# Threestoneburn Forest –

# Red Squirrel Conservation Assessment

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**Contents** **Page**

**Executive summary**


1. I assessed Threestoneburn's suitability for red squirrel conservation in relation to the current tree species composition (forest map for 2007) and the likely effects of restructuring the forest. I also considered the feasibility of capture and translocation.

2. Threestoneburn is a medium sized, relatively isolated conifer forest dominated by Sitka spruce.

3. The restructuring data for Threestoneburn Forest assessed here were based on the original Forestry Commission design plans (see Appendix for more details).

4. Red squirrel population dynamics in Sitka spruce dominated plantations like Threestoneburn follow tree seed crop patterns. Carrying capacity for red squirrels at Threestoneburn will therefore change annually and decline as the forest is restructured.

5. Carrying capacity for red squirrels at Threestoneburn is estimated at approximately 10 squirrels in poor seed years, 62 squirrels in years with an average seed crop and 113 in years with a mast crop. Cone transect line surveys carried out in July 2007 put the observed population at 69 squirrels.

6. Threestoneburn, at first glance, appears suitable for red squirrel conservation, however, consideration of the need to restructure the forest, the limited silvicultural options due to high wind-throw-risk and the relatively even-age structure as well as the vicinity of grey squirrels make this an unrealistic option.

7. During any restructuring at Threestoneburn there would be a period with no trees or seed bearing age, red squirrels would therefore have to emigrate from the forest along the wooded watercourse to the east. The speed of this dispersal movement and the likelihood of subsequent settlement success in the small woodlands to the east will be influenced by annual tree seed crop patterns and food availability.

8. Given the interconnected nature and composition of the small woodlands and wooded watercourses to the east of Threestoneburn (deciduous with a high proportion of large-seeded broadleaves), the vicinity of first grey squirrels sightings in the area (< 4 km) and most importantly, the likelihood of SQPV presence in the future, red squirrel persistence in this area until Threestoneburn can be recolonised is unlikely.

9. I do not see any realistic and feasible management options that would allow the retention of a viable red squirrel population in and around Threestoneburn Forest. As a result, any decision with regard to the future of Threestoneburn Forest and the nature of the landscape that will replace the existing conifer forest should not be made on the basis of red squirrel conservation.

10. There are three main options for red squirrel management and intervention at Threestoneburn: allowing natural emigration of the population, capture for a captive breeding population and capture for translocation.

11. Capture of the red squirrels at Threestoneburn for the captive breeding population in the UK would require a licence and the coordination with facilities, breeders and projects in England and perhaps Wales and Scotland. It would raise welfare and ethical issues of taking wild animals into captivity which would have to be considered carefully.

12. Similarly, capture for translocation would be a challenging and costly undertaking. Furthermore, a number of issues would have to be resolved such as finding a suitable target site that has currently no red squirrels (or grey squirrels) or a red squirrel population below carrying capacity. A release where red squirrels are present at local carrying capacity would lead to high mortality.

## 1.1 Newcastle University Work Programme

1.1.1 Assess Threestoneburn's suitability with respect to red squirrel conservation in relation to:

- Current situation based on present tree species composition (forest map for 2007)
- Likely effects on red squirrel population of restructuring forest as per Forest Design Plan over next 20-25 years
- Discussion of likely effects of felling conifers over 20-25 years and no replanting other than riparian broadleaves
- Impacts of proposals above on Grey Squirrels

1.1.2 Carry out a feasibility study associated with carrying out the live trapping of Red Squirrels (current population estimated at 69 animals) and relocation to suitable habitat elsewhere. Study to include consideration of:

- Trapping
- Transport to release site
- Release site holding facilities
- Post release monitoring

## 1.2 Forest data

Current composition of Threestoneburn (based on 2007 data) shows that the forest is dominated by Sitka spruce (514 ha), and only contains a very small area of broadleaves (Fig. 1).

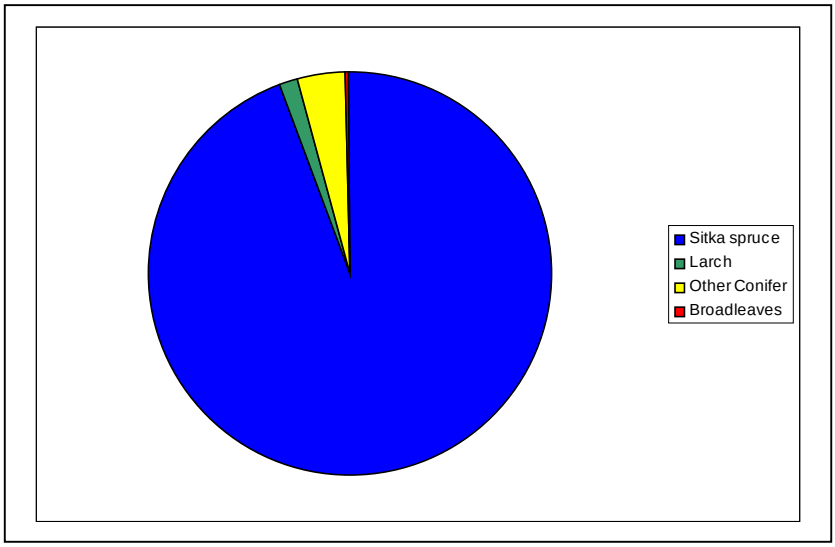



Figure 1. Tree species composition at Threestoneburn in 2007

Restructuring data for Threestoneburn Forest based on the original Forestry Commission design plans (see Appendix 1 for more details) were provided by Lilburn Estates (T. Mathewson pers. comm.) Snapshots of how the forest would have developed are given by data for tree species composition and age structure for 2007, 2015, 2020 and 2030. Fig. 2 shows the amount of mature timber capable of supporting squirrels.

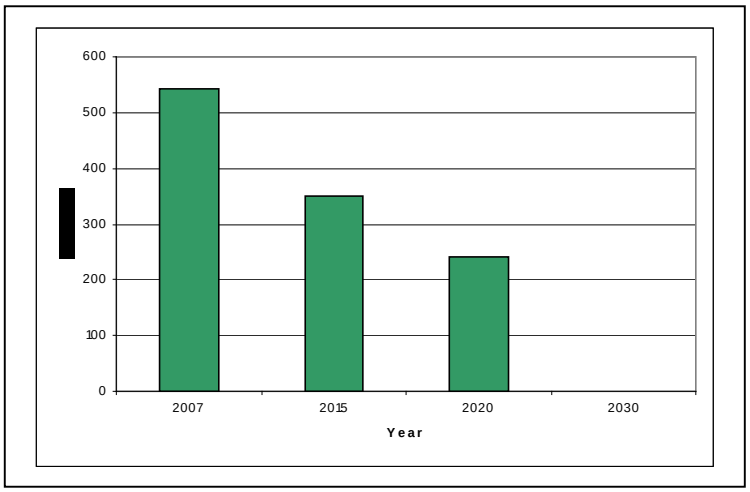



Figure 2. Area of mature forest at Threestoneburn capable of supporting squirrels 2007-2030 for all tree species combined.

### 1.3 Red squirrel population dynamics

Red squirrel densities are highest in mixed deciduous and conifer mixtures dominated by pine and lowest in forests dominated by Sitka spruce *(Picea sitchensis*). Long term densities fluctuate between 0.5 and 1.5 $ha^{-1}$ in both high-quality conifer and broad-leaf habitats. Very low densities of 0.02--0.2 squirrels $ha^{-1}$ occur in boreal forests in Scandinavia and large conifer forests in the north of England and Scotland (Andrén and Lemnell 1992; Lurz et al. 1995, 1998, 2005; Gurnell et al. 2008; see also Table 1).

Table 1 Red squirrel densities in conifer habitat.

| **Squirrels $ha^{-1}$** | **Dominant tree species** | |
|---|---|---|
| 0.047 | Old Scots pine, Norway | Andrén & Lemnell 1992 |
| 0-0.11 | Sitka spruce | Lurz *et al*. 1998 |
| 0.33 | Scots pine | Moller 1986 |
| 0.31-0.43 | Lodgepole Pine | Lurz *et al*. 1998 |
| 0.21-0.41 | Norway spruce | Lurz *et al*. 1998 |
| 0.101-1.41 | Scots pine, Larch | Waters & Dhondt 1990 |

Red squirrel population dynamics in Sitka spruce dominated plantations like Threestoneburn follows tree seed crop patterns (Lurz *et al*. 2000). Home ranges of squirrels are large (ranges of 8-50ha have been observed Lurz 1995) and changes in food availability in different conifer species lead to home range shifts in the squirrels with individuals effectively tracking temporal and spatial changes in the availability of seeds. Carrying capacity for red squirrels at Threestoneburn will change seasonally with concomitant effects on squirrel space use patterns that are flexible and fluid. It is likely that in years with poor seed crops, red squirrels will emigrate Threestoneburn along the existing stream corridors.

### 1.4 Estimated carrying capacity

Carrying capacity for red squirrels at Threestoneburn is estimated at approximately 10 squirrels in poor seed years, 62 squirrels in years with an average seed crop and 113 in years with a mast crop (Figure 3). Cone transect line surveys carried out in July 2007 put the observed population at 69 (68.5) squirrels (SFA Surveys).

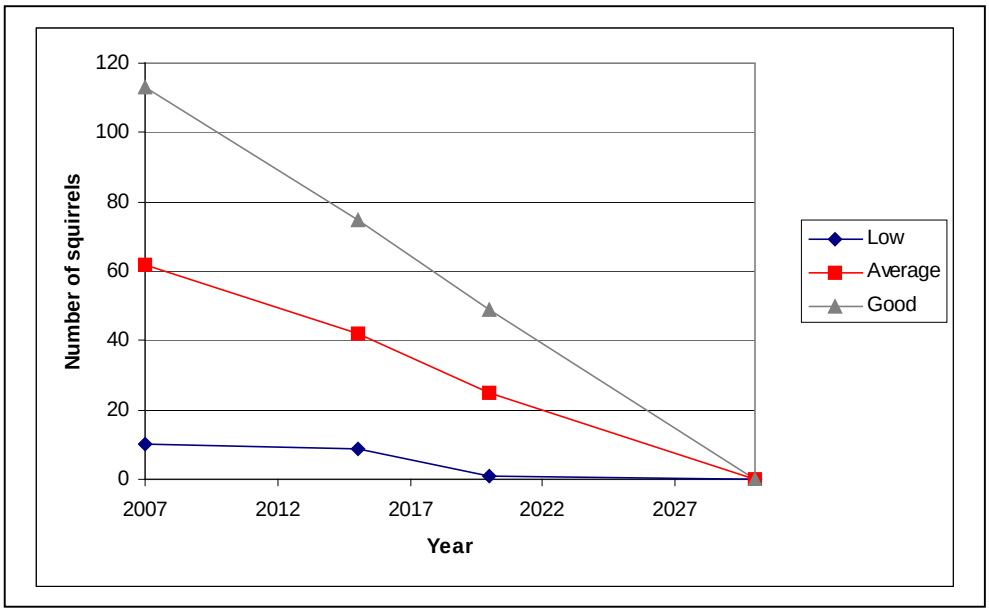



Figure. 3. Predicted number of red squirrels at Threestoneburn for low, average and good seed years based on the restock scenario.

### 1.5 Likely red squirrel response to restructuring

As the forest design plan is implemented, carrying capacity at Threestoneburn would clearly decline and red squirrels would leave along the existing watercourse corridor to the east. However, the rate of emigration of red squirrels from the forest would be modified by tree seed crop patterns. For example, the impact of feeling at Threestoneburn and the linked decline in carrying capacity would be ameliorated if followed by a good seed crop, as this would have the effect of increasing carrying capacity. Conversely, felling operations followed by a poor seed crop would have the effect of speeding up emigration into the surrounding small woodlands and wooded stream corridors to the east.

Under natural conditions, in the absence of grey squirrels, small red squirrel populations would remain (be currently present) in the mainly deciduous woodlands and along the wooded water courses to the east of Threestoneburn. From there they could recolonise Threestoneburn once the forest matures again.

### 1.6 Grey squirrel sightings

Grey squirrels have already been sighted within the very woodlands east of the forest that red squirrels would have to disperse to as carrying capacity declines at Threestoneburn due to felling. They have been reported from the north-west (Southern Knowe, Kirknewton) for a number of years and have been sighted to the east of Threestoneburn at Lilburn Towers and Ilderton in 2008 (Table 2).

Emigration due to a potential restructuring of Threestoneburn, presence in the surrounding small woodlands and river corridors while parts of the forest matures to seed bearing age again, followed by recolonisation is therefore unlikely to occur. In the future, the presence of grey squirrels (and potentially Squirrelpox Virus SQPV) would make a continued presence of red squirrels in the mainly deciduous small woodlands around Roddam Hall, Ilderton, Lilburn and further south impossible. These habitats are high-quality grey squirrel habitat and greys would be likely to outcompete reds in these woodlands even in the absence of SQPV.

Table 2 Recorded grey squirrel sightings

| Easting | Northing | Location | Date/comment |
|---|---|---|---|
| 401657 | 621954 | Ilderton | February 2008 |
| 402544 | 624375 | Lilburn Towers | January 2008 |
| 391381 | 628911 | Kirknewton Tors | Greys shot for last 2-3 years |
| 388950 | 624450 | Southern Knowe | Greys shot for last 2-3 years |

## 2.0 Conclusion

Threestoneburn is a medium sized, relatively isolated conifer forest with the potential of supporting between 10 and a 113 red squirrels (estimated population with average seed crop: 62; observed population 2007: 69). The forest is currently dominated by Sitka spruce and there are no large-seeded broadleaves within the forest, although oak and a number of other deciduous tree species including hazel and sycamore are present within the small woodlands and wooded watercourses to the east of the forest. At first glance, the forest may appear to have potential as an area for red squirrel conservation.

However, consideration of the need to restructure the forest, the limited silvicultural options due to high wind-throw-risk and the relatively even-age structure as well as the vicinity of grey squirrels make this an unrealistic option. The restructuring plan (see Appendix for more details) considered in this assessment will inevitably lead to a considerable period where there would be no trees of seed-bearing age at Threestoneburn. During this restructuring period red squirrels would have to emigrate from the forest along the wooded watercourse to the east. The speed of this dispersal movement and the likelihood of subsequent settlement success in the small woodlands to the east will be influenced by annual tree seed crop patterns and food availability.

Given the interconnected nature and composition of the small woodlands and wooded watercourses to the east of Threestoneburn (deciduous with a high proportion of large-seeded broadleaves), the vicinity of first grey squirrels sightings in the area (< 4 km) and most importantly, the likelihood of SQPV presence in the future, red squirrel persistence in this area until Threestoneburn can be recolonised is unlikely.

The area is highly suitable for grey squirrels and given the known devastating impacts of SQPV on any small, local red squirrel populations within this woodland system, any attempts of control would have to succeed completely on a relatively large scale; and would have to succeed for the next 30 years! Furthermore, even if successful, grey squirrels would also disperse to the replanted Threestoneburn along existing wooded watercourses and compete with red squirrels there.

In conclusion, I do not see any realistic and feasible management options that would allow the retention of a viable red squirrel population in and around Threestoneburn Forest. As a result, any decision with regard to the future of Threestoneburn Forest and the nature of the landscape that will replace the existing conifer forest should therefore not be made on the basis of red squirrel conservation.

## 3. Management options and consideration of translocation

There are three main options for red squirrel management and intervention at Threestoneburn: allowing natural emigration of the population, capture for a captive breeding population and capture for translocation.

Threestoneburn is connected to woodlands to the east of the forest through a wooded stream corridor. This has recently been planted right up to the edge of the forest. Emigration will occur naturally in response to changes in carrying capacity and this can be facilitated best by: avoidance of the creation of large gaps within the forest that are difficult or cross and by leaving the felling of the plantations nearest to the dispersal corridor to last.

Capture of the red squirrels at Threestoneburn for the captive breeding population in the UK would require a licence and the coordination with facilities, breeders and projects in England and perhaps Wales and Scotland. However, it would raise welfare and ethical issues of taking wild animals into captivity which would have to be considered carefully. Similarly, capture for translocation would be a challenging and costly undertaking.
In addition, before any translocation could be considered the following points would have to be resolved.

- Identification of suitable target site that has no red squirrels or a population that is below carrying capacity
- Licences for capture, transport and release from all Country agencies involved
- Permission and cooperation from landowners of release site
- Post-release monitoring commitment

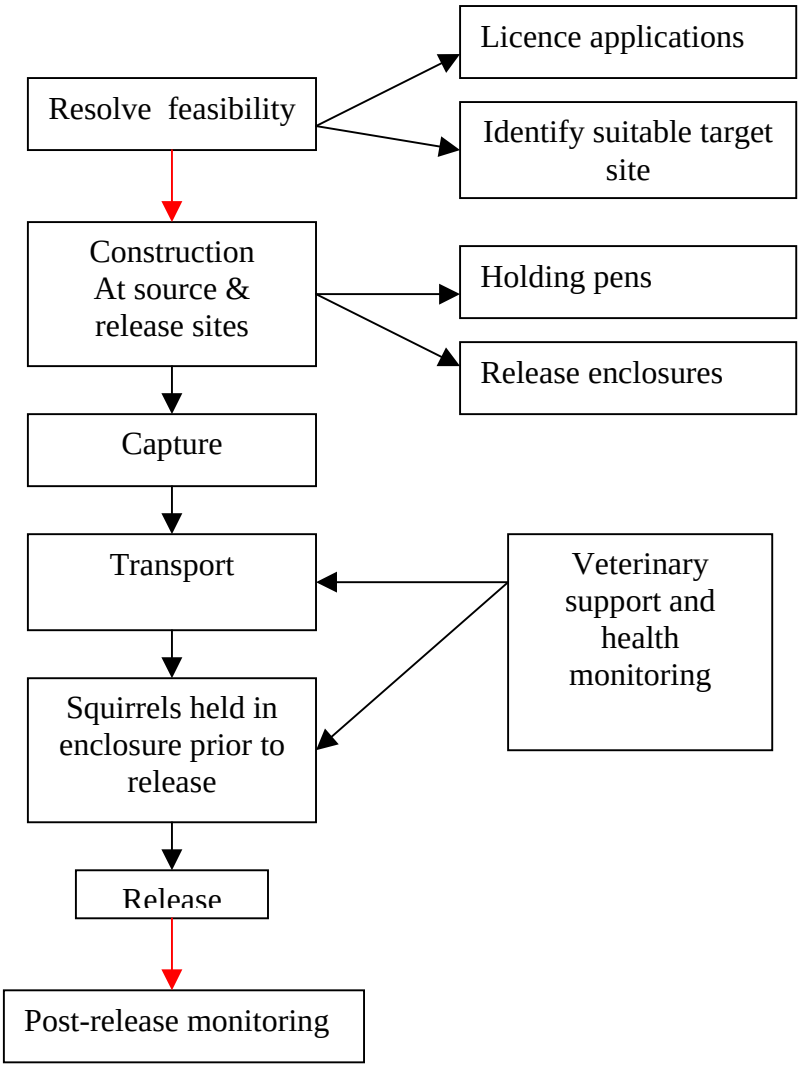
Any suitable target site where red squirrels could be released would have to be surveyed. The survey should determine that there is enough forest cover, that habitat quality in terms of tree species composition of seed bearing age is suitable and will continue to be suitable in the future in order to support a viable red squirrel population. It is important to establish that there is food available in terms of a natural seed crop prior to release (Fornasari et al. 1997).

The site should not contain an existing red squirrel population (or grey squirrel populations) or alternatively if red squirrels are present, the population should be below carrying capacity. A release where red squirrels are present at local carrying capacity would lead to high mortality. It is important that any potential release has both the support of local landowners, residents around the release site and public support.

Prior to any release, there is also a need to determine the level and length of post-release monitoring and the most suitable methods involved (e.g. radio-tracking which involves a mortality risk for animals involved and is costly but provides movement data or low intensity methods such as hair-tubes and cone transects lines or visual surveys which provide data on the presence of squirrels and a population index; the latter has the advantage that the public can be involved in any monitoring work).

Translocation can be carried out as a 'hard or soft' release. During a hard release, animals are released immediately on arrival where as in a soft release animals are acclimatised in a pen within the target area prior to release. It is generally accepted that a soft release protocol represents good practice for squirrels (Venning *et al*. 1997). Detailed descriptions of translocation protocols and dimensions and costs involved are given in Venning *et al*. 1997 and Poole 2007.

Flow chart outlining the main steps involved in a translocation of the red squirrel population at Threestoneburn using a soft-release.




*Holding pens*

Depending on the distance from Threestoneburn to any potential release site, it may not be possible to capture red squirrels on a daily basis and transport them to the release site immediately. It may therefore be necessary to construct small holding pens or cages, house any capture animals for the duration of a number of trapping days and then transport them.

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## APPENDIX 1 - FORESTRY COMMISSION RESTRUCTURING PLANS FOR THREESTONEBURN

### Introduction

In 1997 the Forestry Commission (FC) prepared a Forest Design Plan (FDP) for Threestoneburn Forest. This plan showed how the FC intended to restructure the forest during the period 1997 – 2031, identifying how landscaping and environmental improvements could be incorporated.

As part of the FDP scoping process the Northumberland National Park Authority (NNPA) were consulted. Their reaction to plan was that although they were happy to approve the minor habitat improvement works envisaged for the first phase 1997-2001 they were not prepared to approve the restructuring described in the rest of the plan as the NNPA wished Threestoneburn Forest be a single rotation forest and after each felling operation the land be converted back to moorland, with an appropriate amount of Native broadleaf planting in the riparian zones.

### CURRENT SPECIES COMPOSITION

The plan describes the current situation with the property comprising approximately 80% conifer, 18% open space and 2% agricultural land.

### FELLING SCHEDULE

The plan shows how the Felling phases programme is derived from the optimum economic felling proposals based on yield class and amended to take into account operational and landscape improvement issues. The Felling Proposals map attached shows the phasing over the period 1997-2036, with the bulk of the work during the period 2007-2031.
To date only the small scale work identified in the period 1997-2001 has been carried out.

### LANDSCAPE IMPROVEMENTS

The FDP shows the intention to improve the appearance of the forest in the landscape to reduce the height of the tree-line, by not restocking the upper margins of the Cpts on the upper slopes of Hedgehope, Dunmoor Hill and around the rock outcrops of the Cunyan Crags.
Landscape improvements would also be made by leaving more open space on the Northern boundary and widening the riparian zones.

### CONSERVATION ENHANCEMENT

The plan also focuses on environmental improvements. These are identified on the attached map but can be summarised as follows;

- Widen riparian zones by replacing felled conifers with Native broadleaves and open space

- Establish area of Black grouse habitat on Northern boundary adjacent to Broad Moss. Plant broadleaves and groups of mixed conifers to create a more diverse habitat.
- 

Above; Main riparian zone within forest

**RESTOCKING PROPOSALS**

The restocking proposals would have significantly altered the species composition as the areas of native broadleaves were introduced and additional open space incorporated in addition to that already located on the summits of Hedgehope and Dunmoor Hills.

Sitka spruce - 63%
Mixed conifers - 11%
Braodaleaves - 6%
Open space - 20% ( This area does not include hill tops area )