

SELECTING FOREST RESERVES FOR RED SQUIRREL CONSERVATION

Site Selection Paper by Jason Reynolds and Sarah Bentley

i Background

The native red squirrel *Sciurus vulgaris* is currently declining throughout much of its range in Great Britain. This is as a result of competitive exclusion by the North American grey squirrel *Sciurus carolinensis* which was introduced into the country over 100 years ago. Although disappearance of the red squirrel has been recognised for well over 80 years there have been few coordinated attempts to halt the decline. Advances in scientific understanding and the Biodiversity Action Plan process have helped to focus attention on how the red squirrel might be saved. The selection of key forest reserves for red squirrels is seen as central to this conservation challenge. It is intended that reserves will be managed positively for the benefit of red squirrels in order to ensure their future survival in Great Britain.

ii Aims

This paper aims to assist in the process of selecting and ranking forest reserves for conserving red squirrels throughout Great Britain. It is intended for use by a *group* of regional conservation practitioners.

iii The process

To carry out the selection and ranking you will need:

- A clear picture of the woodland cover, ownership and general landscape composition within the search area. Reserves are selected using either digitised woodland cover in a computerised GIS system, or from the appropriate use of O/S maps and local knowledge, preferably a combination of both.
- To know the general distribution of red and grey squirrels within the defined area.

This paper generates a list of regionally important reserves by assessing the landscape against the following 4 criteria:

<i>Reserve Scoping Phase</i>	<i>Reserve Confirmation Phase</i>
<i>1. Magnitude of threat from grey squirrels</i>	<i>4. Socio-economic/other considerations</i>
<i>2. Extent and suitability of habitat</i>	
<i>3. Site Defendability</i>	

By following the criteria a list of sites will be generated and a clear picture of the sites' merits established. These can be ranked according to their overall quality, from which the list of reserves for red squirrels can be finalised.

Reserve Scoping, Phase I

Step 1: Identify all woodlands of 200 ha or more within your broad geographical Area Of Search.

Identifying your woodland:

On mainland Britain: Our purpose is to identify discrete areas of woodland for management. Only *contiguous* wooded areas of 200 ha or more should be selected (very narrow gaps i.e. for power lines, minor roads etc can be seen in the context of contiguous cover). Nearby pockets of woodland should not be incorporated. Whilst it is accepted that squirrels may utilise these outlying habitats, their inclusion does not facilitate effective site selection or management.

On islands: Select all woodlands.

Note: 'Biogeographic representation'

It is expected that there will be considerable support for retaining the red squirrel throughout the whole of its current range within Great Britain. In accordance with the BAP targets, this will ensure that populations are present in England, Northern Ireland, Scotland and Wales. Therefore as long as reserve selection using this paper, or a parallel process, is carried out in all countries there does not need to be a scored criterion to reflect this point.

Step 2: Now fill in a separate scoring sheet (page 9) for each woodland and complete the comparison table provided (page 10). Use the following notes to guide you.

Step 3: Assign a 'Magnitude of threat' rating for each woodland.

Magnitude of threat from grey squirrels.

Red squirrel presence/absence.

The *magnitude of threat* to red squirrels is the threat from grey squirrel incursion. Other factors, such as disease, are not considered since they occur in a stochastic manner that cannot readily be planned for in a regional strategy. Most forest design and woodland management plans are long term and it should be assumed that within the next 20 years grey squirrels will reach most sites in England, Wales and southern Scotland. It may take a little longer for grey squirrels to reach other parts of Scotland. Due to the timescale of forest planning and growth, however, all efforts to address the issue before greys enter woodlands should be encouraged. The *magnitude of threat* will give an indication on the time frame available to plan and adopt squirrel management plans.

It is recommended that you should only continue with the whole exercise with woodlands that are rated 'Good' or better under this criterion. The resources to address grey squirrel eradication and red re-introductions are currently unavailable or undesirable.

Step 4: Assess and rate 'Extent and suitability of habitat'.

Extent and suitability of habitat.

Woodland type and size

An assessment of the amount of available habitat.

On mainland Britain: Conifer woodland provides the best opportunities for red squirrel conservation. Deciduous woodland supports much higher densities of grey squirrels than reds, and the presence of large seeded broadleaves encourages the incursion of grey squirrels. Since resources are best targeted in areas where grey incursion is most readily prevented, conifer woodland is preferred for red squirrel conservation areas.

When considering the conifer woodland it is important that a variety of species are present (e.g. pines, spruces, firs, larches), as a species mixture ensures that there is always food available for the reds throughout the year. You need not agonise over detailed information about species mixtures as this will be covered when forest planning is carried out.

On islands: Opportunities remain for selection of non-conifer woodlands particularly on islands and in isolated broadleaved woodlands where controlling grey incursion is a realistic possibility. All woodland types found on islands are therefore potentially quite good for red squirrel conservation so long as the trees bear food taken by squirrels. Again, the larger the woodlands the better.

Mixed woodland. Woodland with >20% broadleaf in a conifer wood or >20% conifer in a broadleaf wood.

Suitability of the habitat

On mainland Britain: As mentioned above, conifer woodlands are particularly important. However, if the woodland contains > 5% productive large-seeded broadleaves (particularly oak, hazel, beech and sycamore) grey squirrels may be able to rapidly colonise. Small-seed producing deciduous trees such as birch, alder, willows and rowan are not important food sources for grey squirrels and can be overlooked when selecting reserves.

On islands: All food bearing trees will be good for red squirrels. The focus on conifer trees and away from large seeded broadleaved trees needed on the mainland can be overlooked in this instance and a mix is acceptable. For this reason it is possible to overlook this criterion and move onto the next.

Forests tend to have 5-10 year management plans. Contacting the Forestry Commission or the landowner for any such plan will help you to obtain information on areas of broadleaved woodland and species mixtures.

Note: 'Population persistence'

Persistence of squirrel populations is likely to be closely related to the overall number of animals in a population. Habitat size, composition and age structure, disease processes and competition from grey squirrels are all factors which affect population size and, consequently, are likely to have a major influence upon persistence. Mathematical models of squirrel population persistence can be calculated using computers that examine all these and many other factors for a given population. They can consider management, planting and felling regimes and allow predictions to be made on the future persistence of red squirrel populations in chosen conservation areas. However, they require that data on woodland composition and proposed felling and forest design plans are available in a digitised format usable by a Geographic Information System (e.g. GRASS or Arcview). If the future management of a selected conservation area causes concern, modelling of squirrel populations should be carried out.

For the purposes of this paper, 'Magnitude of threat' and 'Extent and suitability of habitat' are both relevant to long term red squirrel persistence. We have not, therefore, scored persistence separately as another criterion as this would simply duplicate the scores previously entered.

Step 5: Assess and rate 'Site defendability'. In this section some overlap with Extent and Suitability of habitat is discussed. However a separate criteria has been created as it is important to think carefully about this issue.

Defendability

The potential for Defendability will have an important part to play when determining where money and effort is best spent. Our position towards red squirrel reserves is different from many current approaches to conservation, which, on the whole, tries to increase habitat linkage. This is because emphasis is currently focused upon securing red squirrel populations away from greys. Our dilemma is this; which is the more immediate problem, extinction of reds due to greys or extinction of reds due to genetic/disease problems within an isolated population? Our experience places the emphasis firmly on the grey squirrel problem as it is a more immediate issue, therefore we favour isolated habitats for now. It is recognised that habitat linkage to enable population mixing of red squirrels may become important in the future.

1. Landscape defendability.

The nature of the surrounding landscape is the next most important factor in determining how well a site can be defended from grey squirrels.

A working best estimate of the potential grey squirrel routes into the reserve should be established, using local knowledge and by consulting O/S maps. Although we cannot exactly quantify the likely level of incursion we can predict the ways in which the majority of grey squirrels move within the landscape.

The following questions will help you to assess the potential for defendability from grey incursion, 'safe areas':

1. Are there linear or broadleaf woodlands around the reserve that increase connections with the surrounding landscape, particularly along river corridors? This will permit easy incursion for greys.

The more woodland cover within the buffer zone the greater potential for grey squirrels to move into the reserve site. You must also consider the type of the woodland, whether it is largely conifer, broadleaved or mixed. Again, large-seeded broadleaves constitute the greatest risk for permitting greys to establish in large numbers. If another potential reserve site falls within the buffer of your site this needs to be noted because there is then greater potential of favourable management for reds.

2. Does the site have open ground/fen/moorland/mountains/cliffs on any sides? Restricts grey incursion.
3. Is the site bounded by a large river or the sea on any sides? Restricts grey incursion, except where there are road/rail bridges crossing these, as squirrels may use them.
4. Are there very major roads on any sides of the site? May possibly slow grey incursion.
5. What is the size of the surrounding settlements and human population? It is recognised that the wider public has a strong affinity for the red squirrel. However, experience indicates that town parks and gardens enable grey squirrels to become well established. For this reason, although it is desirable to deliver biodiversity benefits in areas where people can enjoy them, the proximity of towns, cities etc. to a reserve is considered detrimental to red squirrel conservation. Rate sites most highly where there is limited human settlement in the surrounding area.

It is hoped that forest reserves will be well promoted in order to engage local people and visitors. Similarly, other red squirrel conservation efforts, such as captive breeding, might be possible closer to centres of human population so as to encourage community interest.

6. Is the forest a vast area of conifer over 10000 hectares? You are advised to start thinking about the best, most defendable areas within this large forest. Don't get too specific - this is solely the initial selection process.

Expecting the whole forest to be entirely managed for the benefit of red squirrels is unrealistic. You should aim to develop reserves as discrete areas within the much larger forest. For reserves within very large conifer forests the forest buffer around the reserve should be classed as only a slight barrier to grey movement because *any* woodland will facilitate their presence more than no woodland at all. However, a large area of non-grey squirrel preferred conifer forest may act to slow incursion and it will certainly not be as bad as large-seeded broadleaf habitat.

7. Are there any other topographic or landscape features that may act as barriers to grey squirrel incursion?

These factors have not been given individual scores as they are all important when assessing if a site has good defendability or not. An overall judgment should be taken.

2. *Buffer size - Woodland perimeter (km).*

A buffer zone is an area around the reserve that is actively managed to keep grey squirrel numbers absent or low. The size of the buffer will influence the chances of delivering effective grey squirrel control.

The buffer zone will have an important role to play in protecting red squirrel reserves.

To estimate the area of the buffer you will need to measure the reserve perimeter and compare it against those on the score sheet. If you do not have a GIS, the measurement can simply be done if you know the scale of your map and then running a length of string around the wood on the map. Measure the length of string and enter the woodland score on the sheet provided. You will quickly see that large sites will score very poor.

Large sites and linear (long, thin) sites have a larger area of buffer. It is important to realise that large sites have been assigned low ratings because we are considering the costs of grey squirrel control. Working on the basis that grey squirrel trapping has a set unit cost, large sites will require greater effort and, therefore, cost more to protect. When comparing sites, this score is important because it helps to identify smaller sites that may actually be more manageable against grey squirrel incursion because of their scale.

Grey squirrel dispersal movements can easily cover many kilometres. A 3km distance has been set for the buffer zone as this is thought to be a realistic balance between grey movement, the likelihood and the cost of managing such large areas of the countryside for red squirrels.

Although grey squirrels do occasionally cross open ground it is possible to reduce the buffer width in landscapes where, relative to woodland habitat, incursion by grey squirrels will be considerably more limited. For sites bordered by 'safe areas' (i.e. open fell/moorland) the buffer width can be reduced to 1 km. You may, therefore, need to select a lesser perimeter size on the score sheet. In these instances you should subtract the 'safe' perimeter measurement from the total and select the appropriate range. You will still need a buffer width of 3 km on any 'un-safe' sides of the reserve.

Step 6: Assess and rate 'Site management.'

Site Management

Management potential of the forest and the buffer

We try to consider some fairly complex issues here. Competent Forestry Commission, Wildlife Trust, University, forest managers/consultants and/or other Conservation Agency staff should be involved to help to interpret the questions.

The Forest. Forests tend to have 5-10 year management plans to determine their timber production. The Forestry Commission or the landowner will tell you if there is such a plan. Rate your sites after considering these five questions.

1. What is the species composition of the woodland? How is it intended to change ?

The greater the range of food producing tree species in the forest the better. A monoculture may leave squirrels short of food. Only consider cone-bearing trees (e.g. pines, spruces) and fruiting shrubs/plants (e.g. brambles, roses) in your deliberations. The presence of old large-seeded broadleaved trees (oak, beech, hazel) should be marked as negative.

2. How suitable is the current age structure of the wood and how is it intended to change?

Squirrels will benefit if the woodland is constantly bearing seed and fruit. A good mixture of different aged trees throughout the wood is ideal. Emphasis should be placed on trying to keep a fairly high percentage of the wood between 30-60+ years old. These are the trees that will be providing a lot of seed for the squirrels on an ongoing basis.

3. What is the felling regime within the woodland and how is it intended to change?

A regime where substantial clear-fell is planned will obviously deprive squirrels of food, shelter and habitat connectivity. Again, a mixture of retention and new planting should be sought and felling in smaller blocks is preferable. We have to remember that forest management is multi- objective, not just to save red squirrels. A balance should be possible.

4. Are there any conflicts with other conservation or development projects?

Woodlands can be good for many species of wildlife. Ensure that you find out what other plans for conservation there might be for the wood. A woodland that is good for a variety of wildlife is best, but we need to remember that large seeded broadleaves should be avoided in red squirrel conservation areas. Site selection should therefore occur on a regional basis so that conservation efforts can be targeted to a variety of different sites and conflicts can be minimised.

5. Is the future ownership and management of the wood secure?

Find out if the wood is owned, a long-term lease or if the ownership is likely to change in the near future. Rapidly changing forestry circumstances can be responsible for ownership changes, which, in turn, may affect the chances of continued management for reds. Even if the woodland habitat appears highly suited to reds, it is strongly advised that this element is fully considered. A future owner may not have the same objectives as the current owner, so constant awareness of potential ownership changes and dialogue will be required.

The Buffer. Management of the buffer zone (3km around the site) is also of paramount importance to the forest reserve. Again, opportunities and constraints in favour and against of the reserve need to be assessed.

1. Are there any new 'large-seeded' native woodland planting initiatives in the buffer?

The presence of, or future creation of, new native woodlands in the buffer zone would potentially be detrimental to the reserve if it included species such as oak and hazel.

2. Are there plans to maintain/increase open ground land use such as bogs, heathland, arable farming, dune systems, reservoirs? May restrict grey incursion.
3. Is there any major new residential building planned in the buffer? May increase grey squirrel incursion.
4. Are there any landfill sites/quarries/MOD activity in or planned for the buffer? Attention will need to be paid to any plans to influence the future land use.
5. (On islands only). Are there plans for any bridges into the site? May increase grey incursion.

Step 7: Your site list and the initial site selection, Phase I, is complete. In Phase II we consider the support you will need, as this is open to influence/negotiation and can only be considered once Phase I is complete. Some months of discussion may be needed before final judgments are made. This will further refine the site list.

Reserve Confirmation, Phase II

Socio-economic/other considerations.

Landowner/manager support.

The key question is:

What proportion of the woodland has owners/managers who will carry out the work needed to make it a red squirrel reserve?

Without management for reds and defence against grey squirrels, the reserves will not work. If 9 out of 10 landowners/managers support red squirrel conservation but only own/manage 10% of the site you should rate the site as 'unsupportive' rather than 'supportive'.

Any potential or existing conflicts with other land uses and/or policy objectives for the woodland and surrounding landscape must be carefully considered and clearly stated. The needs of commercial forestry; other Biodiversity projects; community woodlands and National Parks, to name a few, cannot be overlooked and may be at odds with the priorities for the red squirrel.

Again, common sense is required. Landowners often say they support red squirrel conservation. You must enter a rating for the site, not their general attitude towards red squirrel work. If you have a forest that will require a lot of change to make it good for red squirrels but for commercial forestry reasons they cannot make the necessary changes to the forest, this is effectively ambivalent/unsupportive. Do not be afraid to enter an appropriate rating.

Step 8: Having considered and rated each of the criteria you can now compare and rank the sites.

Ranking Reserves

This paper is not intended to, and could not, provide all of the answers using a mechanistic process. Interested parties should certainly have open discussions when comparing the sites' different strengths and weaknesses. The value of the ranking is that once it has been carried out, the organisations, individuals and communities interested in red squirrel conservation can start to act.

The following points are suggested to assist the ranking and deciding between similar sites.

- Use the comparison table to help you. We have resisted applying weightings to each criterion because the interplay of potential pluses and minuses against each site is highly complex. Even so, you should be able to rank the whole list from best through to worst.
- Begin by generally clumping sites that are obviously better and worse. These separate groups of sites are the first step of ranking. The greater detail you consider for each site will then separate the differences between sites within each group.
- Involve others in the process to maximize the site knowledge/experience. It is pointless to carry out this exercise without wide circulation and discussion of the points contained. We are aiming to translate these considerations into action.

- Important: please make notes to accompany your discussions about each site. Make reference to why one site is better than another if it helps. By comparing the ratings and the notes it is often surprisingly straightforward to see a hierarchy of sites from the best through to the worst.
- Try and identify if there are some very good sites that cover a range of sizes. (The hectareage to which you label small, intermediate and large will depend upon the range of forest sizes in your region) It makes sense to have some very large, intermediate and smaller sites that are (only if the ratings justify it) near the top of your list. This will give a variety of forests where different management regimes can be adopted to suit. Remember, we still don't know which courses of action will work best for red squirrels, so don't put all of your effort into just one type of forest (i.e. all very large or all small).
- Are some potential sites geographically very close to each other? It may be sensible to work for red squirrels in several sites near to each other, or you may lower the priority of a site because others nearby are already higher on the list.
- If you're still having trouble deciding between which is the best of a few sites, have a look at wider geographical coverage. Do your 'top' sites cover a good geographic area or are they closely bunched? It may be worth spreading the coverage.
- It is important to remember differences in woodland cover. If two possible reserves seem similar, a high percentage of conifer woodland in the buffer or surrounding the reserve would certainly be preferable to an equally high percentage of broadleaf in the buffer.
- You may well find that there are some sites with excellent landowner support but which do not have good potential for red squirrels, no matter the goodwill. It is important to remember our objectives and delivery is key, therefore, it is justifiable to place these sites a little lower on the list. Conversely, you might find that the forest characteristics place a site high on the list but you might have to demote its ranking slightly if the landowner is unsupportive. However, do not shift sites a long way down the list because of an unfavourable score – just use it to place a site within its cohort of similar sites. This helps you to realize that your attention for actual red squirrel work should be aimed at the next best site.
- Be careful to rate 'management potential' independently of the rating for 'landowner/manager support' - apply the forest's merits, not your perceived one. It is worthwhile highlighting in your notes the forests which otherwise score well and where attention might be focussed on improving the landowner support.
- Do you still have a list with many excellent sites on it? Have you fully considered the 'management potential'? If several of your forests are mostly Sitka Spruce, this is going to need design changes to make it better for reds. Ask yourself is there are there any sites with a greater species mix that you can place higher up the list of priorities? These will require less to change to their design and therefore stand a greater chance of actually having work carried out in them.
- Is your ambition for a defendable site realistic? It doesn't matter how defendable a site is if the soil/climate etc means that only Sitka Spruce will grow. Such a forest is not likely to support a viable red squirrel population

and changes to the species mix may not be possible. You may find it is sensible to lower the ranking.

- Try not to simply place all of the sites that have got, or will soon have, grey squirrels near them at the bottom of the list. This misses the point about conserving reds in the most appropriate settings, of which the grey is an important, but not the defining characteristic. These forests might have features that mean red squirrel conservation should be pursued. By mistakenly applying the former thinking we run the risk of simply moving back the boundaries of the red squirrel's range without adhering to the science and policy guidance which has suggested ways to save existing viable populations.
- A question such as, 'does the site have visitor potential?' may help when deciding between otherwise similar sites. This could be important to generate revenue for the site.
- As we have mentioned, it is likely that parts of a vast conifer forest might be earmarked as red squirrel reserves. Although we do not ask you to enter scores appropriate to the *particular* section of forest that might become the reserve, you should use this rating and ranking process to help you begin to identify potentially suitable areas.

Targeting resources


An important element of site protection will be the provision of resources by statutory, private sector and other non-statutory organisations. Once a list of potential reserve sites has been selected it needs to be clearly stated where and when money is going to be directed.

Allocating resources may not be a straightforward process of selecting the highest ranking sites. We now introduce the concepts of direct and indirect costs. Two of the most important to consider are:

- the indirect cost of changing forest planting/felling that may mean less timber profit in the future;
- the direct cost of grey squirrel control and population monitoring.

Sites that rate many 'Excellent' or 'Very good' scores are likely to be those at least threat from grey squirrels. These high ranking sites should have attention paid to the long term forest design issues - an indirect cost. It is important to think ahead, forest crops stand for at least 40 years, so it is vital to start thinking about how the forest might change and how to focus resources to plan for that future. This is essential.

At the same time, it is also essential to consider the forests that require immediate and direct spending to ensure red squirrel survival. Direct resources should be targeted at forests lower on the list where resources will result in greatest value added. These will be high ranking sites that are at greatest risk of losing their priority status if action is not taken to prevent grey encroachment into an otherwise viable red squirrel population.



The following example best captures the difference:

A large island offers red squirrels an extremely good chance of absolute persistence, as long as greys are prevented from reaching it, a suitably large area of habitat is maintained and in the absence of detrimental stochastic events. The site is a high priority for conservation but there may be little need to spend resources to protect the populations.

Contrast this with a large conifer woodland on the mainland that also has a viable red squirrel population, but greys are within a few miles. The woodland has a lower overall rating than the island and, without intervention, the greys will soon arrive and the chances for red squirrel persistence decline. However, this site will be high priority for any vital habitat management changes and spending upon grey squirrel control.

Enter the resource need in the final column of the site comparison table. The targeting of resources based upon the above discussion *should not* influence the final ranking. If a site is good, it is good, whether the money is available to protect the site can be determined later, not at the point of ranking, hence this column coming after the ranking.

- Resources should be split into very simple headings. Direct costs: trapping and monitoring costs. Indirect: forest design planning/alteration. Only enter Immediate needs. More detailed information and future needs might be written in a forest management statement that describes what is needed in the forest for red squirrels. We do not cover this here.
- In order to work out the trapping resource needs you should think about two broad types of site, split between extremely large sites (many thousands of hectares) where it will not be financially feasible to undertake grey squirrel trapping and smaller sites where grey squirrel control may be a realistic proposition. It is known that grey squirrel control is expensive using present techniques. It will be beneficial to have a short list of sites at which you implement grey control. To determine if you will carry out trapping it is worth considering a site's geographical isolation. If it just isn't going to be feasible to have contractors working for weeks at a time in some very isolated forests, then mention this in the notes. Remember, this is a pragmatic list. The more tightly you can focus what needs to be carried out, the more likely it is going to be achieved.
- Be realistic about your list, the final number of reserves will be as long or short as available resources permit.

Step 9: The process is complete. You should have a final, pragmatic list of reserve sites in rank order and a clear idea of where to allocate resources.

Recommendations for future action.

1. The above criteria, or a parallel process, should be applied as soon as possible within all regions where red squirrels occur in the UK.
2. A portfolio should be produced for all selected sites describing these points and the reasons why it has or hasn't been possible to retain a priority site within the overall programme of site protection for red squirrels.
3. Assign funds and negotiate favourable management of the site for red squirrel conservation.
4. Where appropriate, assess red squirrel population persistence for proposed management plans using GIS and modelling approaches.
5. Site lists must be agreed by any regional group, the national squirrel fora and then endorsed by the UK Red Squirrel Group. This endorsement will enable clear tracking of local sites when it comes to national reports on red squirrel conservation.
6. It is expected that these lists will be incorporated into statutory agency policy documents and strategy to support and reflect the squirrel BAP process.
7. It is essential that effective promotion and active adoption of Reserves amongst planners, foresters, conservation groups etc occurs if the landscape planning necessary is to be successful. National squirrel fora should assist in this promotion of nationally/regionally important sites.

Conclusions

Effective implementation of the red squirrel Biodiversity Action Plan will require some very difficult decisions.

In particular, a coherent national and regional context needs to be reached between conservation, forestry, and landscape interests if common ground for red squirrel conservation is to be reached. This discussion must balance the following opposing views:

- There needs to be a shift away from 'native large-seeded broadleaf biodiversity in all places' towards an acceptance that red squirrel conservation will fail unless we retain non-native conifer forestry which does not contain large-seeded broadleaved trees.
- There is good reason for the current diversification within conifer woodlands. The reduction of conifer and the re-planting of deciduous trees should be strongly encouraged. Red squirrel conservation is a minor consideration that must fit in with this framework.

It is suggested that geographical separation of these two aspirations will result in both being achieved rather than one occurring at the expense of the other.

Just as this argument needs to be successfully addressed, there also needs to be a realisation that, in areas where both species occur, grey squirrel control is fundamental to red squirrel conservation at this time. The effectiveness and costs of this site protection are not yet known. It is essential that sufficient efforts are made, including monitoring of the effectiveness of any control/habitat management, both for the benefit of red squirrel populations where greys are just arriving, and for the knowledge we will need to apply to other sites when the time comes to protect them against the grey.

At all times it is important to recognise that red squirrel conservation may be at odds with some species, habitat or landscape objectives. Single species conservation efforts sometimes founder on the inability to compromise with other objectives. However, it is important to remember that forest design should cater for many different goals. We fully support the inclusion and planning of forests for other species, such as goshawk, pine marten, black grouse. This paper is not about woodlands *only* for red squirrels, but about woodlands to *include* red squirrels. It is intended that the presentation of a clear message for red squirrel reserves will win some compromise from other objectives. The management of these reserves will hopefully lay the foundation for the future of red squirrels in Great Britain.

Scoring sheet for red squirrel forest reserves.

Reserve Scoping, Phase I

Magnitude of Threat

Red squirrel presence/absence

Only red squirrels present	<input type="checkbox"/>	Rating Excellent
Only red squirrels present but greys are expected to appear soon	<input type="checkbox"/>	Very good
Red squirrel population and very few grey squirrels present	<input type="checkbox"/>	Good
Red squirrel population and many grey squirrels present	<input type="checkbox"/>	OK
Reds recently disappeared and no greys are present	<input type="checkbox"/>	Poor
Only grey squirrels present	<input type="checkbox"/>	Very Poor
Is it uncertain if any of the above apply*	<input type="checkbox"/>	Find Out

*Implement visual or hair tube surveys or transect monitoring in woodland, as described in *Practical techniques for surveying and monitoring squirrels*. Forestry Commission Practice Note 11, September 2001

Extent and Suitability of Habitat

Woodland Type and Size*

Coniferous woodlands: 2000 + ha <u>or</u> a large woodland on an island	<input type="checkbox"/>	Rating Excellent
Coniferous woodlands: >200-2000 ha <u>or</u> a medium sized woodland on an island	<input type="checkbox"/>	Very Good
Mixed woodlands: containing 2000+ ha contiguous conifer <u>or</u> a small woodland on an island	<input type="checkbox"/>	Good
Mixed woodlands: containing 200-2000 ha contiguous conifer block	<input type="checkbox"/>	OK
All other woodlands	<input type="checkbox"/>	Poor

*Specifics about size, tree species and age structure will be required for precise planning – considered after the list has been drawn up.

Suitability of the Habitat (Do not apply this criterion to island populations)

No mature large-seeded deciduous trees	<input type="checkbox"/>	Rating Excellent
<5% mature large-seeded deciduous trees	<input type="checkbox"/>	Very Good
>5% mature large-seeded deciduous trees	<input type="checkbox"/>	Poor

Site Defendability

Landscape defendability (Do not apply this criterion to island populations)

Expected to be a highly effective barrier	<input type="checkbox"/>	Excellent
Expected to be a reasonably effective barrier	<input type="checkbox"/>	Good
Expected to only be a slight barrier	<input type="checkbox"/>	OK
Expected not to act as an effective barrier	<input type="checkbox"/>	Very Poor

Buffer size - Woodland perimeter (km)

15+	<input type="checkbox"/>	Very Poor
13-15	<input type="checkbox"/>	Poor
8-12	<input type="checkbox"/>	Good
5-8	<input type="checkbox"/>	Excellent

Site Management

Management potential of forest and buffer Forest Buffer

Highly suited	<input type="checkbox"/>	<input type="checkbox"/>	Excellent
Good potential, a few compromises	<input type="checkbox"/>	<input type="checkbox"/>	Good
Some scope. Conservation value may arise, but not as a major consideration.	<input type="checkbox"/>	<input type="checkbox"/>	OK
Unsuitable and/or Many conflicts with red squirrel conservation	<input type="checkbox"/>	<input type="checkbox"/>	Poor

Reserve Confirmation, Phase II

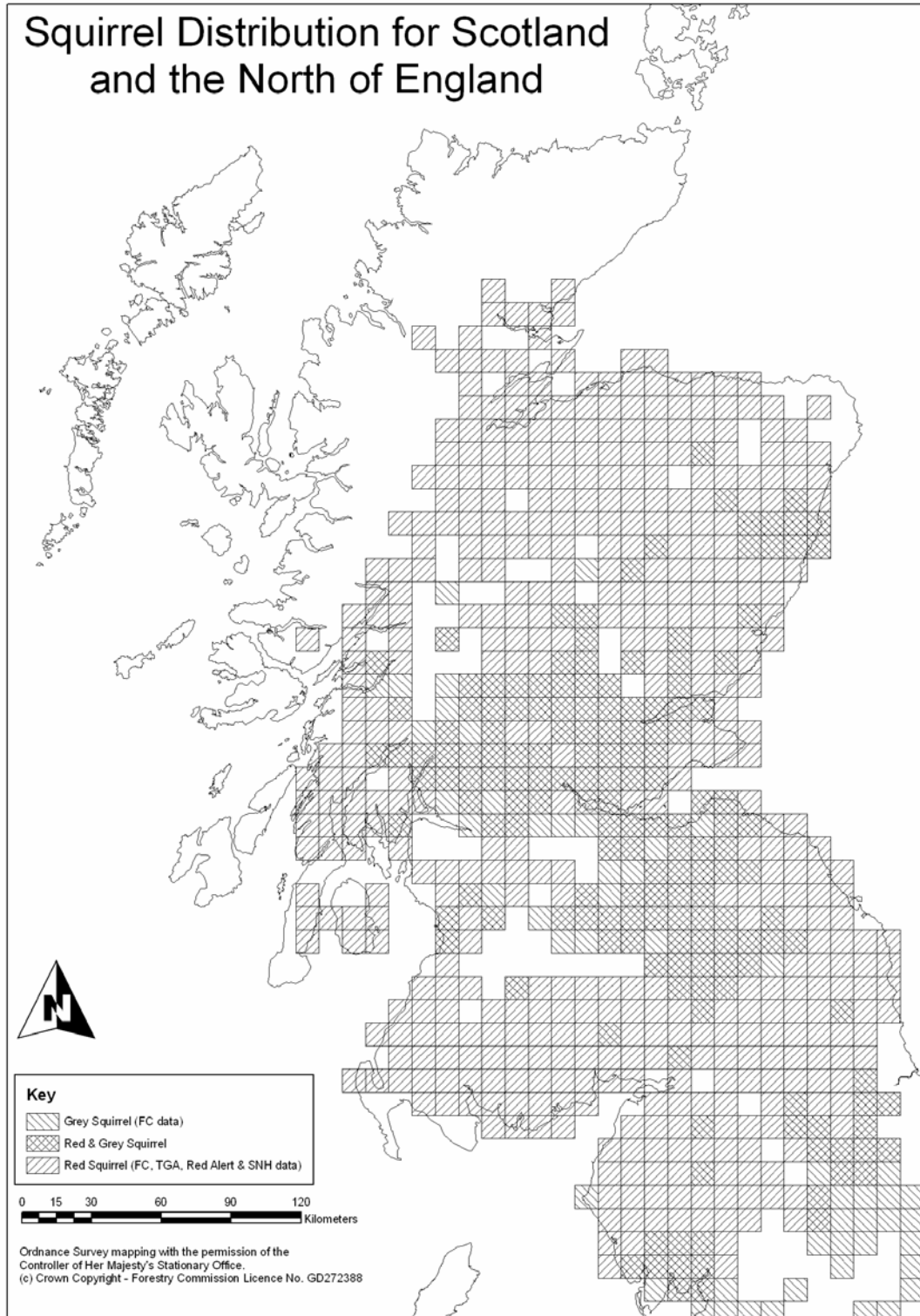
Socio-economic/other considerations

Landowner/manager support

Majority of land managed by very supportive owners/managers	<input type="checkbox"/>	Excellent
Majority of land managed by supportive owners/managers	<input type="checkbox"/>	Very Good
Majority of land managed by ambivalent owners/managers	<input type="checkbox"/>	Poor
Majority of landowners/managers unsupportive <u>or</u> don't know	<input type="checkbox"/>	Very Poor

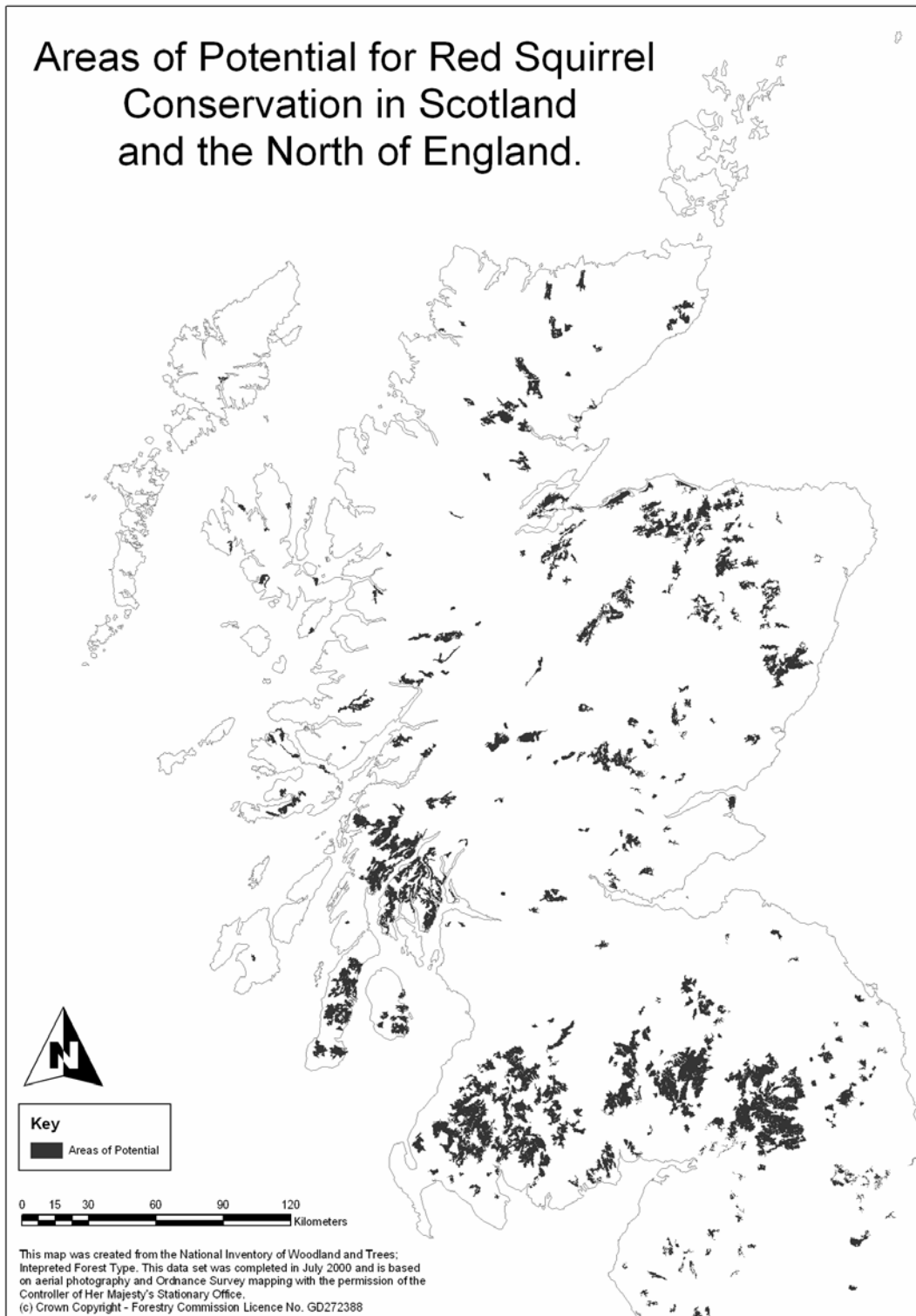
APPENDIX A

Map Showing Red And Grey Squirrel Distribution Across Scotland and Northern England
1991-2001



APPENDIX B

Map Showing 'Areas Of Potential for Red Squirrel Conservation in Scotland' (Forest Research)



**Priority areas for
red squirrel conservation
in the UK**

