



England Red Squirrel Action Plan 2023 - 2028





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2023 - 2028

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Foreword

The plight of England's red squirrels is often felt most keenly in areas where this native and endangered species still survives. Thanks to dedicated conservation work to protect them, red squirrels remain in England's northern counties as well as in isolated and, so far, safe areas further south such as the Isle of Wight. Without continuous efforts from conservation organisations, community groups and other stakeholders, the future of the red squirrel would be far bleaker.

This England Red Squirrel Action Plan has been developed to support conservation work already underway and support Government objectives to reverse the loss of this species. Over the next five years, the actions in the plan aim to ensure better protection for and enhancement of England's red squirrel populations and habitats. This vision can only be realised through collaborative stakeholder working and the raising of public awareness.

Foreword

If we want to ensure red squirrels benefit from this opportunity and recolonise areas of the country where they once thrived, we need to tackle the threats they face. The greatest of these is the invasive grey squirrel that was introduced in the late 19th century. England's goal to continue to increase tree and woodland cover, which would offer a lifeline to many struggling species as well as bringing wider environmental benefits, is also threatened by the large, rapidly expanded and now dominant grey squirrel population through their destruction of young trees.

Nationally and globally, invasive species are one of the main threats to biodiversity. The United Kingdom is currently classed as the developed country experiencing the worst biodiversity declines. Invasive species need to be effectively tackled and removed to improve the health of our ecosystems and allow native species to thrive. New management methods being developed, such as grey squirrel fertility control, offer refreshed hope that we can reduce the grey squirrels' negative impacts on our red squirrels and broadleaf trees.

The UK Squirrel Accord welcomes involvement from all stakeholders in the delivery of this action plan. England's red squirrel future depends on our actions and we must not let them down.

Lord Kinnoull DL

Chair of the Red Squirrel Survival Trust and UK Squirrel Accord



Introduction

Over the last 150 years, UK red squirrel, *Sciurus vulgaris*, populations have significantly declined (see Annex 1). This iconic species is now classed as endangered in Britain (Mathews & Harrower, 2020).

The England Red Squirrel Action Plan complements similar work in other UK countries. It has four core aims:

1. Protect, identify and strengthen red squirrel populations across the current range
2. Expand the current range of red squirrels
3. Support and improve collaborative action at all levels
4. Promote better understanding and support for red squirrel conservation across England

Delivering the actions needed at the scale required to achieve these goals is a complex and significant challenge. The England Red Squirrel Action Plan provides a framework of strategic actions to underpin and guide red squirrel conservation and recovery.

Effective collaboration between interested parties, local communities and wider society is vital to provide the resources, investment and support required to ensure the Plan's success. Delivery will depend on strong collaboration between many partners at the local level, and a coordinated approach between local and national level players. The success of these actions will also depend on effective communications to raise awareness of and engagement in red squirrel conservation in the general public.

Its framework recognises that delivery of key actions should be tailored and matched to local circumstances. Resource availability, geography and logistics can be different across local and regional areas, and an adaptive approach is necessary.

Local stakeholders should have a strong sense of ownership and control over their activities, and believe their work is valued and supported by others. The Plan is designed to be adapted to local circumstances by local partnerships.

This approach provides individuals and funding bodies with assurance that any investments contribute to an effective programme of red squirrel conservation. One that outlines the big picture, while promoting confidence that funding and resources provided will deliver good value and outstanding outcomes.

The resulting structure will enable the red squirrel community to work together to achieve better outcomes for red squirrels.

Background

Red squirrels are protected under Schedules 5 and 6 of the Wildlife and Countryside Act (1981 and as amended). The UK Government's A Green Future: Our 25 Year Plan to improve the environment (Defra, 2018) is an important policy driver of red squirrel conservation. A key goal for the 25-Year Plan is to achieve 'thriving plants and wildlife'.

A summary of the 25-Year Plan (Defra, 2021a) states that Government will achieve the above goal by 'taking action to recover threatened, iconic or economically important species of animals, plants and fungi, and where possible to prevent human-induced extinction or loss of known threatened species in England and the Overseas Territories'.

A key risk identified in the 25-Year Plan is 'the proliferation of invasive non-native species (which) can also prompt unwelcome changes in the wider ecosystem that climate change might further exacerbate. Where it is not feasible to eradicate these species because they are too widely established, we will seek to neutralise their threat by managing them effectively'.

Red squirrel survival and recovery in England are dependent on effective management of invasive non-native Eastern grey squirrels, *Sciurus carolinensis*, and provision of suitable habitat. In the UK, grey squirrels were introduced between 1876 and 1929. Their establishment and range expansion has been well documented.

Evidence shows that expansion of grey squirrel populations and range are the main cause of local red squirrel extinctions (figure 1). Red and grey squirrels are unable to coexist. Without management interventions or natural predators, grey squirrels outcompete and replace red squirrels. Transmission of disease accelerates this displacement and results in a rapid increase in red squirrel deaths and reduction in red squirrel range.

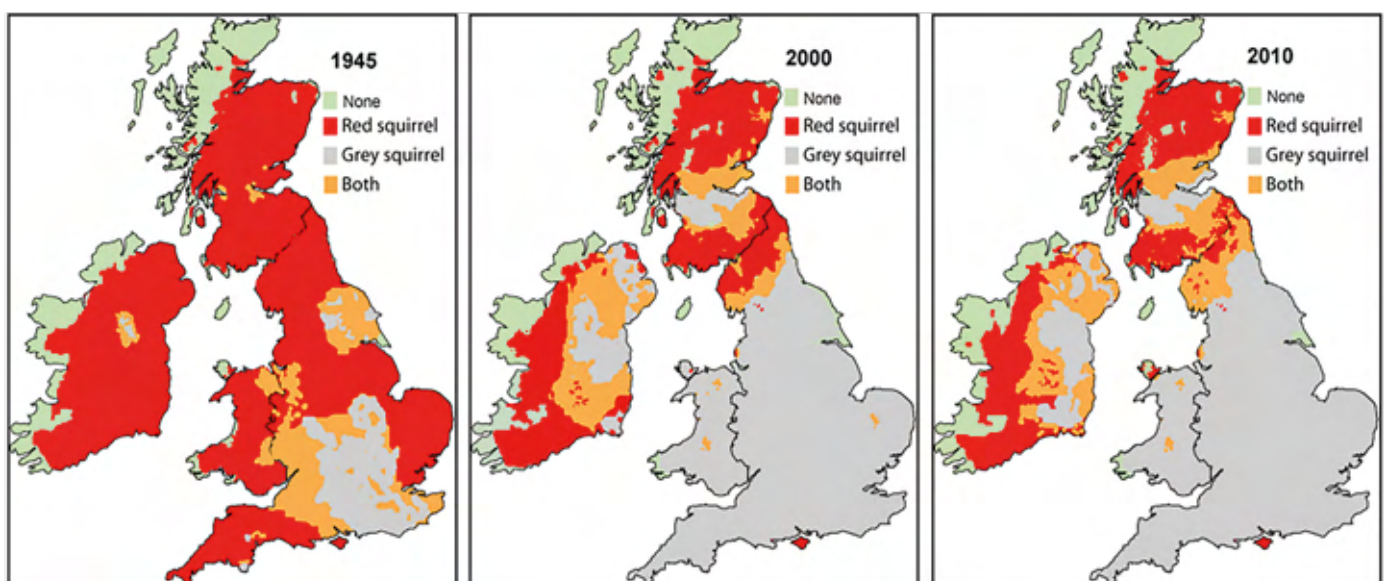


Figure 1: Time series of changing red and grey squirrel range 1945 - 2010 (Shuttleworth and Red Squirrel Survival Trust, 2022)

The England Red Squirrel Action Plan was developed by the UK Squirrel Accord following consultation with key stakeholders, while a separate England Grey Squirrel Action Plan is in-preparation by Defra.

The two action plans for red and grey squirrels are closely linked and should be considered together. They both form part of the provisions and arrangements for invasive-species management in England. Their implementation will show how new approaches can be developed and used to manage and mitigate the problems caused by invasive non-native species in the 21st century.

This Action Plan focuses on red squirrel conservation, which includes the need for grey squirrel management. The Grey Squirrel Action Plan will focus on wider issues and needs to manage this invasive species.



Red squirrel population and distribution

Prior to the release of grey squirrels in the 1870s, native red squirrels were once a widespread and common species found in suitable habitats across England. There are no reliable historic estimates of red squirrel population change but calculations indicate their range has contracted by around 95% since 1876 (Traut, 2021).

In England, the red squirrel population is fragmented, occurring in isolated populations on the islands in Poole Harbour and the Isle of Wight, and predominantly across the north of mainland England (figure 2).

There are patchy distributions across parts of Lancashire, Cumbria, Northumberland, Durham and NW Yorkshire (see figure 2 and Annex 2).

Geographic isolation has prevented grey squirrels colonising the islands. The high density and strong populations of red squirrels here are indicative of the likely populations on the English mainland prior to displacement by grey squirrels – and a vision for how England’s woodlands could look in future.

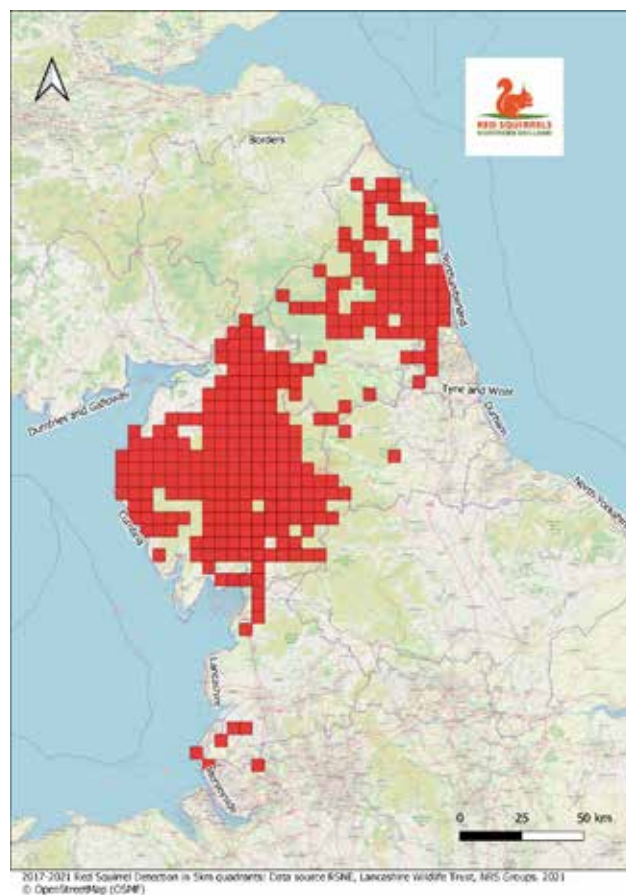


Figure 2: 2017 - 2021 Red Squirrel Detection in 5km quadrants : Data source RSNE, Lancashire Wildlife Trust, NRS Groups. 2021 © OpenStreetMap (OSMF)

There is uncertainty around the current population of red squirrels in England as no systematic national census has been undertaken due to the cost and difficulty of survey. The only available information, which informs this Action Plan, is derived from regular survey and monitoring using presence /absence data at sampling points rather than counting the numbers of individuals.

The most recent population estimate (Mathews et al., 2018) for red squirrels in Britain is 287,000 (95%CI = 218,000–553,000), while based on a systematic analysis this is likely to be an overestimate (see Annex 3). There are an estimated 38,900 (95%CI = 29,500-91,000) red squirrels in England (Mathews et al., 2018) and there is more confidence in this figure due to surveying in the field.

There are an estimated 2.7 million grey squirrels in Great Britain (Mathews et al., 2018), but without widespread census data or monitoring of the species this is not a definitive figure.

Annual monitoring indicates that the situation in any locality can change rapidly. Both squirrel species respond dynamically to factors such as food supply, that influence their reproductive success and dispersal behaviour.

Disease can have a rapid and devastating impact on local red squirrel populations. Outbreaks of squirrel pox can result in major local red squirrel population declines which accelerate the displacement effect. The impact of the 2008 squirrel pox outbreak in the red squirrel population on the Sefton Coast can be seen in Figure 3. The population rapidly declined by over 80% and took 3 to 5 years to recover following effective grey squirrel management.

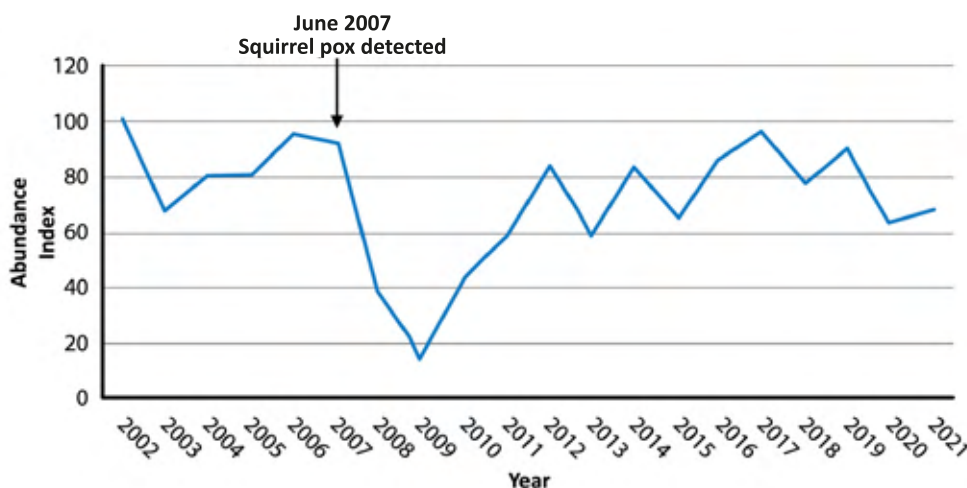


Figure 3: Results of the 2002 to 2021 spring monitoring programmes on the red squirrel population in the Sefton Coast reserve woodlands (Lancashire Wildlife Trust, 2021)

Mainland England's red squirrel survival can be deemed a success story. Without conservation efforts since the 1990s, it is highly likely the species would have been driven to extinction by the early 21st century. Success is predominantly due to the dedicated conservation work and investment of resources by local red squirrel community groups, local landowners, Defra arms-length bodies and wildlife organisations such as the Wildlife Trusts, National Trust and Red Squirrel Survival Trust. A range of funders played a critical role in supporting this effort including the National Lottery Heritage Fund, the UK Government and numerous other sponsoring individuals and organisations.

In 2020, community groups carried out 80% of red squirrel conservation activities across Northern England. They are vital to maintaining and expanding red squirrel populations. Much of this activity is based on very limited funding, with resources coming predominantly from Defra's woodland agri-environment schemes, the Green Recovery Challenge Fund, local charitable fundraising and individual donations, National Lottery Heritage Fund projects, and other independent Charitable Trusts.

Drivers of red squirrel decline

Presence of grey squirrels is the most significant factor driving the decline and loss of red squirrels on the English mainland. The two species seem to have a significant degree of overlap in their ecological requirements and occupy more-or-less the same habitat 'space'.

Scientific evidence and field experience indicates that red squirrels are unable to co-exist in the same woodlands with grey squirrels and are quickly displaced as grey populations become established. Any observed co-existence in the same localities is usually a short-term transitional phase unless other factors interrupt the displacement process, e.g. differential rates of predation and/or management of grey squirrels.

Red squirrel displacement times vary from around 3 to 5 years from the first grey squirrel sightings in a locality, to several decades. Local conditions and various ecological factors can accelerate or slow the rate of displacement but not, apparently, the ultimate outcome. There are no examples in England of a sustainable equilibrium emerging between the two species.

Interspecific competition

Grey squirrels outcompete red squirrels for food and habitat. The grey squirrel is larger and more aggressive. It consumes nuts and seeds before they are ripe enough for red squirrels to eat and digest. This results in physiological stress that leads to reduced health and reproductive rates in red squirrels (Santicchia et al., 2018), and populations die out in areas where grey squirrels become established.

Presence and transmission of disease

The grey squirrel is an asymptomatic carrier of squirrel pox. In the UK, 61% of apparently healthy grey squirrels were found to have been exposed to the virus (Sainsbury et al. 2000). Through direct contact or contaminating objects, grey squirrels transmit the disease to red squirrels where it can rapidly spread through a population and is almost always fatal. In the presence of squirrel pox, red squirrel populations decline 17-25 times faster than with grey squirrel competition alone (Rushton et al., 2006).

Additional factors that can add pressures on red squirrel populations:

Supplementary feeding

Feeding grey squirrels is likely to provide them with an ecological advantage by artificially increasing their fecundity and dispersal. This is counter to the interests of both the red squirrels and forestry.

The Plan advises that grey squirrels should not be fed under any circumstances. Great care should be taken when feeding garden or game birds not to inadvertently give access to grey squirrels – especially in areas where red squirrels may be present. Measures should be taken to exclude grey squirrels from feeding sites.

Targeted supplementary feeding can benefit red squirrels (Magris & Gurnell, 2001), but it is not advised in the presence of grey squirrels as they are more likely to benefit from the extra food source and transmit disease at communal feeding stations. During disease outbreaks, feeding should be stopped to prevent grey-red or red-red transmission (Chantrey et al., 2014). Feeders should be cleaned regularly and especially during outbreaks.

Forestry management and operations

Timing, implementation and design of felling operations at any scale can have significant impacts on red squirrel populations – especially where they are fragmented and critically vulnerable. However, it is important to note that forestry and woodland management can make a very positive contribution to red squirrel conservation, if operations are designed, planned and practiced in line with good practice guidelines.

Road traffic mortality

Road deaths have been shown to be an important cause of mortality for both squirrel species at some locations, especially in urban areas. Reducing red squirrel losses to road traffic accidents is a priority in problem areas, e.g. busy roads separating key red squirrel habitats. There is significant potential for this to be exacerbated by any reduction in tree cover in urban areas, alongside the risk of squirrels crossing roads to move between supplementary feeding sites.

The provision of rope bridges across busy roads has proven to be beneficial in reducing traffic mortality and connecting fragmented habitats (Timmerman, 2018).

Predation by wild predators

Both squirrel species are preyed upon by various carnivores. In the UK, the main wild predators of squirrels include buzzard, *Buteo buteo*, fox, *Vulpes vulpes*, goshawk, *Accipiter gentilis*, stoats, *Mustela erminea*, and pine martens, *Martes martes*.

Emerging evidence from studies in Ireland and Scotland on the effects of recovering pine marten populations is encouraging for red squirrel conservation. The findings demonstrate a correlation between the recovery of pine marten populations, the disappearance of grey squirrels and the recovery of red squirrel populations. The mechanisms and long-term effects of these interactions are still unclear and research is ongoing. However, results to date suggest that red squirrel populations can benefit from the recovery of this native predator, particularly where there is good availability of structurally varied native broadleaved woodland habitat.

Predation by domestic animals

Attacks by cats and dogs can be an issue for red squirrel conservation in some urban and suburban areas where populations are under stress from other pressures. This may provide an additional pressure on local populations that in combination with other factors may accelerate the rate of displacement.

Actions for red squirrel population recovery

The core aims of the Red Squirrel Action Plan for England are to:

1. Protect, identify and strengthen red squirrel populations across the current range
2. Expand the current range of red squirrels
3. Support and improve collaborative action at all levels
4. Promote better understanding and support for red squirrel conservation across England

Leads and timelines for each action will be identified and defined via a stakeholder working/steering group. The group is set up and managed by the UK Squirrel Accord to ensure engagement and delivery of the actions in the plan. Information on activities and how to get involved can be found here:

<https://squirrelaccord.uk/EnglandRedSquirrelActionPlan>

1. **Protect, identify and strengthen red squirrel populations across the current range**
 - a. **Maintain red squirrel distribution across the landscape**

Existing red squirrel populations will be protected and their current range maintained by prioritising grey squirrel management and habitat best practice across mainland England, and the protection of offshore island or isolated populations.
 - b. **Grey squirrel management**

Effective programmes of humane grey squirrel management will be maintained and promoted in red squirrel areas and around a reasonable proximity. Support will be provided for the provision of appropriate grey squirrel management training and accreditation that promotes high ethical and efficacy standards. New, cost-effective and alternative and complementary methods for grey squirrel management will be adopted and promoted where suitable, if and when they become available.
 - c. **Improve and expand suitable areas via appropriate habitat management**

Promote the use of good practice guidance for woodland management and forestry operations to landowners and managers in and adjacent to red squirrel areas. Woodland management can make a significant contribution to red squirrel populations by improving the suitability, extent and connectivity of habitat at a landscape-scale within and adjacent to red squirrel areas.
 - d. **Improve the protection of red squirrel habitats from development**

Interact with the planning system to better ensure red squirrel habitats are better protected from development activities. Link with Nature Recovery Networks and Local Nature Recovery Strategies to ensure red squirrel interests are covered through involvement at a local/area level.

e. Build on the current area-level approach to red squirrel protection and recovery
Review, redefine and update the stronghold approach to reflect and build on the last 25 years of experience and the current situation. This could include encouraging and supporting the development of landscape-scale partnerships amongst the red squirrel community – enabling greater collaboration.

Focus areas should embrace Northumberland, Cumbria, Durham, West/North Yorkshire, Lancashire, Merseyside and the Scottish border, and work to create and join-up an expanded defined network of red populations by 2030.

f. Standardise monitoring and surveying

Review and update the current monitoring and survey methodology, and reporting arrangements to better inform red squirrel conservation activities. Explore options for the reporting of actions by individuals unconnected to red squirrel conservation community groups, non-governmental organisations and arms-length bodies.

g. Control and reduce disease risks

Maintain the national system for disease monitoring and early warning systems. Promote biosecurity best practice to reduce risks of disease transmission during red squirrel conservation activities. Promote further research and provide guidance and information on controlling disease risk.

2. Expand the current range of red squirrels

a. Increase time spent on targeted red squirrel conservation

Highlight the correlation between the presence of red squirrel populations and their apparent success and the amount of conservation activity. A 2021 baseline will be established with an aim to increase the time spent conserving red squirrels by 20% over the next five years. Local areas to define expansion zones and implement grey squirrel management in those areas if they have sustainable funding/resources.

b. Provide advice and guidance

Identify and promote best practice to landowners and managers, local communities and businesses to encourage greater involvement in red squirrel conservation. Best practice to include red squirrel conservation, disease management, forestry operations, grey squirrel management and data management.

c. Promote best practice guidance for red squirrel translocation

Working with the Defra Reintroductions Code (2021b) and the International Union for the Conservation of Nature Guidelines (2013), promote good decision-making and best practice for red squirrel translocation projects.

3. Support and improve collaborative action at all levels

a. Review current structures

Map the structure and roles of the various stakeholders within the red squirrel conservation sector. Explore opportunities for more effective partnership working and develop a plan to improve collaboration.

b. Enhance collaboration across the sector

Promote better collaboration, integration and coordination of action at a local level through the development of evidence-based conservation plans by local partnerships, which bring together all relevant partners around shared objectives. Empowering local red squirrel community groups and partnerships to develop and deliver their own bottom-up area plans that connect to local nature recovery strategies and to which partners at all levels can contribute.

c. Support for community groups

Ensure the important work of red squirrel community groups informs and engages with national action. Encourage funding and partnership opportunities. Increase the visibility of community groups and recognise the vital role they play in red squirrel conservation.

d. Increase knowledge sharing

Organise and deliver an annual programme of communications activities within the red squirrel conservation community to share best practice, research and achievements that support and promote delivery of the action plan.

4. Promote better understanding and support for red squirrel conservation across England

a. Develop a communications strategy for the Action Plan

Building on the experience of stakeholders, a communications strategy will be developed and delivered via various communications channels that identifies and targets key audiences and their needs. This will promote and encourage red squirrel conservation along with wider benefits of and incentives for increased tree cover.

b. Create best practice guidance

General guidance on communications best practice will be developed and promoted with stakeholders to ensure scientifically accurate and sensitive messaging around red squirrel conservation and grey squirrel management.

c. Identify key messages

Create and endorse the use of key messages for different audiences to better promote red squirrel conservation and grey squirrel management to protect red squirrels and tree health.

d. Research

Promote and seek funding for research into the ecology of squirrels and applied conservation issues to improve understanding of red squirrels and assess the success of interventions and the need for further actions. See appendix 3 for suggested research areas.

Key Performance Indicators

- Increase the time spent conserving red squirrels by 20% over the next five years from a 2021 baseline
- Collaborative conservation plans developed in all red squirrel areas
- Increase the number of tetrad squares containing red squirrels from a 2021 baseline

The England Red Squirrel Action Plan will be reviewed and updated after five years.

Appendix 1. Red squirrel ecology

Red squirrels arrived in England with trees and woodlands that recolonised the post-glacial landscape following the melting and retreat of the ice around 10,000 years ago. The earliest fossil record was found in the Wye Valley's Madawg Cave and is from 8710BP in the Mesolithic period (Gurnell and Hare, 2008; Yalden, 1999).

Ecologically, the red squirrel is cosmopolitan in its habitat requirements and occurs in a wide range of woodland habitats and areas with trees. It is equally at home in coniferous, mixed and/or broadleaved woodland in the Boreal and temperate zones of Europe and Asia. The species can also readily adapt to scrub, hedgerows, gardens and parkland where good food sources and suitable cover for dreys are available.

Red squirrels eat a wide range of food, including seeds, fungi, buds, bark and invertebrates (Krauze-Gryz and Gryz, 2014). While the species does not hibernate, a key adaptation that enables them to survive periods of food shortages (e.g. in winter) is to hoard surplus food supplies in numerous buried caches for subsequent retrieval. Their ability to relocate caches is thought to be variable and nuts and seeds that remain buried can germinate and contribute to natural regeneration.

Average home ranges vary from 1 to 6.6 hectares in mixed woodland on the Isle of Wight, to 9 to 30 hectares in the conifer-dominated plantations of Northern England and Scotland (Gurnell and Hare, 2008). Densities on average vary between 0.5 to 1.5 animals per hectare in both deciduous and coniferous woodland. However, annual fluctuations can be significant depending on food supply and weather. Very low densities (0.02 to 0.2 animals per hectare) are reported from large conifer forests in the north of England. The species can recover quickly from low levels within two to three years.

Further information on ecology and behaviour can be found in the literature (Shorten, 1954; Gurnell, 1987; Shuttleworth et al. 2014).

Appendix 2. Red squirrel population estimate

Uncertainty around the absolute size of the current red squirrel population exists because no systematic census of red squirrels has been undertaken across England or the UK. This is due to the difficulty and expense of field survey required to achieve a precise and scientifically robust estimate.

Red squirrel population figures

- In 2008, Gurnell and Hare (2008) estimated a pre-breeding population in Great Britain of 161,000 with around 30,000 in England, but this is likely to have declined.
- The most frequently quoted estimate (Forestry Commission, 2010) is that fewer than 140,000 red squirrels remain in the UK and less than 20% of these are in England. This is an adjusted figure based on the 2008 estimate and has been used by various projects.
- The most recent figure (Mathews et al., 2018) estimates there are 287,000 (95%CI = 218,000–553,000) red squirrels in Britain. This figure is based on a systematic analysis but is considered an overestimate. There are an estimated 38,900 (95%CI = 29,500-91,000) red squirrels in England (Mathews et al., 2018) and there is more confidence in this figure due to surveying in the field.

Notes on the Mathews et al. (2018) study methodology

The following text is included in the published study and helps to explain the issues surrounding the methodology, the final figure's reliability and why it is viewed as an overestimate: *The general approach for estimating population size in this study was to multiply habitat-specific density estimates by the extent of these habitats within the geographical range.*

With very limited field survey data available, the assessments presented in this review are based on some broad and potentially incorrect assumptions. For example, that red squirrels occupy and are present in all suitable habitats within their range at an average density inferred from a small number of research studies. This means that the reliability of the estimate must be interpreted with caution and the following caveats apply to the estimate.

Caveats on the 2018 red squirrel population estimate

The red squirrel population size estimate may be affected by the following factors, which were not included in the analysis:

- 1. No percentage occupancy data are available, so the population size is overestimated.*
- 2. There may be some overestimation resulting from the inclusion of extensive Sitka spruce plantations, which support only very low densities of red squirrels.*
- 3. Population estimates for England, Wales and southern Scotland are likely to be too high owing to overlapping ranges of grey squirrels.*
- 4. The study allocates a Reliability score of 2 to the estimate. A value of 1 indicates very poor reliability, and 4 indicates very good reliability.*

Based on this model, the current estimates suggest there are around 38,900 wild red squirrels (95%CI = 29,500-91,000) in England. The island populations are on the Isle of Wight, Brownsea and Mersea Island. Those on the mainland are mainly found in Northumberland, Cumbria and Lancashire, with some in Durham and North Yorkshire.

There is no reliable estimate available for the population of red squirrels prior to the introduction of Eastern grey squirrels, but due to the distribution of woodland and known densities in some areas it may have been as high as 3.5 million across the UK (Yalden, 1999).

Despite these inherent data issues, some indications of relative population trends can be inferred from the presence and absence distribution data collated by Red Squirrels Northern England. Nevertheless, preparing a statistically robust estimate of the red squirrel population is difficult, if not impossible, within the current level of resources available for survey.



Appendix 3. Suggested research areas

The following are suggested areas of red squirrel conservation research that could be pursued by key stakeholders or academic students during the life of the action plan. Suggested areas of grey squirrel specific research are outlined in the England Grey Squirrel Action Plan.

Topics to be discussed and prioritised by stakeholder working group:

- Explore and develop research into alternative or complementary methods to manage and reduce grey squirrel populations, e.g. grey squirrel oral contraceptive.
- Better understand the essential place of red squirrels in British ecology.
- Explore potential for an oral red squirrel vaccine for squirrelpox virus.
- Carry out more work on population genetics studies.
- Research behaviour traits of grey squirrels in red areas and/or where there are lower numbers of greys due to management. Behaviour is different to that shown when there are higher numbers of greys, which can make monitoring and management more difficult.
- Improve red squirrel population estimates through modelling using the monitoring data.
- Define and measure conservation effort to ensure there is a reliable indicator.
- Compare different methods to assess red squirrel presence.
- Assess recolonisation rate by red squirrels in areas where grey squirrels are removed.
- Build upon research into potential red squirrel resistance to squirrel pox virus.

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The UK Squirrel Accord (UKSA) is a UK-wide partnership of 43 conservation and forestry organisations, Government agencies and companies, with links to red squirrel community groups. UKSA works collaboratively to protect native red squirrels and trees, and mitigate the negative impacts of invasive grey squirrels. This plan is supported by a number of UKSA signatories and wider stakeholders that have an England remit.



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