable, Achievable, Relevant and Time-related) and primarily achievable within the five year period of the Plan. However, the Plan also signals that, whilst the actions can markedly improve conditions for the red squirrel, conservation of the species will not be secured within five years and requires a longer-term commitment. This is true of actions to address all the primary issues to include grey squirrel control and research on disease prevention, habitat management planning and implementation and monitoring of changes in populations.

The Plan sets out key actions required to delivery the key objectives of the *Scottish Strategy for Red Squirrel Conservation*. However, the Plan identifies that some actions are 'essential' whilst some are 'desirable' in meeting the objective. In order to present a set of actions which are realistic and achievable, the Plan uses systems analysis to identify various options for delivering the objectives, actions and outcomes of the *Strategy*. These are:

Option 1

- A similar approach to current action but costs enhanced from current projected spend (£542,250) to £1,364,500 to cover local group support;
- national presence/absence surveys to be delivered mainly through local groups;
- red squirrel-friendly management encouraged generally, but no defined priority areas; no areas managed to restrict broadleaves to deter grey squirrels;

- no new grey squirrel control effort beyond the current grant schemes; no effort to stop squirrelpox virus (SqPV) from spreading;
- limited research on grey control alternatives.

Option 2

- An increase in the overall cost from £542,250 to £2,235,225 to cover commissioned survey and woodland management;
- partial commissioned survey for current 150 'candidate priority woods' and strongholds;
- limited areas of most defendable stronghold sites developed;
- management for red squirrel habitat in stronghold woods to be a priority, and encouraged where suitable elsewhere; possible broadleaved restriction in stronghold woods only;
- grey squirrel control to stop squirrelpox virus in south Scotland, added to existing effort in grant schemes;
- research into squirrelpox virus transmission methods.

Option 3

- An increase in overall costs from £542,250 to £3,719,000 to cover full targeted survey, grey squirrel control and habitat management;
- survey to be carried out largely by funded staff, covering 150 woods plus strongholds and red/grey interface areas;
- larger area of strongholds, with red squirrel-friendly management a priority, drawn from a wide range;
- stronghold buffer areas defined where restriction of large-seeded broadleaves would be planned to deter grey squirrels;
- grey squirrel control aimed at stopping regional spread in Grampian, Argyll and Perthshire, as well as squirrelpox virus in the south;
- research into vaccine development for squirrelpox virus.

Option 4

- An increase in overall costs from £542,250 to £5,304,900 to cover full commissioning of survey work, grey squirrel control and extended grant-aid for woodland management;
- survey totally commissioned and all woods covered;
- as well as strongholds as in Option 3, all other 150 potential priority woods would have red-friendly management, restriction of broadleaves and control of greys where present;
- high opportunity costs in terms of restriction or removal of broadleaves from up to 25% of the Scottish landscape;
- basis for grey squirrel control unproven and very poor value for money with high forward commitment of funds.

The Working Group recommends Option 3 as the best overall balance of red squirrel conservation, woodland management objectives and value for money, and sets out the main approaches related to conservation management for red squirrels under this option. The current expenditure falls short of estimated costs for Option 3 by £3,176,750. These resources would have to be obtained to deliver the option as the most integrated, efficient and cost-effective approach to red squirrel conservation in 2006–2011.

1 INTRODUCTION

1.1 Background

The red squirrel is one of the most threatened species of mammal in the UK. Once widely distributed, the population has suffered marked losses and declines over the past 50 years; 75% of the UK population is now estimated to be found in Scotland (c.121,000 animals). It was one of the first species identified for conservation action under the UK Biodiversity Action Plan in 1995 and is also proposed as one of the species to be the focus of species management action on the Species Action List in *Making a difference for Scotland's Species: a Framework of Action*, currently out for consultation.

At the conference on *Red Squirrel Conservation in Scotland*, hosted by SNH in February 2006, the Deputy Minister for Environment and Rural Development, Ms Rhona Brankin MSP, noted the main concerns facing red squirrel conservation in Scotland. In response, the Minister requested preparation of an integrated, effective and costed Action Plan to address these. The following Action Plan has been developed against these issues.

1.2 Action Plan Working Group

As requested by the Minister, the Plan has been developed by a partnership of Scottish Natural Heritage (SNH), Forestry Commission Scotland (FCS) and The Scottish Executive. However, whilst it is, primarily, a call upon the public agencies to marshal action to safeguard red squirrels across Scotland, the Plan fully acknowledges that this cannot be achieved in isolation. Delivery of the Plan relies heavily on local, private and volunteer action and, as such, the Plan reflects the integrated nature of the actions required.

The Plan was prepared in consultation with members of the Scottish Squirrel Group at their meeting on 2 May 2006 and subsequently through circulation of a later text. This sought to identify not only the direct actions required of the public agencies but also to include actions which the agencies can facilitate for local, private and volunteer groups. The integrated nature of the Plan reflects the level of co-operation and collaboration necessary to successfully halt the decline in red squirrels in Scotland and meet the targets of both the UK Biodiversity Action Plan and Scottish Biodiversity Strategy. Failure to establish this co-operation will, inevitably, result in the continued loss and eventual disappearance of red squirrels from Scotland.

1.3 Issues affecting the conservation of the red squirrel

The UK Biodiversity Action Plan identified three primary issues to the species: the spread of the non-native grey squirrel, habitat fragmentation and disease. All three of these factors continue to pose problems to the species in Scotland in 2006.

1.3.1 Grey squirrels

Ecological competition with the grey squirrel is the primary threat to the survival of red squirrels in Scotland. Originally introduced from North America in the late 19th/early 20th centuries, this species has spread rapidly throughout England and Wales to the detriment of the native red squirrels. Populations were also introduced in Scotland to the Central Belt and Aberdeen City and they continue to spread from both of these areas, threatening both the populations in the south of Scotland and those to the north and west. It is likely that, if left unchecked, the non-native grey squirrel population will replace the native red squirrel over most of Scotland within the next 50–100 years.

Grey squirrels also carry the squirrelpox virus (SqPV) and are thought to transmit it to red squirrels. Evidence indicates that the grey squirrels are apparently unaffected by the virus whereas infection invariably results in a fatal disease in red squirrels. Preliminary modelling has suggested that red squirrel populations decline and are lost at a much enhanced rate when the virus is present compared to areas where the principal threat is restricted to ecological competition with grey squirrels. At present there is little known about the epidemiology or transmission of this virus and, consequently, there is no vaccine available. The only guaranteed method of protecting red squirrels under these circumstances is to eliminate the likelihood of them coming into contact with infected grey squirrels.

Grey squirrel control is urgently required to reduce the competitive pressure on red squirrel populations, to prevent further spread of the non-native species and to reduce the risk of infection with squirrelpox virus to the native species. However, given their current distribution, this requires action over a very wide area of the country. Under these circumstances, it is the belief of the Working Group that eradication of the grey squirrel is not a realistic aim and, as such, we advocate strongly focused action which is sustainable and effective in the long-term. Such an approach is only possible with the collaboration and co-operation of both public and private land managers together with a suitable support mechanism to underpin this as a matter of priority with particular attention given to the areas where grey squirrels carrying antibodies to squirrelpox virus have been found.

1.3.2 Habitat management

Forest management to diversify conifer woodlands often favour red squirrels but will also favour grey squirrels wherever large-seeded broadleaved woodlands are present. The principal challenge is to favour the red squirrel without encouraging the grey squirrel. Difficult decisions, therefore, have to be made between broadleaved woodlands and red squirrels. Evaluation of the long-term viability of known red squirrel 'sites' will help to identify appropriate and sustainable action for the long term. However, this also needs to be underpinned by advice on methods of management, including the required scale of action, timing of actions and site-specific considerations. Land managers are crucial to the implementation of this and, as such, a clear concise method of support to help deliver practical management is required to ensure their involvement.

1.3.3 Monitoring

Accurate and up-to-date information on the distribution and abundance of both red and grey squirrels is key to underpinning effective conservation action. To date, there has been only one widespread survey of squirrels in Scotland (through the Forestry Commission in the 1990s) with other records reflecting incidental sightings submitted on an *ad hoc* basis. Recent work by volunteer and local groups has sought to supplement the information which is available locally and this has met with some success in previously unsurveyed areas. However, the effort is still patchy and relies heavily on the resources available to local groups.

Support for a national survey is vital to provide a robust dataset underpinning national conservation objectives. SNH currently contracts the Scottish Squirrel Survey Co-ordinator for this purpose. The current survey includes collection of both red and grey squirrel sightings to help detect any changes and ensure effective conservation action. However, further work is urgently required to provide a more robust, comprehensive dataset of the distribution of both species. Given the threats posed by grey squirrels, action should target the interface areas of red/grey squirrel distribution to detect any changes in their distribution within these areas as a matter of priority.

2 THE ACTION PLAN

2.1 Plan format

The Plan has been developed following the format of the *Scottish Strategy for Red Squirrel Conservation*. This identified eight strategic objectives necessary to meet the requirements of the Biodiversity Action Plan (BAP), providing guidance on the main elements to be considered for each. The Plan presents the actions in the same order; however it should be emphasised this does not infer any rank importance between actions or objectives. The role and importance of each action and objective in achieving red squirrel conservation across Scotland is evaluated further in the support packages presented under Section 4, *Options for action delivery*.

2.2 Timescale and partnership working

The Plan covers the period 2006–2011. Although many actions may be achievable within this timescale, it should be recognised that others may only be initiated during this period and will require a longer-term commitment; this is particularly true of work on grey squirrel control and squirrelpox virus. To address this, the Plan seeks to identify strategic approaches which are sustainable in the long term. Whilst the following plan presents viable options for red squirrel conservation action in Scotland over the next five years, these are offered as options against a backdrop of ongoing commitment to meet the requirements of the UK BAP. Similarly, some actions reflect partnership with other agencies south of the border. For example, the costs associated with research on immuno-contraception are based on an assumption that partnerships will be established with other UK agencies. As such, the costs attributed to the project reflect only 25% of the total costs. Failure to establish these partnerships would increase the costs for Scotland markedly or risk non-delivery of the action.

2.3 Rationale

The Action Plan builds on the concept of priority woodlands for red squirrel conservation first published in the report *Priority Woodlands for red squirrel conservation in north and central Scotland: a preliminary analysis*. SNH Commissioned Report No. 089 (Poulsom *et al.*, 2005). This analysis identified 127 potential woodlands across Scotland where targeted conservation action offered the maximum likelihood of conserving red squirrels. These woodlands were ranked using criteria on the magnitude of threat (distance to nearest grey squirrels), extent and suitability of habitat, site defendability and socio-economic and other reasons, eg management felling regime, ownership of woodland and other species of conservation interest. A similar exercise was undertaken in south Scotland, by the Red Squirrels in South Scotland project, raising a list of a further 23 priority woodlands. The Plan builds on the concept of targeting action presented by these 150 woodlands.

The current list of 150 candidate 'priority woodlands' totals 450,000ha, representing a third of all Scottish woodlands. This increases to 1.85 million ha when buffer zones of 3km are added for protection of the core woodlands. This equates to one quarter of Scotland's land area. Under the Scottish Biodiversity Strategy, it is not pragmatic or desirable to dedicate such a large area of land mass to the conservation of a single species. Moreover, much of this area can be managed to maintain or improve red squirrel habitat as part of the Scottish Forestry Strategy. For this reason, the Action Plan recommends further refinement of the list and offers the concept of Stronghold sites.

Stronghold sites will be selected from the candidate Priority Woodlands list. They are selected to be large and sufficiently viable for the long-term retention of red squirrels even in the face of further spread of grey squirrels. They are generally over 2,000ha and are defensible in the long term. They are also geographically representative of the current distribution of red squirrels. Annex 1 sets out the approach to their selection. These would be recommended for enhanced management for red squirrel conservation. Each would have an associated buffer for further protection. Action outside the stronghold sites would be focused on large, viable red squirrel populations. This would be guided, initially, by the list of candidate priority woodlands taking into consideration other management objectives.

The Action Plan identifies four possible levels of delivering actions, with associated costs. The relative benefits and disadvantages of each are described and a recommendation made for one option.

2.4 Key actions

2.4.1 Establish and monitor the red squirrel populations

	Lead responsibility
a. Complete the Scottish Squirrel Survey by 2009 as set out in the <i>Framework for Surveying Squirrels in Scotland: a basis for a first round of surveys</i> . In addition, other viable red squirrel populations, identified through parallel survey work, should also be included in this process as appropriate. This survey primarily will be conducted through commissioned work but will include contributions by local volunteer squirrel groups and other interested parties where appropriate.	SNH FCS support
b. Initiate baseline population monitoring of stronghold sites by 2008.	SNH FCS support
c. Maintain support for the Scottish Squirrel Survey Co-ordinator until August 2007. Thereafter, set in place a mechanism for central co-ordination of advice and data collation for red squirrel conservation. Funding for full-time posts should be secured until 2009 (currently secure until 2007) and reviewed thereafter.	SNH
d. Provide, by December 2007, clear guidance on survey methods currently available. This should identify the most appropriate method relative to the conditions prevailing at each site and should cover both presence/absence data and methods of density estimation.	SNH

2.4.2 Prioritise woods where conservation work will be focused

a. By December 2007, identify and prepare maps for red squirrel stronghold areas. These should satisfy the criteria set out in Annex 1, with assessments based on the information presented in <i>Identification of priority woodlands for red squirrel conservation in North and Central Scotland: a preliminary analysis</i> (SNH Commissioned Report No. 089) and the data available on priority woodlands in Borders and Dumfries and Galloway. The eligibility of sites should be informed by data collated under the Scottish Squirrel Survey and any adjustments to the list made as appropriate. Stakeholder consultation must be an integral part of the process.	FCS/SNH partnership
--	------------------------

	Lead responsibility
b. Using the results of the 2009 Scottish Squirrel Survey, review and publish revised Priority Woodland analysis by March 2010, including survey results to assess potential viable populations and guide conservation action. This should cover the whole of Scotland.	SNH/FCS partnership

2.4.3 Improve woodlands for red squirrels

a. Prepare overall Red Squirrel Plans for each stronghold site (including buffer zones) to set a framework for individual woods/owners plans, by March 2011.	FCS/SNH partnership
b. In the context of the overall Red Squirrel Plans, for stronghold sites and buffer areas, promote red squirrels as a key objective into any new or revised component National Forest Estate design plans and private forest plans created by 2011. Where possible, digitise and model future forest compositions to optimise management for red squirrels in the long term.	FCS
c. Outside stronghold sites, incorporate red squirrel-friendly habitat management where suitable into woodland planning and practice. This should be guided by priority woodlands analysis of viable woods (National Forest Estate design plans, forest plans, felling licences).	FCS
d. By March 2008, produce current best practice guidance on woodland design and management to encourage red squirrel and discourage grey squirrel occupation.	FCS SNH support
e. By March 2007, produce and implement guidance in respect of forest operations and the Nature Conservation (Scotland) Act 2004.	FCS SNH support
f. Develop and implement forestry grants, within the Land Management Contracts framework, to improve red squirrel habitat and to deter grey squirrels in private woods. These should target, primarily, stronghold sites, buffer areas and key grey squirrel control areas.	FCS
g. Carry out habitat improvement operations on FES land (red squirrel-friendly- and grey squirrel unfriendly-management), targeted primarily at stronghold sites, buffer areas and key grey squirrel control areas.	FCS
h. Ensure distribution of information on stronghold woodlands to appropriate local planning authorities, by December 2007, and on revised priority woodland analysis to avoid conflicts with development planning.	SNH

2.4.4 Minimise or reduce the threat from grey squirrels

a. Fund, by August 2006, two grey squirrel control officers in South Scotland to address the spread of SqPV. These posts should integrate with an established surveillance and monitoring scheme, including the support for analysis and reporting of results.	SNH
--	------------

	Lead responsibility
b. Subject to the outcome of 2.4.4(a), provide funds for grey squirrel control officers to prevent grey squirrel range spread in other strategic areas of the country. Funding should be made available for an officer in Grampian by April 2007 and other qualifying areas from 2008. Evaluate the need for additional dedicated grey squirrel control in stronghold sites based on Management Plans (see 2.4.2(a)).	SNH with FCS and SEERAD support
c. Support control of grey squirrels for red squirrel conservation in existing schemes under the Scottish Forestry Grant Scheme (closed 2006).	FCS
d. From March 2007, offer support from revised forestry grants and SEERAD funds under Land Management Contracts (LMCs). These should target support for grey squirrel control projects in 2.4.4(a) and 2.4.4(b).	FCS, SEERAD
e. Prepare guidance, by December 2006, identifying the risks from grey squirrels for all Local Authorities in areas supporting known populations. Encourage urban grey squirrel control programmes in towns, cities and other areas contributing to the expansion of the species into red squirrel areas. Urgent priority should be given to the situation in Grampian and the dispersal of grey squirrels from Aberdeen City.	SNH with SEERAD and Local Authority support
f. By December 2006, prepare a Contingency Plan for the control of SqPV. This should include guidance on what to look for and what actions to take in the event of a suspected case. This should include appropriate funding to support rapid analysis of samples in novel areas and an awareness/education campaign supported with appropriate material.	SNH with SEERAD support

2.4.5 Contribute to research into red squirrel conservation

a. Continue to provide funding to identify, and implement, cost-effective methods of grey squirrel control.	SEERAD SNH/FCS support
b. Establish, by December 2006, a funded research programme to support research on SqPV, specifically the mode of transmission and potential for vaccine development.	SEERAD SNH support
c. Review the impact of predation and road mortalities on red squirrel population management by March 2009.	SNH
d. As part of targeted grey squirrel control (see 2.4.4(a)), monitor the effectiveness of grey squirrel control in encouraging red squirrel retention or re-colonisation of woodlands subject to grey squirrel incursion. This should quantify the minimum level of control required (complete eradication or long-term population depression) and associated costs. This should be completed by March 2009.	SNH FCS support
e. Develop forest habitat network options for red squirrels. Reports should be prepared for stronghold sites and buffer areas by March 2008 and for grey squirrel control regions and other revised priority areas by March 2010.	FCS/SNH partnership

2.4.6 Implement the strategy locally with central support

	Lead responsibility
a. Continue to support the Scottish Squirrel Group for central co-ordination of red squirrel conservation action in Scotland. Meetings should be hosted twice annually and on other occasions as required.	SNH/FCS partnership
b. Host a red squirrel conference in 2007 to promote the effective delivery of the red squirrel action plan in Scotland.	SNH
c. Encourage local initiatives to maintain the involvement of local volunteer groups in red squirrel conservation.	SNH
d. Review, by August 2006, the need for Red Squirrel Conservation Officers to assist local squirrel groups. Consideration should be given to requirements for full-time and part-time support and collaboration across groups.	SNH
e. Support the establishment of an Argyll Red Squirrel Group by March 2007.	SNH/FCS partnership

2.4.7 Promote the strategy and raise awareness of red squirrel conservation

a. By March 2008, prepare a strategy identifying opportunities for red squirrel eco-tourism, seeking collaboration with VisitScotland. This should aim to highlight the importance of red squirrels in Scotland whilst providing support and fund raising for local community and conservation projects.	SNH/ VisitScotland partnership
b. Encourage the use of available educational material, eg the Nutcase, in schools throughout Scotland.	SNH, SEERAD support
c. Encourage inclusion of red squirrel in all PR opportunities, both on a local and national scale.	SNH/FCS/ SEERAD

2.4.8 Monitor and assess progress of the plan

a. Review progress under the plan annually. Using information collated during this period, revise targets appropriately in 2011.	SNH/FCS/SEERAD Working Group
--	---------------------------------

3 EVALUATION OF OPTIONS FOR DELIVERY OF THE PLAN

Each of the strategic objectives has a range of contributory actions. However, in order to present a set of actions as a realistic and achievable plan, it is necessary to distinguish those which are 'essential' from those which are 'desirable' to achieve the required strategic objectives. To this end, Annexes 2–4 set out a process by which the primary outputs and outcomes for each objective are identified. The risks and assumptions inherent in trying to achieve each are considered and this information used to identify a range of options which may meet the objective. These options are evaluated against the risk of meeting or not meeting the objectives and are used to identify four 'packages' of support for red squirrel conservation ranging from the current level of delivery through to more aspirational options. The costs for these packages are set out in Annex 5.

4 OPTIONS FOR ACTION DELIVERY

4.1 Option descriptions

Option 1

This package focuses on establishing a network of voluntary groups as the main delivery route for the national survey and local initiatives. This would be restricted to the survey deadline with no significant commitment beyond 2009. The package would not invest in defining formal priorities within the existing list of priority woodlands, identified in the SNH report (see 2.3). As such, it would provide no additional guidance for targeting action nationally.

Red squirrel-friendly woodland management would be encouraged generally in the 150 priority woodlands but no area would be restricted in terms of broadleaved trees to deter grey squirrel incursion. Grey squirrel control would continue to be funded primarily through existing agreed SFGS grant schemes available over the current 150 priority woodlands. No new grant funds would be added for control.

No attempt would be made to address the problem of squirrelpox virus. Research would continue to investigate efficiencies of methods of grey squirrel control currently available, with limited investment in alternative long-term options.

Option 2

This package would focus national survey activity on the existing list of priority woodlands only. This would be delivered through professional surveyors to provide a measurable level of control in the process. However, restricting surveys to priority woodlands would return a limited dataset to inform future management. Informal surveys by local groups would continue to be encouraged to supplement this but there would be no associated funding and, as such, local groups would continue to rely on local donations and fund-raising. Priority woodlands would be ranked by defendability criteria only to provide a list of top priority stronghold sites (c40,000ha) for the long term safety of red squirrels should grey squirrels continue to spread. However, these are likely to be geographically clustered in areas away from grey squirrel presence and, as such, would not represent the current geographic range of the species. Although such an approach would incur relatively low maintenance costs, the lack of geographic representation would not meet the targets of the Biodiversity Action Plan or Scottish Biodiversity Strategy.

In stronghold sites, habitat management to favour red squirrels would be a priority. The management regime would include habitat management to deter grey squirrels (restriction or removal of large-seeded broadleaves) within the stronghold woods but not the wider surrounding buffer areas.

Targeted grey squirrel control would be restricted to that necessary to address the threat from squirrelpox virus. Research would investigate viable alternatives to the current methods of grey squirrel control and to study the transmission of squirrelpox virus to help inform future management practices. It would not, however, extend to alternative protection through vaccine development.

The development of forest habitat networks would address only the requirements of the primary, stronghold sites to ensure appropriate connectivity for long-term retention of red squirrel populations.

Option 3

This package relies on the employment of six Red Squirrel Conservation Officers (RSCO) to deliver the full *Scottish Squirrel Survey Framework* (priority woodlands plus red/grey squirrel interface areas). Although providing no additional funding for local groups, experience has shown that the support of an RSCO can bolster local interest and re-juvenate local involvement. These are benefits to be considered when seeking to maintain a volunteer network alongside professional delivery of the plan.

A greater area of stronghold woods (c.80,000ha) would be selected with buffer areas together totalling as much as 400,000ha (around 5% of the Scottish land area). The list of stronghold sites would be assessed by criteria including the geographic spread of the species, the long-term viability of the site and the presence of other constraints such as native broadleaved woodland. Some sites would be within mixed red/grey zones and would require grey squirrel control within the period of the plan. This analysis would be linked to management planning of stronghold sites to include red squirrel-friendly habitat management and management to deter grey squirrels both in and around the stronghold sites.

Grey squirrel control would be targeted firstly in areas at risk from squirrelpox virus in addition to any stronghold sites and buffer area affected. This would be supplemented by an investment in Grey Squirrel Control Officers to co-ordinate and conduct a control programme in nationally strategic areas, eg Grampian, Argyll and north Perthshire. This would support the action within stronghold sites and stop further spread of grey squirrels into larger core areas of red squirrels. These project officers would undertake most control, including national forest estate and private woods, but new forestry/LMC grants would be made available to landowners in the same areas to support the overall strategy.

Research would include investigation of current and alternative, long-term methods of sustainable grey squirrel control to improve the options available. This would be conducted alongside a programme to investigate the viability of vaccination of red squirrels against squirrelpox virus. Forest Habitat Networks would include stronghold and other priority red squirrel sites (as identified in the SNH report) to manage their connectivity for red squirrels. Research may also extend to investigating other issues of conservation, for example the impact of road mortalities, to help inform local management practices.

This package represents a relatively complete and realistic, long-term approach to conserving red squirrels. It meets the requirements of the BAP and offers a management balance between red squirrel conservation, native woodland management and other biodiversity targets.

Option 4

This package relies heavily on a suite of professionals to deliver the main elements of the Action Plan. This includes both the full national survey as well as grey squirrel control for the prevention of disease spread and range spread in grey squirrels. Woodlands on the SNH list would be prioritised as in Option 3 but both red squirrel-friendly habitat management and management to deter grey squirrels would be identified as a primary objective in all the 150 woodlands.

Whilst priority would be given to grey squirrel control to prevent the spread of disease, funding would be made available to control grey squirrels in other areas for the purpose of protecting all red squirrel populations.

Research would be as Option 3, investigating both sustainable long-term management of grey squirrels and vaccine development for SqPV alongside the development of forest habitat networks encompassing all the red squirrel woodland sites. Funds would be made available to local groups on an individual project-basis in order to maintain the local network alongside the professionals.

4.2 Comparison of options

Option 1 broadly represents the basic level of investment in red squirrel conservation but with a significantly enhanced investment in local group support. Although successfully maintaining a network of local groups through this route, it does not provide long-term security for them beyond 2009. There is also a risk that the survey will not be completed if the groups do not have the ability or infrastructure to use the resources efficiently. Moreover, it provides no strategic approach to grey squirrel control and, consequently, the spread of this species, and squirrelpox virus, is likely to continue at the present rate. With no attempt to prioritise action within the current list of 150 red squirrel woodlands, investment in appropriate management may continue to be subjective and patchy, relying heavily on local perceptions of the importance of red squirrels relative to other management objectives. Research would clarify existing methods of grey squirrel control but would not provide alternatives should these prove inadequate. Under this option, the red squirrel is likely to continue to face all the pressures and problems faced currently and the likely outcome is that the species will be lost from large areas of the country over the coming decades.

Estimated costs for this package are £1,364,500. This includes a significant increase in the resources to support delivery of action by local groups (see 5: Current Delivery). However, experience has demonstrated that, at this level of investment, the package does not present a viable approach to maintaining red squirrels in Scotland and represents poor value for money. Consequently, this option is not recommended.

Option 2 addresses the risk presented by squirrelpox virus but, by not controlling grey squirrels on a wider basis, does not protect the core red squirrel regions facing grey squirrel incursion. It does provide more guarantee of completing the national survey, through the use of professionals, but the usefulness of this could be undermined by the narrow focus on priority woodlands alone. It addresses the need to focus hard on some areas as strongholds to ensure the species survives in some areas, but by using only defendability to rank woodlands for conservation action, the resulting list would be geographically clustered and most likely confined to the north and west.

The package represents a greater commitment to the processes underlying red squirrel conservation but does not establish the infrastructure necessary to ensure their efficient and effective deployment in the field. It risks reducing red squirrel populations to isolated woodlands which would, in turn, come under increasing pressure from a largely unchecked grey squirrel population. As such, it does not significantly improve the long-term prognosis for red squirrels against the current situation.

The estimated costs for delivery of this package are £2,235,225. The option represents a targeted but possibly too narrow an approach to counter widespread problems and is insufficient to safeguard the long term survival of red squirrels in Scotland. On this basis, the option is not recommended.

Option 3 addresses the widespread problem of grey squirrels through targeted action in stronghold areas combined with a national programme of supportive strategic control. Whilst it presents a highly targeted approach to management for red squirrels, it does provide a relatively secure and achievable method of ensuring red squirrels are maintained across representative areas of Scotland. As with Option 2, ineffective delivery of grey squirrel control outside the stronghold areas risks reducing the red squirrel population to isolated woodlands in the longer term. However, this caveat applies to any approach seeking to reduce the pressure from such a widespread species. The problem is more achievable if land managers are invited to contribute to a strategic approach which is led by dedicated trappers rather than widespread and untargeted action with long-term implications and minimal chance of success.

The estimated costs for delivery of this package are £3,719,000. It does accord with the requirements of the BAP and is a cost-effective option for the long-term retention of red squirrels in Scotland. This option is recommended as the most viable and cost-effective package of support.

Option 4 relies heavily on a suite of professionals. Whilst this provides ultimate control over delivery of the actions, the associated costs are high and has more limited volunteer stakeholder involvement. Red squirrel-friendly habitat management and management to deter grey squirrels are desirable regimes for all woods containing red squirrels but this will inevitably be more effective in some areas than others (depending on the competitive pressure from grey squirrels). As such, it is questionable whether the benefits of investing this level of management in all woodlands containing red squirrels are greater than a more targeted approach. Moreover, the value of extending grey squirrel control to protect all current red squirrel populations is unquantified. Currently one third (50) of the woodlands on the SNH list are in the vicinity of grey squirrels. Under these circumstances, the costs would be very high and difficult to sustain. The costs associated in sacrificing broadleaved woodlands under this option would be very high as this would require restriction or removal of broadleaves from up to 1.85 million ha (25% of the Scottish landscape) which would strongly affect other biodiversity objectives. It also risks failure as it would be very difficult to achieve and sustain.

The estimated costs for delivery of this package are £5,304,900. The options reflect a substantial investment in red squirrel conservation but elements of the package, eg the effectiveness of widespread grey squirrel control to protect the national red squirrel population, remain unproven. Consequently, the value for money of this option is questionable in light of these uncertainties. Whilst experience may provide support for future investment at the enhanced level, this package is not recommended.

5 CURRENT DELIVERY

SNH and FCS currently fund red squirrel conservation action at the following level:

SNH (commitment for 2006–2007)

Grant-aid support:

Red Squirrels in South Scotland	£15,000
Ayrshire Red Squirrel Group	£6,000
Highland Red Squirrel Group	£10,000
Survey Co-ordinator	£35,000
Scottish Squirrel Group	£1,250

Funds committed for 2006–2007:

Grey squirrel control officers	£40,000
Grey squirrel control model	£10,000
Squirrelpox virus research/surveillance	£25,000
Total	£142,250

Current forward commitment for 2007–2011:

Red Squirrels in South Scotland	No current commitment
Ayrshire Red Squirrel Group	£6,000
Highland Red Squirrel Group	£10,000
Survey Co-ordinator	£43,750
Scottish Squirrel Group	£6,250
Total	£66,000

Funds are also being considered for supporting the local group network or Red Squirrel Conservation Officers. However, progress on this has been deferred pending any decisions on the Action Plan.

FCS

Scottish Forestry Grant Scheme

Grey squirrel control	£30,000
Woodland planning and habitat management for red squirrels	£20,000

FES

Operational planning to accommodate red squirrel protection	£35,000
Forest Design Planning and habitat management spending for red squirrels	£20,000
Highland Red Squirrel Group project officer	£7,000
Red Squirrels in South Scotland project	£5,000

Forest Development Programme partnership projects

Red Squirrels in South Scotland project	£5,000
National office projects (selection of strongholds/habitat networks)	£20,000

Research and advisory

Guidance on forest operations in red squirrel areas	£14,000
Scottish part of projects funded through Forest Research:	
• index-trapping	£11,000
• reproductive research	£8,000
• understanding/predicting tree-cone production	£9,000
Total FCS spend for 2006–2007	£184,000

FCS commitment is currently c.£150,000 for 2007–2008. All additional costs from proposals in this plan will require new funds to be made available.

Total current expenditure/commitment for 2006–2007 **£326,250**

Total current commitment for 2006–2011 **£542,250**

This estimate excludes revenue forgone for early felling of trees or planting less productive species specifically for red squirrels. It also excludes staff costs.

SNH/FCS current expenditure falls short of estimated costs of Option 3 by £3,176,750. These resources would have to be obtained to deliver the option as the most integrated, efficient and cost-effective approach to red squirrel conservation 2006–2011.

6 RECOMMENDATION

The Scottish Strategy for Red Squirrel Conservation aims to conserve viable red squirrel populations across their current range. This aim has been carried forward into the Action Plan which aims to retain red squirrels in all the main current centres of population.

The range of options for delivery are set out in Section 4. Option 3 is recommended as the best overall balance of management objectives and value for money. Annex 6 sets out the approach relating to management under Option 3.

Annex 1 **Selection of potential red squirrel stronghold areas: proposed criteria**

- 1 Selection of squirrel strongholds should use the list of candidate priority woodlands sites published Poulson *et al.* (2005) *Identification of priority woodlands for red squirrel conservation in North and Central Scotland: a preliminary analysis*. SNH Commissioned Report No 089. In addition, the list of priority woodlands prepared by the Red Squirrels in South Scotland project should be used. The list should be refined to identify strongholds by the following process.
- 2 Identify three lists as a starting point:
 - a) the top 50 sites in the original rankings based on all criteria;
 - b) the top 40 sites ranked on defendability and distance to nearest grey squirrel only; and
 - c) the 'high priority woods' from south Scotland.
- 3 Combined to a single list. Subsequently, filter these to the top 20 strongholds, ensuring that these reflect the current geographic spread of the species in Scotland.
- 4 The resulting list should be representative of the following elements:
 - large and sufficiently viable for long-term red squirrel retention under isolated conditions (generally areas over 2,000ha);
 - not under current, immediate threat from grey squirrels;
 - defendable, with low cover large-seeded broadleaves in the main, priority area; high amounts of moorland or other open ground in buffer zones and/or isolated geographically on island or peninsulas;
 - geographically representative of the current distribution of red squirrels in Scotland.
- 5 The area of semi-natural woodland, ancient woodland and woodland SSSI/SACs of each potential stronghold and buffer needs to be considered to determine the compatibility of red squirrel management with other management objectives.
- 6 Further analysis should:

Confirm the presence of red squirrels in these woodlands;

- a) consider any new potential sites arising from information obtained through the national survey;
- b) consult local stakeholders to determine the defendability/constraints of each site; and
- c) identify boundaries of strongholds and buffer zones of component woodlands. Work and consultation with stakeholders to confirm the selection of these sites.

Annex 2 Criteria for the delivery of Action Plan objectives

Table 1 Criteria for the delivery of Action Plan objectives: risks and assumptions

Objective	Outputs/Outcomes	Assumptions	Risks
1. Establish and monitor the red squirrel population.	Full dataset from which to target effective red squirrel conservation action.	<ul style="list-style-type: none"> Dataset encompassing all Scottish woodlands is achievable and desirable. Resources will be available to cover necessary manpower. Central resource is maintained to collate and manage data. 	<ul style="list-style-type: none"> Resources are not available for full professional survey. Volunteer groups are inconsistent or fail to deliver required survey. Resources not available to maintain central data repository.
2. Prioritise woods where conservation work will be focused.	List of stronghold and other woodlands for action to benefit local red squirrel populations.	<ul style="list-style-type: none"> Data on all woodland compositions are available. Accurate data on red squirrel distribution is available. Requirement to maintain current geographic spread of the species. Benefits to red squirrel population can be measured. 	<ul style="list-style-type: none"> Data on woodlands not sufficiently detailed/digitised for preparation of plan. Insufficient resources available to underpin management of all woodlands. Red squirrels not prioritised in woodland management.
3. Improve woodlands for red squirrels.	Design plans for all viable red squirrel occupied woodlands taking into account the presence and requirements of the species.	<ul style="list-style-type: none"> Resources are available to cover costs of woodland design, planning and management. Woodland managers undertake appropriate management. Requirement to maintain all currently occupied woodlands to maximise probability of squirrel persistence. Balance needed between red squirrels and other biodiversity priorities. Most important red squirrel sites must have red squirrel-friendly management. 	<ul style="list-style-type: none"> Data on woodlands not sufficiently detailed/digitised for preparation of plan. Insufficient resources available to underpin management of all woodlands. Red squirrels not prioritised in woodland management.
4. Minimise or reduce the threat from grey squirrels.	Removal of grey squirrel from areas posing greatest threat to national red squirrel persistence. Associated reduction of grey squirrel numbers to reduce population pressure on important red squirrel populations.	<ul style="list-style-type: none"> Grey squirrel control effective. Resources available to fully support required action. Areas for control action identifiable. 	<ul style="list-style-type: none"> Grey squirrel control methods ineffective. Resources not available to support full action required. Grey squirrel too widespread in some areas to identify suitable targeted action.
5. Contribute to research into red squirrel conservation.	Network of institutes conducting funded research on issues necessary to inform appropriate conservation management.	<ul style="list-style-type: none"> Priority for research on SqPV. Research required to quantify effectiveness of grey squirrel control to underpin management action. 	<ul style="list-style-type: none"> Resources unavailable for research.
6. Implement the strategy locally with central support.	Network of local groups to underpin national decisions and deliver action locally.	<ul style="list-style-type: none"> Maintenance of Scottish Squirrel Group essential. Existing networks of local groups continues. Resources are available to administer any new RSCO posts. 	<ul style="list-style-type: none"> Local groups fail to achieve sufficient support or finance. Resources are unavailable to administer RSCO posts.
7. Promote the strategy and raise awareness of red squirrel conservation.	Maintain high profile of species in the media to encourage wide participation in red squirrel conservation.	<ul style="list-style-type: none"> Red squirrel remains on SNH Species Framework following consultation period. Wide media exposure maintains high interest in the species. Continued participation from all current key stakeholders. 	<ul style="list-style-type: none"> Red squirrel removed from SNH Species Framework. Opportunities not presented for public exposure of the species. Failure to measure progress on actions diminishes public interest.
8. Monitor and assess progress on the plan.	Timely and accurate recording of plan delivery with mechanism to address slippage where necessary	<ul style="list-style-type: none"> Plan reflects action required for the species. Resources made available to monitor plan progress. 	<ul style="list-style-type: none"> Plan fails to reflect accurately the action required for the species. Fails to meet requirements for stakeholder buy-in. Resources diverted and unavailable for regular plan reviews. Mechanism unavailable to address slippages.

Annex 3 Evaluation of options for delivering targets

Table 2 Evaluation of options for delivering targets

Each objective contains a range of options for delivery of outputs and outcomes, varying in the degree to which they will meet the requirements of the objective. In order to assess the relative value of each of these to red squirrel conservation, they have been evaluated against their likelihood of achieving the objective. Each option was scored according to the following criteria and a total estimated on a range of three (does not significantly meet the requirements of the objective) to nine (fully meets the requirements of the objective).

Criteria and scoring:

Risk

- 1 **High risk:** delivery unlikely due to extraneous factors.
- 2 **Medium risk:** delivery possible if extraneous factors can be controlled. Dependent on internal resources available to resolve problems.
- 3 **Low risk:** Defined method of delivery, participants fully accountable.

Value for Money

- 1 **Low VFM:** expenditure significant, outputs not guaranteed either on consistency or deliverability.
- 2 **Medium VFM:** expenditure may be significant but is accountable in terms of outputs. Cost per unit output exceeds minimum. Delivery of action plan may require additional expenditure.
- 3 **High VFM:** expenditure fully accountable. Cost per unit output minimal.

Community involvement

- 1 **Low community involvement:** action does not rely on community involvement and does not serve to increase this.
- 2 **Moderate community involvement:** action may be partially undertaken by community/volunteer groups or may be used to encourage wider participation.
- 3 **High community involvement:** action relies heavily on participation of community/volunteer groups or could be delivered solely through this route.

1 Establish the red squirrel resource and monitor

	Risk	VFM	Community involvement	Total
a. Central co-ordination of volunteer group network to conduct survey. No investment in commissioned survey and no commitment beyond 2009.	Dependent on volunteer time commitment. No guarantee of completion within required timescale. (1)	Expenditure subject to requirements of volunteer surveyors. (1)	Full community delivery (3)	5
b. Survey work commissioned in stronghold sites and other potential priority woodlands only. No reliance on volunteer network.	Contracted out: minimal risk of non-completion (3)	Area of survey restricted. May require supplementary expenditure to fully deliver conservation requirement. (2)	No community involvement. (1)	6
c. Full commission of <i>Survey Framework</i> (including red/grey interface areas). No reliance on volunteer network and no commitment beyond 2009.	Contracted out: minimal risk of non-completion (3)	Full dataset achieved for future evaluations. (3)	No community involvement. (1)	7

2 Prioritise woods where conservation work will be focused

	Risk	VFM	Community involvement	Total
a. No prioritisation exercise. Revise rankings based on survey for the purpose of guiding management only.	No list prepared: no ability to target action accordingly may result in continued losses of red squirrels. (1)	No financial outlay (1)	No exercise undertaken to involve stakeholders.(1)	3
b. Identify ranked stronghold areas based on defendability, distance from grey squirrels and other constraints such as native woodland management.	List likely to reflect remote areas. No substantial gain to status quo. (1)	Minimal outlay but with restricted benefits to squirrel conservation. (2)	Would require stakeholder co-operation to prepare and implement. (2)	5
c. Identify larger set of strongholds also taking into account current geographic range of species.	List prepare: based on current information may be inaccurate. (2)	Minimal outlay but significant benefits to conservation if funding for subsequent action is available. (2)	Would require stakeholder co-operation to prepare and implement. (2)	6

3 Improve woodlands for red squirrels

	Risk	VFM	Community involvement	Total
a. Include red squirrel-friendly habitat management, balanced with other objectives and guided by priority woodland analysis. No significant removal/restrictions of broadleaved trees to deter grey squirrels.	May be no woodlands where red squirrels are a priority; no significant improvement without grey control. (1)	No strategic approach to financial spending. Potentially no significant gain for substantial spend. (1)	Stakeholder involvement only as current. (1)	3
b. Include red squirrel in habitat management generally as for (a) but as a priority in 40,000ha of stronghold woods. Restriction/removal of broadleaves to deter grey squirrels limited to stronghold woods only.	Stronghold sites do not cover large enough areas if grey squirrels eventually arrive; other sites not secure without grey squirrel control. (2)	Significant area secured for long term if grey control can be guaranteed in stronghold areas when needed. Low sacrifice of other biodiversity benefits from broadleaved woods. (2)	Stakeholder involvement largely as current. (1)	5
c. Include red squirrel-friendly habitat management generally as (a) but as a priority in 80,000ha of stronghold woods plus buffer areas (totalling c.400,000ha). Restriction/removal of broadleaves to deter grey squirrels.	Lack of grey squirrel deterrent habitat management may undermine on non-stronghold sites. Also, approach may not benefit red squirrels on strongholds. (2)	Resources targeted to secure substantial core of sites across red squirrel range. Acceptable loss of other biodiversity benefits (eg broadleaved woodlands). (3)	Would require stakeholder involvement on all sites. (2)	7
d. Include red squirrel-friendly habitat management and management to deter grey squirrel on strongholds sites as in (c) plus all other woodlands identified on priority list.	Habitat management prescriptions may not be effective for red squirrel conservation. High risk of supporting grey squirrel control not being sustainable on the required scale: could undermine management. (1)	Large expenditure with unquantified benefits and high loss of other biodiversity benefits. Only potentially worthwhile with large scale grey control. Massive sacrifice required in terms of broadleaved woodland and HAP/SAP biodiversity targets. (1)	Would require stakeholder involvement on maximum number of sites. (2)	4

4 Minimise or reduce the threat from grey squirrels

	Risk	VFM	Community involvement	Total
a. Localised grey squirrel control only to address immediate risk from SqPV. No investment in surveillance monitoring of disease spread.	Reactive management only. Cannot evaluate further risks. (1)	Outlay could be substantial but addresses only the immediate threat. (1)	Minimal community involvement around known infected areas only. (1)	3
b. Localised grey squirrel control to address immediate risk from SqPV. Wider surveillance programme to detect potential new cases further afield. Wider grey squirrel control targets stronghold sites only.	Grey squirrel control targetting only immediate risks: too restrictive. (2)	Outlay could be substantial but expenditure controllable and accountable in terms of benefits. (2)	May require community involvement. (2)	6
c. Grey squirrel control/surveillance to address immediate risk from SqPV, plus control programmes in stronghold sites and supporting strategic areas.	Grey squirrel control is not effective: strategy fails. (2)	Outlay substantial. Benefits directly related to effectiveness of method but targetted action most cost-effective approach. (3)	May require community involvement. (2)	6
d. Grey squirrel control/surveillance to address immediate risk from SqPV, plus control elsewhere to protect all red squirrel populations.	Grey control is not effective or action too widely dispersed. Control fails to protect strategic sites. (2)	Outlay substantial plus financial support distributed over wide area with no guaranteed success. (1)	May require community involvement. (2)	5

5 Contribute to research into red squirrel conservation

	Risk	VFM	Community involvement	Total
a. Clarify the efficacy of currently available methods of grey squirrel control.	Assumes current methods effective. (2)	Minimal outlay but VFM depends on efficacy of methods. (2)	No community involvement. (1)	5
b. Clarify current methods of grey squirrel control and Identify and refine alternative (long-term, cost-effective) options.	No suitable alternative methods found. (2)	Depends on research outputs. Potentially significant outlay for minimal benefits. (2)	No community involvement. (1)	5
c. Research on routes of transmission of SqPV only to inform future management regimes.	The route of transmission is not defined. (2)	Outputs of significant value but period of funding (overall outlay) uncertain. Useful information obtained on the epidemiology of SqPV. (2)	No community involvement. (1)	5
d. Subject to preceding research, develop vaccine to counter the impact of SqPV on red squirrels.	Vaccine cannot be delivered successfully. (2)	Period of funding subject to success of research. May require an ongoing commitment to vaccination. (2)	No community involvement. (1)	5
e. Clarify habitat management requirements to favour the long-term retention of red squirrels in woodland.	Based on current knowledge but assumes applicable results. (2)	Outlay significant but benefits to squirrels widespread and integrated with other management objectives. (3)	No community involvement. (1)	6
f. Clarify the impact of other mortality factors on red squirrel populations.	Little data available or easily obtainable. (1)	Without survey data unlikely to clarify impact. (1)	May require community involvement. (2)	4

6 Implement the strategy locally with central support

	Risk	VFM	Community involvement	Total
a. Maintain Scottish Squirrel Group for central liaison. Local delivery of actions, including survey, through network of local groups.	Depends on volunteer availability and commitment. (1)	Lower funding required to support volunteers but limited guarantee on delivery. (2)	Full community involvement. (3)	6
b. Maintain central Scottish Squirrel Group but deliver local survey through employment of Red Squirrel Conservation Officers. No significant support for local groups from central funds.	Work contracted out. Minimal risk of non-completion. (3)	Outlay controlled and restricted to survey. (3)	Restricted to locally-funded initiatives only. No guarantee of involvement. (1)	7
c. Maintain Scottish Squirrel Group for central liaison. Survey delivered through commissioned work with support for local groups on individual project-basis only.	Work contracted out. Minimal risk of non-completion. (3)	Outlay controlled. Local group funding relative to outputs and benefits. (3)	Partial community involvement through funded initiatives. (2)	8

7 Promote the strategy and raise awareness of red squirrel conservation

	Risk	VFM	Community involvement	Total
a. Use existing network of public relations to promote awareness.	Network insufficient to promote the messages effectively. (2)	Minimal outlay but benefits could be similarly minimal. (2)	Dependent on applicability to local community (2)	6
b. Develop further partnerships to widen involvement in red squirrel conservation.	Wider partnership widens options for promoting message. (3)	May require additional outlay but benefits should be correspondingly beneficial. (3)	Wider partnership presents opportunities for greater community involvement. (3)	9

8 Monitor and assess progress on the plan

	Risk	VFM	Community involvement	Total
Annual review	Changes occurring within timescale not detected (2)	No significant outlay. (3)	Stakeholder feedback required. (3)	8

Annex 4 Identification of outputs for delivery options

Table 3 Identification of outputs for different delivery options

Obj.	Option 1	Option 2	Option 3	Option 4
1.	Local group delivery of survey co-ordinated until 2009. Support from Survey Co-ordinator plus assistant. Methods of survey prepared and published.	Commissioned survey in Priority Woodlands only. No reliance on volunteer groups. Methods of survey prepared and published. Conservation monitoring of priority woodlands.	Full Survey Framework conducted and delivered through Red Squirrel Conservation Officers (see 6 below). Methods of survey prepared and published. Conservation monitoring of priority woodlands.	Full Survey Framework conducted and delivered through commissioned surveyors. Methods of survey prepared and published. Conservation monitoring of priority woodlands.
2.	No formal priority categories.	Select 10–15 red squirrel stronghold areas, (40,000ha of woodland), based on 150 potential priority woods, based on remoteness/defendability from grey squirrels, degree of conflict with native broadleaved woods, and stakeholder consultation.	Select 15–20 red squirrel stronghold sites (c. 80,000ha of woodlands plus buffer areas together totalling up to c.400,000ha). These should be based on the list of 150 candidate priority woodlands and the criteria set out in Option 2. They should also cover the range of major red squirrel populations (including some areas in red/grey regions).	Select 20 red squirrel stronghold areas, (80,000ha of woodland, together with buffer areas) as per Option 2.
3.	Priority Woodland analysis repeated for 150 woods following completion of survey to assess viability of woods for red squirrel and guide conservation action. Management of woodlands incorporates red squirrel-friendly forest management practices in balance with other objectives, guided by analysis of viability for red squirrels (see 2 above). No large-scale removal or restriction of broadleaves to deter the spread of grey (because of the biodiversity and other values of broadleaves).	'Priority woodland' analysis repeated for 150 woods, following survey, above, to assess viability of woods for red squirrel and guide conservation action. Red squirrel-friendly forest management encouraged in all FCS/SNH approved woodland areas. Investment in removing/restricting large-seeded broadleaves to deter grey squirrel confined to woodland area itself (no buffer zone). In other areas with red squirrels, management as for Option 1.	'Priority Woodland' analysis repeated for 150 woodlands, following survey above, to assess viability of woods for red squirrel and guide conservation action. Integrated plans for strongholds sites and buffer zones to promote red squirrel-friendly forest management and restriction/removal of large-seeded broadleaves to deter greys. All FCS/SNH approved plans for stronghold woodlands and buffers areas to incorporate red squirrel measures as a key objective. Other sectoral land use and development plans to be encouraged to incorporate red squirrels in strongholds and buffers. In other areas management as in Option 1.	'Priority Woodland' analysis repeated for 150 woodlands, following survey above, to assess viability of woods for red squirrel and guide conservation action. Strongholds and buffers to be managed as for Option 3. Red squirrel-friendly habitat management and management to deter grey squirrels encouraged in woodland plans in the other (130 plus) woodland areas plus buffers identified in the initial 'Priority woodlands' report. In other areas with red squirrels manage as per Option 1.

Table 3 (continued)

Obj.	Option 1	Option 2	Option 3	Option 4
4.	Localised grey squirrel control only funded through grant-aid to individual land managers. Limited co-ordination of funding possible. No co-ordination or programme of disease surveillance.	Grant aid for control as in Option 1; Localised grey squirrel control programme to contain and monitor disease only. No co-ordinated regional control to prevent range expansion No strongholds with grey squirrels needing control. SqPV contingency plan prepared.	Localised grey squirrel control programme to contain and monitor disease Additional targeted grey squirrel control in stronghold sites and buffers; and in key areas to prevent range expansion into core red only regions and strongholds. SqPV contingency plan prepared.	Localised grey squirrel control related to programme of disease monitoring. Grey squirrel control elsewhere to protect all red squirrel populations in 150 woodland sites as for Option 3 (currently 50 sites and 600,000ha total area of land including buffers have grey squirrels present). SqPV Contingency Plan.
5.	Research on current grey squirrel control methods only. Refine methods for monitoring/detecting squirrelpox virus. Research/guidance on forest management to favour red squirrels and minimise operational disturbance.	Research/guidance on forest management to favour red squirrels and minimise operational disturbance. SqPV research on routes of transmission only. Research/guidance on forest management to favour red squirrels and minimise operational disturbance.	Research on current methods of grey squirrel control plus alternative methods, including long-term options. SqPV research on routes of transmission and vaccine development. Research/guidance as in Option 1, 2 plus research into design of buffer areas to deter grey squirrels, increase connectivity for red squirrels.	Research on current methods of grey squirrel control plus alternative methods, including long-term options. SqPV research on routes of transmission and vaccine development. Research/guidance as in Option 1,2 plus research into design of buffer areas to deter grey squirrels, increase connectivity for red squirrels. Research on other mortality factors.
6.	Maintain SSG as central liaison. Local groups supported until 2009 to complete survey. Thereafter, funding subject to project-basis only.	Maintain SSG for central liaison. Survey delivered through commissioned work: no significant support for local groups (funds raised locally).	Maintain SSG for central liaison. Survey delivered through Red Squirrel Conservation Officers: no significant support for local groups (funds raised locally). Extend existing network of publicity.	Maintain SSG for central liaison. Survey delivered through Red Squirrel Conservation Officers: local groups funded on project-basis only. Other funds raised locally. Extend existing network of publicity.
7.	Maintain existing network of publicity.	Extend existing network of publicity.	Extend existing network of publicity.	Extend existing network of publicity.
8.	Monitor plan annually.	Monitor plan annually.	Monitor plan annually.	Monitor plan annually.

Annex 5 Cost of options

Table 4 Cost of options

Obj.	Action	Costed elements	Options			
			1	2	3	4
1.	Survey: local group delivery		480,000			
	Survey: commissioned delivery	Staff costs		391,500	*	546,000
	Survey co-ordination/support	Co-ordination/management	100,000	58,725	70,000	81,900
	Publications		5,000	5,000	5,000	5,000
	Methods report		10,000	10,000	10,000	10,000
	Conservation monitoring of priority areas			84,000	168,000	168,000
2.	Prioritisation process		0	20,000	25,000	25,000
	Priority Woodland report		32,000	32,000	32,000	32,000
3.	Woodland management	Overall plans for stronghold sites.		40,000	80,000	80,000
		Design and forest plans for stronghold sites.		95,000	195,000	195,000
		Red squirrel-friendly management planning outside stronghold sites.	86,000	86,000	86,000	86,000
		Forest operations guidance and implementation Nature Conservation Scotland Act (NCSA).	189,000	189,000	189,000	189,000
	Best practice guidance note			25,000	25,000	25,000
	Grants for private woodland management for red squirrels.		90,000	160,000	230,000	370,000
	FES operations for habitat improvement		25,000	50,000	100,000	200,000
	Information to planning authorities		3,000	3,000	3,000	3,000
4.	SqPV Grey Squirrel Control Officers: south	2006 onwards		260,000	260,000	260,000
	Grey Squirrel Control Officers: north and central.	2007 onwards			385,000	770,000
	SqPV surveillance programme	Traps		6,000	12,000	12,000
		Blood samples		27,000	27,000	27,000
		Post mortems		2,500	2,500	2,500
		SqPV kits		7,500	7,500	7,500
		Reporting		2,500	2,500	2,500
	SqPV Contingency Plan			4,000	4,000	4,000
	Local Authority Guidance		5,000	5,000	5,000	5,000
	Current SFGS grant support for targeted Grey Squirrel Control for red squirrel conservation.		150,000	150,000	150,000	150,000
	New forestry grant support for targeted grey squirrel control to support Grey Squirrel Control Officers.		50,000	80,000	400,000	
	New SEERAD grant for Grey Squirrel Control to support Grey Squirrel Control Officers.		20,000	32,000	160,000	

Table 4 (continued)

Obj.	Action	Costed elements	Options			
			1	2	3	4
5.	Research on current grey squirrel control	Strategy model	20,000	20,000	20,000	20,000
		Effectiveness data	15,000	15,000	15,000	15,000
		Reporting	2,000	2,000	2,000	2,000
	Research on alternative grey squirrel control (long-term options)	Immunocontraception		60,000	60,000	60,000
		Warfarin		2,000	2,000	2,000
	SqPV transmission work	Transmission work		300,000	300,000	300,000
		Vaccine development			100,000	100,000
	Habitat networks		10,000	40,000	50,000	50,000
	Red squirrel mortality factors				10,000	10,000
6.	Scottish Squirrel Group		2,500	2,500	2,500	2,500
	Local group funding: project work					60,000
	Network co-ordination				105,000	
	Red Squirrel Conservation Officers		140,000		857,000	857,000
7.	Existing PR		0	0	0	0
	Extended PR			10,000	10,000	10,000
8.	Plan monitoring		0	0	0	0
	Total		1,364,500	2,235,225	3,719,000	5,304,900
	Currently committed funds		542,250	542,250	542,250	542,250
	Additional costs		822,250	1,692,975	3,176,750	4,762,650

* included as RSCO staff costs

Annex 6 Red squirrel management under Option 3

6.1 Stronghold areas

Annex 1 sets out the process by which these would be identified. These would present highly defensible and viable areas which are representative of the current regional populations of the species in Scotland. This would include some outlying, isolated sites.

Approximately 20 strongholds would be identified across Scotland. These would be drawn from the current list of 150 priority woodlands and would include:

- Islands, peninsulas with high natural defensibility against greys;
- Large areas of conifer forest on the mainland in areas, with few large-seeded broadleaves and readily defensible buffer zones around them.

Red squirrels would be a primary management objective. The stronghold woodlands and buffer areas would be planned and managed to enhance them for red squirrels and deter grey squirrels. Grey squirrels would be controlled if they colonised the wood or buffer. (Most would be remote from greys at present but some within southern and eastern areas may require early grey control).

6.2 Grey squirrel control programmes

Action to prevent the further spread of squirrelpox virus would be targeted at the Lockerbie/Langholm area. In addition, grey squirrel control programmes would be established to prevent further expansion in Grampian, Argyll and north Perthshire, to protect core red squirrel regions, and to maintain stronghold sites and their buffer areas free from grey squirrels.

6.3 Action for red squirrel populations outside stronghold sites

Red squirrel conservation will not be a primary management objective of woodlands outside the stronghold sites and their buffers areas. Management for red squirrels in these areas will be balanced with other objectives of the Scottish Biodiversity Strategy and Scottish Forestry Strategy. This will include native woodland restoration and expansion, growing quality hardwood timber and diversifying conifer forests for other species. Management practices will include:

- management of red squirrel-friendly habitat through diversification of species composition and age structure of conifer forests. This would follow normal planning and forest practice under the Scottish Forestry Strategy and UK Forestry Standard;
- a general presumption against large-scale restriction or removal of broadleaved trees to deter grey squirrels outside strongholds. However some detailed local measures may be considered, eg to avoid creating corridors of oak or beech within significant red squirrel woods, as part of balanced woodland management plans.

Any additional control of greys should be considered for the second phase of the plan if the key control programmes above have been successfully achieved.

6.4 Summary of practices

Management practices required under this option are set out in the following table (high priority actions are in red):

Type of action required	Strongholds and buffer areas	Red squirrel only areas	Mixed red/grey areas
1. Red squirrel-friendly habitat management.	Yes: high priority	Yes: where suitable as an objective	Yes: where suitable as an objective, and in large, potentially viable areas
2. Manage habitat to deter grey squirrel (restrict/remove large-seeded broadleaved trees).	Yes	No	No*
3. Grey control: to prevent spread of squirrelpox virus into red squirrels.	Yes: if needed (all strongholds sited away from current virus zone)	Yes: in areas at red/grey interface in virus zone	Yes: in all areas in virus zone
4. Grey control: to prevent range spreading into red-only areas.	Yes: if needed (most strongholds sited away from the edge of range)	Yes: in key areas at red/grey interface	Yes: in key areas at red/grey interface
5. Grey squirrel control locally to save individual red populations.	Yes, if greys present	N/A	No

* other than local minor adjustments