

# COME ON YOU REDS!

IT'S NOT OFTEN WE'RE ABLE TO BRING YOU GOOD NEWS ABOUT RED SQUIRRELS, BUT A STUDY FUNDED BY PTES IS GIVING SOME CAUSE FOR OPTIMISM IN AN OTHERWISE DISMAL STORY. TONY SAINSBURY OF THE INSTITUTE OF ZOOLOGY AND AMY-JANE BEER REPORT.

**T**he plight of the red squirrel is familiar to most people with even a passing interest in wildlife. People lucky enough to live in parts of the British Isles where red squirrels survive (mainly Scotland and northern England, and Ireland, plus isolated enclaves in Wales, and on the Isle of Wight and Brownsea Island) almost invariably regard the proximity of the species as a privilege, and for visitors from other parts of the country, the sighting of a red squirrel is often a highlight of their trip. Of all our threatened mammal species, the red squirrel is perhaps best known, and the reasons for its decline are at least partly understood by almost everyone (see survey box).

Grey squirrels are implicated in the decline of reds, but where competition alone is the issue, the replacement of reds by greys is a

relatively slow process. However it is now known that the rate of decline is greatly accelerated where the encroaching greys carry a virus, known as squirrelpox virus (SQPV).

### Squirrelpox virus

While harmless to grey squirrels, SQPV causes a fatal disease in red squirrels. Victims develop lesions on the face, paws and genitalia, become listless and unable to feed, and usually die within 15 days. SQPV has swept through the red squirrel populations of England and Wales over the last century, and much more recently has appeared in Scotland. It is undoubtedly a major factor in the red squirrel decline, and it is spreading relentlessly northwards. Antibodies to SQPV have recently been detected in a handful of grey squirrels north of the border and a few Scottish red squirrels have succumbed to the disease. Previous research has shown that in areas

where red squirrels encounter greys with SQPV they decline up to 27 times faster than those which co-exist with SQPV-free grey squirrels.

### Early signs

While the link between red squirrel decline and the spread of greys has been well documented and is widely known, research linking the red squirrel's demise to infectious disease was slow to materialise. AD Middleton wrote the first authoritative account of epidemic disease in red squirrels in England and Wales in 1930 and expressed concern for the red squirrel's fate. Monica Shorten, was the first to map cases of red squirrel disease, and recorded continuing epidemics in her 1950s monograph on the species. Serious research to elucidate the cause of the disease did not start until the 1960s and 1970s when first AD Vizoso and later Ian Keymer carried out investigations on

outbreaks in Norfolk. Samples submitted from one post-mortem examination carried out by Dr Keymer were scrutinized using electronmicroscopy at the Central Veterinary Laboratory and the breakthrough diagnosis was finally made: the squirrelpox virus was detected. Follow-up research over the last 15 years by a team from several universities and institutes has included further investigation of dead red squirrels, and mapping and modelling studies have confirmed the severity of the threat posed by SQPV to the future of the red squirrel.

### Resistance is possible

The outlook is bleak, but we are pleased to report a possible small chink of light. In a piece of research funded by PTES, and recently published in the journal *Ecohealth*, antibodies to SQPV have been discovered in eight red squirrels which had died of other causes. Antibodies confer immunity, but they only develop following exposure to the antigen, in this case the squirrelpox virus. The presence of antibodies, without symptoms



Like other tree squirrels, the red has sharp grappling hook claws and double jointed ankles, which enable it to grip tree bark and run both up and down trunks with equal ease.

**Is pox immunity new?**  
What we can't tell from this research is whether immunity in red squirrels is new, or whether it has existed since the virus arrived in the UK but at levels too low to maintain red squirrel populations. If it is new, it could be that the virus or the red squirrel (or both) are changing their behaviour to each other. We need to monitor red squirrels for several more years before we can develop an understanding of these changes. In the meantime we can at least say with certainty that the red squirrel is capable of generating immunity to SQPV (although there is probably more to it than just an antibody response). This may be of critical importance should we collectively decide that it is right to intervene to alter the balance between red squirrels and grey squirrels. We now know that if a vaccine was developed, free-living red squirrels would respond to it

of the disease, suggests that these eight individuals had been exposed to SQPV and had either developed the disease then recovered, or had fought off the infection without becoming ill. Seven of the eight immune red squirrels were from northern England and one was from North Wales, which shows us that immunity is not a one-off phenomenon confined to a single population of related squirrels from an isolated area.

## 'Why are reds in Britain endangered?'

In an unscientific straw poll, 80 people were asked why they thought red squirrels in Britain are endangered. After discounting all those known to have a professional interest in wildlife, more than 94% of respondents mentioned grey squirrels. None said they had no idea, though some of those who didn't reply may have failed to respond because they were unable to hazard a guess.

The arrival of grey squirrels in UK has indeed been catastrophic for reds. Not only are the greys larger and rather hardier, in most habitats they are able to exploit available resources more effectively than reds.

Many respondents to the survey (72%) had an inkling of this competitive advantage, although the lingering perception that 'big bad greys beat up small sweet reds' is not really justified. Interestingly, relatively few people (33%) mentioned disease, though this is now well known to be a highly significant factor. Squirrelpox virus is carried by grey squirrels, which suffer no ill effects themselves, but which can pass the infection on to reds with which they share habitat. Until recently it was thought that squirrelpox virus was invariably fatal to red squirrels.

Red squirrels are lighter and more agile than greys. This gives them a competitive advantage in coniferous woodland, allowing them to venture onto thin branches to collect cones. However, if greys encroach closely enough to pass on the squirrelpox virus, the reds may succumb despite being better adapted to the habitat.



This map, supplied by the Veterinary Laboratories Agency, shows the incidences of SQPV in red squirrels around the country. The red squirrel population in Suffolk is probably now extinct.

## New guidelines for red squirrel monitoring by PTES Chief Executive Jill Nelson

With funding from PTES and the Joint Nature Conservation Committee, Professor John Gurnell (Queen Mary University of London), Dr Peter Lurz (University of Newcastle), Dr Robbie McDonald (CSL Woodchester) and Dr Harry Pepper (Forest Research) have been investigating techniques for monitoring red and grey squirrel populations to find out which work best when carried out by volunteers while having negligible effects on the squirrels.

Squirrel numbers vary widely through space and time, naturally tracking tree seed availability. Densities in conifer, and especially

in Sitka spruce plantation forest, can be very low, much less than one squirrel per hectare. This makes it difficult to survey and monitor them and to estimate population densities.

A practical user-friendly digest of the findings, in the form of Forestry Commission Practitioner Notes, will be published later in 2009. The notes will advise on which monitoring methods to use where in relation to red and grey squirrels and outline what can be expected in terms of reliable data. There will be a link to this new material on [www.ptes.org](http://www.ptes.org) in due course.





Red squirrels spend less time on the ground than greys. Where possible they move from tree to tree by leaping. The exception is autumn when they may descend frequently to cache nuts at ground level.

LAURIE CAMPBELL

READ ON

Read the original paper detailing the discovery of SQPV immunity in red squirrels. *Poxviral disease in red squirrels *Sciurus vulgaris* in the UK: spatial and temporal trends of an emerging threat.* Sainsbury AW, et al 2008. Ecohealth, DOI:10.1007/s10393-008-0191-z

You can find out more about red squirrels in general by reading *Red squirrels* by Jessica Holme, published by Whittet Books and available from booksellers.

by becoming immune, and would be protected from this serious disease. There are good reasons to intervene in favour of the red squirrel because it was human activity (the introduction of the grey squirrel) that initiated its demise. Of course, there is a lot of work to be done before a vaccine could be developed for use in the wild, but the findings of the Institute of Zoology's research are an important starting point.

Saving the red squirrel in Britain is going to be a very tough fight, but one in which there is now some hope that the red squirrels themselves, with our help, may be able to contribute, by throwing off a disease once thought to represent an inescapable death sentence.

What we should learn

There are two other crucial lessons to be learned from the squirrelpox story. Firstly the situation serves as a grave warning of the dangers to native biodiversity of introduced alien species. Alien species can out-compete our native animals and diseases such as squirrelpox are just one mechanism through which this comes about. As a result, we need to think very carefully on the consequences of other human-

induced introductions. A disease carried by introduced American crayfish is decimating populations of our native species and there are many other introductions for which we don't yet have a clear understanding of ecological interactions, for example the red-eared terrapin.

Secondly, the squirrelpox story illustrates the difficulty inherent in pinning down the true cause of a species' decline. It took over 130 years for the detrimental consequences of grey squirrel introduction to be fully recognised and even now we don't have a solution to safeguard red squirrels. If we wait for such a protracted period before we investigate other declining species we may witness further potential extinctions in years to come. For example, other PTES-sponsored studies have highlighted the decline of the hedgehog. Early research into the health and diseases of that species would be wise.

In addition to supporting research into squirrelpox virus, through your donations, the People's Trust for Endangered Species has been able to fund several other red squirrel projects over the past year (see boxes).

fact FILE Red squirrel



LAURIE CAMPBELL

Squirrels are rodents of the family Scirudiae. There are seven native European squirrels, of which only the red lives in the UK. The others are the Persian tree squirrel, flying squirrel and four ground-dwelling species: the alpine marmot, chipmunk and two species of souslik. Sadly the most common species here today is the American grey squirrel (*Sciurus carolinensis*).

COMMON NAMES Red squirrel, *gwiwer* (Welsh) *Fèòrag* (Scots Gaelic), *Iora Rua* (Irish Gaelic)

SCIENTIFIC NAME *Sciurus vulgaris*

DESCRIPTION Lightly built tree squirrel with bushy tail and pronounced ear tufts in winter. Head body length 18–24cm, tail 14–20cm. Fur variable shade from dark chocolate brown to auburn, but usually very strong red with no hint of grey, and a white belly.

HABITAT These days restricted to mainly coniferous woodland, also visits parks and gardens in stronghold areas.

HABITS Highly arboreal, fast and agile climber. Active by day. Activity reduced in poor weather but does not hibernate. Loud chattering calls challenge rivals and human passers by.

DIET Nuts and seeds, especially pine kernels nibbled from the cone, also acorns, fungi and the soft tissues of trees.

BREEDING Mate Jan-March; litters of 1–8 (usually 3) born after 5–6 weeks gestation; weaned at 8 weeks, independent at 2–3 months, sexually mature at 10 months. Longevity 6–7 years.

DISTRIBUTION Mainly Scotland, Cumbria and Northumberland with scattered populations elsewhere – notably North Wales (Anglesey), Ireland, the Isle of Wight, Brownsea Island, Formby and the western Yorkshire Dales.

CONSERVATION STATUS Has declined in range and numbers since the introduction of grey squirrels in the early 20th century.

Squirrel adenovirus by David Everest of VLA

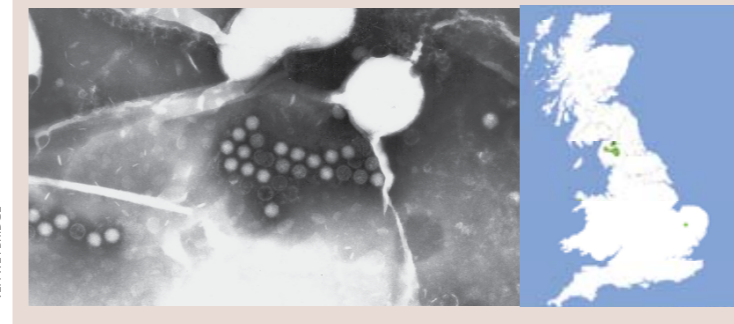
As if the threat of SQPV wasn't enough, red squirrels in the UK also face another threat, from adenoviruses. These widespread pathogens cause a wide range of gut and respiratory infections in many species, including man. In the context of the red squirrel, adenovirus is associated with gut infections that cause diarrhoea. Squirrel adenovirus was first confirmed in red squirrel casualties from Thetford Forest, Suffolk, in 1997 by the Veterinary Laboratories Agency (VLA) in Weybridge. The individuals concerned had been translocated from south Cumbria.

Then in 2006, two cases cropped up at the same location in north Cumbria. Further cases followed throughout 2006 and 2007 and to date, we have confirmed the virus in 14 cases, all within about a 20km radius. Additionally, in 2007 on Anglesey, in a pre-release captive breeding pen, three cases were identified among seven juvenile squirrels. The remaining four were released into the forest before the virus was identified. No

trace of these individuals has been found in subsequent trappings and they are likely additional victims. In 2008, tissue molecular studies confirmed that adenovirus was implicated in the deaths of at least five animals from a previous Anglesey captive breeding programme in 2005 and a further two wild cases in 2006.

The contribution of adenovirus to the demise of the red squirrel is unclear, due to the lack of pathological findings in most cases. So far we have been unable to identify any consistent outwards signs of the disease, though these may often be masked by decomposition of the carcasses we receive. Pathology has been seen in only one case so far, making it difficult to determine if the adenoviral disease is fatal or if the dead squirrels we see died of other causes.

The PTES has kindly funded a small survey, utilising archive material, in which we will aim to discover to what extent adenovirus has been present among red squirrels in Britain.



VLA WEYBRIDGE

Red squirrels are alert and wary animals. Their natural enemies include birds of prey and pine martens, which will occasionally raid breeding dreys and predate young squirrels.



LAURIE CAMPBELL

SOS update by Carri Nicholson of Northumberland Wildlife Trust

2008 was a bit of a mixed year for red squirrels and the Save our Squirrels project. Firstly, we are delighted that a new red squirrel reserve has been created at Greenfields Forest in the Yorkshire Dales National Park, the 17th such safe haven in the north of England. More good news came when the Heritage Lottery Fund agreed to extend our grant claim period to July 2010, giving us another six months to continue our work whilst we plan for the future. The year also saw the creation of Northern Red Squirrels, an umbrella organisation for all the local squirrel groups across the north, and we are working closely with them to create a region-wide strategy for the protection of existing red squirrel populations. The benefits of a partnership approach to grey control are becoming apparent as we are starting to see red squirrels return to areas from which they were displaced. Sadly, though, the tragic impact of the squirrelpox virus on squirrel numbers at the Sefton National Squirrel Refuge this year (where we've lost about 60% of the population) clearly demonstrates that to save vulnerable red squirrels from extinction on mainland England we must address the threat of disease. At present the only way to do that is to prevent contact between reds and disease-carrying grey squirrels. Our special thanks must go to PTES for their continued support for red squirrel conservation.

Solway squirrels by Cally Quigley of the University of Cumbria

I am examining the use of habitat corridors by red squirrels. This is the second year PTES has funded the project through an internship; the first project showed that corridors linking two woodland habitats together would significantly increase the long term viability of red squirrels in the area. However, there has been some debate as to what actually constitutes a wildlife corridor. I am investigating squirrel usage of a range of potential corridors using hair tube surveys. Preliminary findings indicate that red squirrels are using a number of different corridor types, which is good news for the conservation effort. Landscape ecology modelling will take place at Forest Research in Edinburgh to model the best way to connect the woodlands on the Solway Plain. I hope in the future this will allow more efficient design of red squirrel reserves and improve our chances of saving this valuable and threatened native.