RED SQUIRRELS IN MY GARDEN

Guidance and tips to help encourage and conserve local populations

Craig Shuttleworth & Liz Halliwell

ISBN 978-0-9547576-5-6

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The Red Squirrels Trust Wales and Directors are delighted to be associated with this book which gives a comprehensive insight into the natural history of the red squirrel including all the problems they currently face. Although aimed at families and children, there are sufficient well explained scientific facts to make it an excellent read for any age group interested in red squirrel conservation. I myself learnt a lot by reading it. There is also a section explaining the do's and don'ts of feeding them in your garden if you are fortunate enough to have them visit you there. The authors should therefore be congratulated on this publication with its well written, informative and easy to read content.

Dr Gareth Jones
Chair, Red Squirrels Trust Wales.

Front cover by kind permission of Philip Snow ©

About the authors

CRAIG SHUTTLEWORTH Born in Dumfries and growing up in the Highlands of Scotland, Craig went on to study wildlife management at Edinburgh University. He spent four years conserving merlin, peregrine falcon and white tailed sea-eagles. Since 1993, he has studied red and grey squirrels including managing a project that successfully eradicated grey squirrels from Anglesey. Working with captive red squirrel breeders across the United Kingdom, he has also undertaken and advised upon several red squirrel reintroductions. Craig is currently a Director of Red Squirrels Trust Wales, the Scientific Advisor to the European Squirrel Initiative and is an Honorary Visiting Research Fellow at Bangor University. He lives with his family near Bethesda in north Wales.

LIZ HALLIWELL Following her childhood on Jersey, Liz completed a Biology degree at Southampton University, and then a PhD at the University of Aberdeen for research into the relationship between red squirrels and pine martens. During the course of her career, Liz has worked on a range of other British mammals including badgers, dormice, mink and moles. In 2001 Liz joined the Countryside Council for Wales, providing specialist advice, information and strategic overview of issues relating to the conservation and management of terrestrial mammals, and she continues in the same role in Natural Resources Wales. She lives on Anglesey with her family.

BETHAN WYN JONES Bethan is a native of Talwrn, Anglesey and still lives there. She has an MSc in Zoology from the University of Wales, Aberystwyth. She regularly contributes nature articles in Welsh to the '*Herald Cymraeg*' in the Daily Post and contributes frequent talks in Welsh on '*Galwad Cynnar*', the Radio Cymru's weekly nature magazine programme. Her twelve publications include "*Y Wiwer Goch*", a Welsh adaptation of 'Red Squirrels' by Tom Tew and Niall Benvie.

Preface

There were only 40 red squirrels on the island of Anglesey in the late 1990s and the population was very close to extinction. In response, Esmé Kirby and her husband Peter galvanised local efforts to save the species by removing the large grey squirrel population that was present. Thanks to this initiative, there has been a sea change in the fortunes of the native red squirrel, and today it is a common sight in woodland, parks and gardens across the island. By 2009, red squirrels had actually managed to cross the Menai Strait sea channel separating Anglesey from Gwynedd. They then colonised a narrow belt of coastal woodland between the city of Bangor and the village of Y Felinheli (Port Dinorwic). As red squirrels became more abundant, some animals began to visit local gardens where they would eat peanuts and other foods placed on bird tables or within hanging feeders. As a result, increasing numbers of people are able to watch their acrobatic antics. The local community have been keen to learn about red squirrel ecology and often ask questions about how they might help conserve this enchanting animal.

This book sets out to answer many of the commonly asked questions about red squirrels. These include where they live, what they eat and how they spend their time. We have included guidance on how and what to feed red squirrels in gardens, tips on the common signs that reveal red squirrels are active in a woodland and a wealth of other information that we hope will allow local people to get actively involved in their conservation.

Craig & Liz

Chapters

Chapter 1

Introducing the red squirrel: the only native squirrel in Britain

Above *The red squirrel is the only native squirrel found in the UK*

THE RED SQUIRREL is the only species of tree squirrel native to Britain and it has been present since the end of the last ice age, some 10,000 years ago. Red squirrels were historically widespread across the British Isles. As their woodland habitats were progressively cleared and replaced by agriculture, towns and roads, squirrel numbers would have steadily declined to lower levels. The national population remained widespread until the introduction of the eastern grey squirrel, a bigger species originally from North America. Grey squirrels have now largely replaced the red squirrel across many parts of Britain.

Red squirrels spend up to 70% of the day in the trees and are adapted for a life climbing amongst the highest branches. This is an extremely agile animal, with a long tail to aid balance and long legs to jump across small gaps between adjacent tree canopies. With large feet and long claws on each slender toe, they have an amazing grip and can move with ease

Right *Long fingers and claws help animals move through the tree tops*

Right *Long and sharp front teeth are designed to open hazel nut shells*

along branches. A double jointed ankle allows them to very gracefully move down tree trunks to the woodland floor.

Red squirrels, in common with other rodents such as rats and mice, have specialised front teeth, known as incisors, which have a hardened yellow front surface that form a sharp edge for gnawing. They have whiskers on their muzzle and on their ankles which allow the animal to be aware of

twigs and branches near them as they brush through the forest canopy. They have a broad diet including the seeds, shoots, flowers and buds of trees, fungi and occasionally the eggs of song birds. Whilst on the ground they forage for fungi, fallen tree seed, bulbs and flowers of plants. They also bury seeds in the ground, a process called ‘caching’ and a behaviour that allows them to store food which they can later recover.

Adults typically weigh 260-350g and may live for up to six years in the wild. A mature female can produce two litters annually which consist of one to six young. Populations fluctuate in size depending on the abundance of tree seeds and seasonal weather patterns. So, in years when there are few tree seeds available, and the winter weather is harsh, many animals will succumb to the effects of exposure and starvation.

The red squirrel is afforded legal protection under the Wildlife & Countryside Act (1981) which makes it an offence to deliberately injure or kill them. It is also illegal to disturb them when they are using a nest site and any place being actively used for refuge or shelter is also protected.

Image of a grey squirrel

Chapter 2

Why are red squirrels rare?

Above *Squirrel pox virus is spread to red squirrels by grey squirrels*

THE RED SQUIRREL was once common across Great Britain. It is now absent from most of England and Wales, largely because of competition from the grey squirrel, a bigger species introduced between 1876 and 1929 from the eastern part of the United States and Canada. In Scotland the replacement of red by grey squirrels is also happening, but there are many more remote areas which grey squirrels have yet to reach.

Grey squirrels are found in the same woodland habitats and eat the same foods as the red squirrel, but tend to live in much higher numbers. There can in fact be four to ten times the number of grey squirrels in a broadleaved woodland area than we would typically see in an equivalent habitat area where only red squirrels are present.

When grey squirrels colonise a habitat where red squirrels are present, they make it difficult for young red squirrels to remain in the forest area because they dominate the food supplies. These juvenile red squirrels have lower growth rates and tend to weigh less than would normally

be expected. The result is that, although adult red squirrels continue to breed, fewer and fewer young animals survive to adulthood. As mature animals age and die, they are not replaced quickly enough to prevent the overall population from steadily declining. Eventually the red squirrels become extinct in that locality and only grey squirrels remain.

Although there are only occasional aggressive interactions between the two species, grey squirrels not only compete with red squirrels for tree seed crops and other foods, but they also dig up and pilfer their stored seed. The loss of some of this important buried autumn store is detrimental to the winter survival of red squirrels. Buried seed is a valuable food source and takes a lot of time and energy to store.

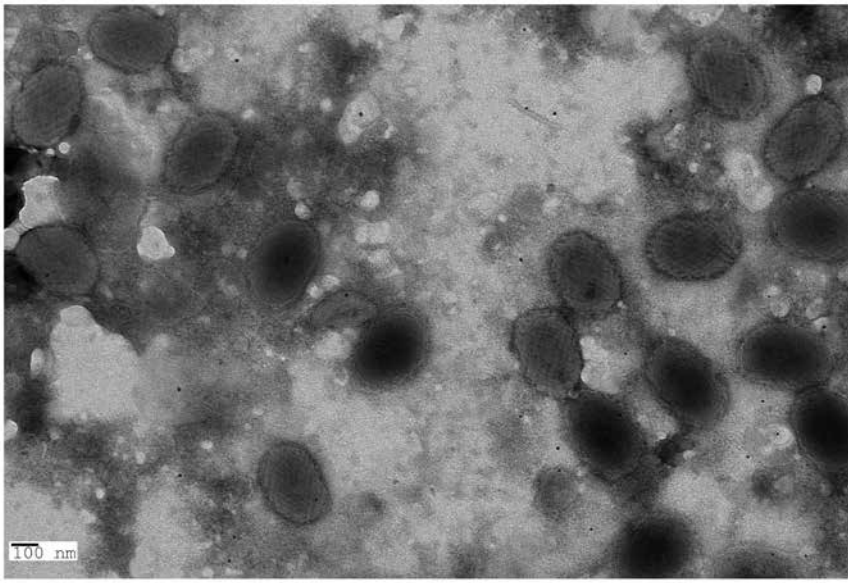
In addition to direct competitive interactions, grey squirrels also bring infections with them including the squirrelpox virus. Grey squirrels pass this virus on to red squirrels. Red squirrels have little immunity to the virus and generally die within three or four weeks of infection.

The virus is present in the majority of grey squirrel populations in the British Isles, but it very rarely causes the animals any health problem. The virus is concentrated in the upper skin but without causing any evident harm. The grey squirrel shows what is called ‘an immune response’, or put in simple terms, a reaction to the presence of the viral particles. This is all quite technical, but for those interested, the immune system creates ‘antibodies’, which are small molecules that try and cleanse the skin of the virus. These antibodies can be detected in blood, and so by testing blood, it is possible to understand what proportion of grey squirrels in a forest have been exposed to squirrelpox virus and therefore to understand if the virus is likely to be present and pose a threat to the red squirrel.

When the virus spreads from grey squirrels to red squirrels it does lead to an antibody response. However this response is insufficient to prevent the infection in the red squirrel from growing and from causing very severe skin lesions. These sores become infected by a variety of bacteria commonly found on the skin or in the environment. This results in inflammation, pus forming and further stress on the animal. Although the dying animals continue to forage and feed, they are typically dead within three to four weeks. During this interval they are highly infectious and produce large amounts of viral particles that contaminate nests and feeding areas. Other red squirrels may get infected.

Outbreaks of squirrelpox can kill a large proportion of the red squirrel population in a matter of months. In the Formby coastal pine forests it was estimated that up to 90% of the red squirrels perished in one outbreak. Computer simulations of the impact of this virus on populations has suggested that it accelerates the rate at which red squirrels are lost to grey squirrels by around fifteen times compared with just competition alone.

How is the virus spread between grey and red squirrels? Research has suggested that fleas may be involved as the grey squirrel flea can live on red squirrels. However, it may also be spread by a bite during an aggressive encounter, or simply get picked up from soiled nest material or places that the animals might share, such as a garden bird table



Left *Squirrel pox virus under the electron microscope ©APHA Labs*

Chapter 3

Woodland homes

Left *Red squirrels spend up to 70% of their time in the trees*

RED SQUIRRELS ARE equally at home in broadleaved woodland as they are in pine and mixed coniferous forests, as long as the trees provide good seed crops. Populations are always associated with areas of mature woodland and benefit from a dense forest canopy. This is especially true where the forest contains different tree species, so it provides a variety of good food sources and shelter. A thick lower vegetation layer containing a wide mixture of shrubs and trees can also provide useful berries, flowers and seeds, whilst the presence of decaying wood helps provide fungi in the autumn months. Decay inside the trunks of trees can form cavities where red squirrels will build nests known as tree dens. The age, structure and composition of woodlands are therefore all important.

Not all tree species will produce seed each year, some like beech for example, may only seed heavily every four or five years. If a variety of trees are present in a woodland, this will ensure that in any particular year at least one species will be producing a good seed crop for squirrels to use.

Red squirrels are highly adapted for a life in the trees and a complex series of inter-connecting branches allows them to move through a landscape

Right *Managed forests can be important red squirrel habitats*

Right *Old broadleaved woodlands offer a network of branches that make it easy for squirrels to move through the trees*

with ease without the need to come to the ground. They may in fact spend up to 70% of their active time high in the tree tops. Studies carried out in the 1990s within the Thetford pine plantations showed that if foresters fell a large number of trees in an area so that the remaining trees have crowns that are isolated from each other, then red squirrels will not use that part of the forest. Good connectivity is clearly vital between adjacent trees and also between forest areas. As forest areas become more isolated from each other it becomes more difficult for red squirrels to move between them. Where each forest block is small, it may become impossible for red squirrels to permanently occupy the area and their presence will be temporary; perhaps limited to an occasional animal moving through on their way to find a better forest area to live in.

Left *Squirrels can make urban habitats a home*

Red squirrels are not just found in forests, they can survive in suburban landscapes if there are sufficient parks and wooded gardens connected with the wider landscape by hedgerows. They will forage for natural foods amongst the trees and will also take advantage of food placed out for the birds by householders.

Image of a grey squirrel

Chapter 4

Diet in the forest

Far left *Hazel catkins in the spring sunshine*

Left *Elm seed can be an important part of the spring diet*

RED SQUIRRELS EAT a wide range of natural foods found in the forest. They are quite opportunistic and will take advantage of different foods as they become seasonally abundant. So although tree seed is the mainstay of their diet, animals will consume the flowers, shoots and buds of a wide range of trees, a variety of fungi, tree bark, birds' eggs and insects in different quantities through the year.

In the spring, the flowers of oak, sycamore and other tree species are consumed along with fruit blossom. Where elm is present in a woodland, red squirrels will eat the seed which are produced in the spring rather than in the autumn. In coniferous woodland they will eat the prominent and protein rich flowers before these mature and begin to release their pollen.

Tree buds and shoots are a rich source of calcium and help bone growth and the production of milk when a female is nursing young. In the late winter and early spring these items can be eaten in some quantity by foraging animals, so their importance should not be overlooked.

In the summer months, squirrels consume conifer seed, some insects and the occasional bird's egg and tree bark. This is a time when broadleaved trees offer little in the way of food and so squirrels may become very active in gardens at feeders during this period.

In the autumn, red squirrels will eat a wide variety of seed from trees such as oak, beech, hornbeam, hazel, and walnut, as well as fruit including bramble, damson and apple. Research has shown that red squirrels eat fewer acorns than grey squirrels because these seeds have a high

Clockwise, *from the top left:*
Boletus fungi
Larch cones
Scots pine cone
Scots pine flowers

tannin content, a chemical which limits the amount of protein that can be obtained when they are digested. The grey squirrel has a digestive system which is much better adapted to breaking down the tannin and so they are able to get more goodness and nutrition from the seed when they eat it.

Both red and grey squirrels have strong jaws and sharp front incisor teeth that allow them to tear off the outer scales of pine cones so they can consume the seed nestled tightly underneath. With a little experience, squirrels quickly learn the skill to efficiently open hazel nut shells allowing them to access the sweet kernel or nut within. They nibble off a little of the pointed end of the shell which reveals a weak line in the shell, insert their incisors and twist the shell so it pops apart.

Red squirrels consume or store (cache) a wide range of fungal fruiting bodies (mushrooms) including the Penny Bun and the Jersey Cow mushroom. As fresh mushrooms contain a large amount of water, squirrels will often dry them before they are eaten. Animals chew through the stalks, carry mushrooms up into the tree tops and wedge them between branches so

Left (far) *Oak knopper gall wasp larva are often eaten by red squirrels*

Left (near) *Squirrels frequently consume bird seed*

that they are air dried. Once dried they are a much more nutritious meal. We have occasionally seen red squirrels storing the Fly agaric mushroom, which if eaten uncooked by people can induce vomiting.

In addition to mushrooms, red squirrels will eat fungal mycelium (strand like growth) of species such as Vuilleminia which grow under dead tree bark. If you look closely at dead sycamore branches you may notice the fungi growing beneath.

We know that red squirrels consume gall wasp larvae, caterpillars and aphids which they find amongst the tree foliage. They also encounter nesting birds and will sometimes consume either eggs or chicks. However, they are not specialist nest raiders and frequently ignore opportunities to predate nests. Occasionally animals are seen eating carrion e.g. dead woodmice, but such behaviour is rare. More frequently, they will gnaw on bone or antler as these are good sources of calcium. Bone fragments found on the ground are very often carried up into the tree tops and secreted away by wedging them between branches; the animal returning regularly to chew on the bone.

Whilst active in the trees, red squirrels may strip bark either to use as nest material, or in order to eat the sweet sap beneath. There is historical evidence that this can lead to serious damage as for example in the period 1880-1900 and in the 1960s when bark stripping was serious in some areas of Britain. However, such serious levels of damage is relatively infrequent and is much more often the result of grey squirrel activity.

Where they encounter garden bird feeders, red squirrels will readily feed on peanuts, sunflower seeds or fat balls. This is described in more detail within chapter 6.

Chapter 5

Storing food for winter

Above *Red squirrels hide a variety of foods in the ground to create a winter store*

SQUIRRELS LIKE TO hide a wide variety of foods. This behaviour is called caching and is characteristic of both red and grey squirrels. Why do they hide food? Well, squirrels are busy creatures and use a lot of energy each day as they forage through the forest. They can only eat so much before they get full and so, if they then find a nutritious food item, they may decide to hide it so they can come back and eat it later. They will chew through the stalk of mushrooms and then frequently carry them up into the tree tops to hide them in the branches so that the soft flesh dries out. Bone fragments are also hidden in this way too. In contrast, large sized tree seeds such as hazel nuts and acorns are typically buried in the ground and seldom hidden amongst branches or wedged in the fissures of tree bark.

Tree seed makes up a large proportion of the red squirrel diet and in deciduous forests it is most abundant in the autumn months. At this time, the squirrels will spend a large amount of time hiding fallen seed that they find whilst foraging through the leaf litter on the woodland floor. They will also take hazelnuts and peanuts from garden bird tables and hide

these too. If you watch carefully, you will see red squirrels sometimes start to bury a nut but then change their minds and decide on an alternative location, sometimes some distance away from the original position that they had selected. Scientific research has shown that the animals sometimes 'pretend' to bury a food item in order to 'bluff' any watching animal who may try and dig up and steal the item. Squirrels frequently bury nuts on the verge of a forest path, along the length of fallen logs or large branches, and sometimes even in car wheel trims and garden flower pots. They also quite randomly select other locations across the woodland floor and in gardens. They may bury items in the open and at some distance from the nearest tree.

Sometimes two or more animals may be seen busy burying food in the same area, carrying a nut in their mouths as they scamper to and fro. Each animal will make a small hole, perhaps an inch in depth, and then either pretend to bury a nut, or will carefully place the nut inside before covering the hole over again with a quick movement of both forepaws. Frequently, a squirrel will locate an item previously hidden, perhaps by another animal. They have a keen sense of smell. They dig up and eat the item, or carry it away to bury it elsewhere. All this dedicated activity creates a large volume of buried or hidden food, some of which will be eaten by squirrels, some consumed by other animals and some forgotten and undiscovered. A proportion of seed buried will germinate and some will survive to produce a sapling. In this way, red squirrels assist with forest regeneration.

Where red and grey squirrels are found together, grey squirrels will pilfer the seed store buried by red squirrels. This means that there is less available for the red squirrels and consequently they have a harder time surviving the winter months. Grey squirrels also gnaw out the seed embryo. This is the part of the seed that allows it to germinate. If the seed germinates then it will produce a shoot and tap root and begin to grow and use up the energy store in the seed. This makes the store unavailable to squirrels and so the animals want to prevent it happening. It is unclear how frequently grey squirrels do this in Great Britain, but in north Wales we have seen them do it with sweet chestnut seed several times.

Chapter 6

Feeding your red squirrels

IN REGIONS WHERE red squirrels are still found, many people with woodlands, or gardens next to woodland, will have a visit from a red squirrel out exploring their patch. Some squirrels will travel for more than 500 metres to access the food that is available in gardens. You may already be delighted to have squirrels regularly visiting and/or permanently resident on your properties. And, if a bird table or feeder is present, the animals will have quickly discovered these and will help themselves to some of the food. So typically they will have unilaterally decided that you are going to feed them!

Scientific studies have shown that even where *ad lib* amounts of peanuts are available, the squirrels themselves will ensure that they get a balanced diet by consuming natural foods too. We should therefore consider any food we offer to squirrels as additional to natural food rather than as a replacement. In areas where there are few cone bearing coniferous trees, like the Scots pine or larch, and largely broadleaved species only, the summer can be a time when natural food is scarce. This is because tree shoots and buds are no longer available and the autumn tree seeds and mushrooms are not ready. This short interval (June-August) is a time when the local squirrel population will greatly benefit from any supplemental feeding. It is also a period when many females have dependent young in nests and consequently have high energy and nutritional demands whilst they are producing milk.

Which foods benefit them

Squirrels will often take the peanuts and sunflower seeds from your garden bird table. However, it is best to offer a variety of different foods. Providing a few hazel nuts and walnuts will increase the value of the garden as a feeding site for the animals. Red squirrels will eat fruit and carrot and so providing slices of apple, pear or plums can make a satisfying treat.

It is also a good idea to provide a rich source of calcium, either near the squirrel food or elsewhere in the garden. Cuttlefish or antler (both sold by some pet shops) can be wired to a tree or fence post and are ideal sources of calcium. Calcium is important for both females nursing young and also to weaned youngsters as they are growing rapidly. It is also worth noting that peanuts contain a high phosphorous content. An animal that has a high phosphorous diet over a long period, can develop osteoporosis (brittle

Above *Biscuits are probably not the best thing to offer red squirrels visiting your garden*

bones) if they cannot find sources of calcium. This is because a phosphorous imbalance in the blood ratio of the two minerals leads to the body taking calcium from the skeleton which weakens the bone.

There are a couple of food types to avoid. Wheat, dried maize and peas are not particularly useful foods, whilst old and decayed Brazil nuts can cause poisoning and death, so to be on the safe side, it is best to avoid giving red squirrels any Brazil nuts.

Red squirrels will consume bread, biscuits and fat balls put out for the birds. Many years ago, a couple with a caravan in woodland near Southport kept a diary of the items eaten by red squirrels visiting their bird table. They noted that the animals would consume custard cream biscuits in preference to bourbon or ginger snaps. The animals would eat midget gems™ although they never consumed the black liquorice sweets.

Slices of bacon rind, garlic sausage and suet were all eaten too. So a fairly cosmopolitan, if perhaps not an ideal, range of foods were used. However, our advice is to use sunflower seed and occasionally hazel nuts and peanuts in the mix. Thin slices of red apple and carrot are also good foods to offer from time to time.

How to feed them

Red squirrels will feed confidently from a bird table or whilst acrobatically hanging upside down on a wire mesh bird feeder. However, we would recommend that they are fed using a wooden feeder with a lid that the animals must lift to access the food inside. The lift-lid feeders restrict access to the food by other animals and birds.

There are a wide variety of squirrel feeder boxes available using this design and they can be purchased for £10-20 pounds. Those with practical skills might like to build a red squirrel feeder, alternatively a local red squirrel conservation group may be able to provide a wooden feeder. A step by step guide to the construction of a feeding box is available at the end of this booklet.

All bird feeders, bird tables and squirrel feeders should be regularly and thoroughly cleaned with either soapy water or, preferably, with an anti-viral wash such as Virkon™. This is to reduce the chances of infections spreading between animals that visit the feeder and also to keep the food clean.

Wash your hands

Red squirrels can pick up a nasty bacterial infection (*Staphylococcus aureus*) from food at bird tables. These bacteria are common on our hands and it has been suggested that when we touch peanuts and other foods whilst placing them out for the animals, bacteria are transferred onto the surface of the food. The infection is rare, but can cause terrible blisters around the mouth and on the forepaws of the squirrels. In some cases it can lead to death.

Domestic Cats – please take care if they are around

Domestic cats can kill red squirrels by ambushing them. Cats are very effective at creeping up on their prey and catching it unaware.

Consequently, attracting red squirrels to feeders can increase the risk of their predation by cats. It is therefore prudent to make sure that food isn't scattered widely on the ground, and that squirrels are fed on platforms or bird tables that are placed as high as possible and in a location that does not require the red squirrels to cross lawns or open ground to reach them e.g. on a fence or fixed to a tree trunk. Another good reason to use an appropriately placed feeder box.

What to do if a grey squirrel visits the garden

If greys are known to be in the area, you should also cease feeding the red squirrels and minimise the amount of foods put out for birds. Grey squirrels carry the squirrel pox virus which can be transmitted to red squirrels and cause very high mortality rates and epidemic disease. They also carry adenovirus, reovirus, Sendai virus and Lymphocytic Chorio-Meningitis Virus (LCMV) which may also be a risk to red squirrels.

Local red squirrel conservation groups (see list at the end of the book) actively trap and kill grey squirrels and they can help remove any animals that you have seen. Once the grey squirrels are removed from the area then you can restart feeding the red squirrels.

Water butts

In hot weather, red squirrels may try and drink from water butts or livestock field troughs. Sometimes an animal may fall in and it is often impossible for them to climb back out because of the slippery sides. Always cover garden water butts with a lid or mesh to prevent animals falling in. Where possible place a wire mash ramp at one end of each water trough, so that any animal that falls in has a way to clamber out to safety.

Things to observe at garden feeders

You can learn a lot about the behaviour and ecology of red squirrels by watching them in the garden.

1. If your garden is within the regular range of a red squirrel then it may often take seed from a bird table and bury it. However, when an animal that does not live locally ventures through an area and visits a bird table, then it will seldom cache any food.

2. Keep a careful eye on animals as they sit feeding. Heavily pregnant or lactating female red squirrels will have very visible teats (they have four pairs) and as young increase the amount of time they suckle, the hair around the teats will become very sparse with the appearance of circle shaped patches.

3. In the spring the animals will start their moult. The coat is shed around the shoulders first and in some animals the hair loss may be quite pronounced before the new coat grows in.

4. Watch through the seasons as the pattern of food caching changes with the most intense period in the autumn and early winter months.

5. If there is an abundance of natural food, particularly oak, beech or hazel seed in the autumn, then the red squirrels may become quite scarce at feeders. People often worry that 'something must have happened to the squirrels' because they are not visiting regularly at these times. Don't worry, they will return in a few months when natural food becomes scarce again.

6. There is an established hierarchy between the squirrels. You will notice that some animals move away from a feeder when another approaches and in contrast, once a particular animal is active at a feeder then others will wait until it has left before approaching to feed.

Chapter 7

Nests and nest sites

Far left *Squirrels will opportunistically use plastic bags and sheets in their nests (image is of a grey squirrel)*

Left *Chewed strands of hemp rope can provide warm nest material*

IT WILL COME as no surprise to learn that, with a life spent high in the tree tops, red squirrels build their nests in the forest canopy. The classic nest, with which most people are familiar, is the drey - sometimes called a leaf drey.

The drey is typically constructed within the sheltered branches of a tree, often against the trunk so that it sits upon a large branch or group of branches. Squirrels chew off twigs and small dead branches from the tree and carry these to their nest construction site. Here, with amazing dexterity, they are woven together to form an oval structure which is a little larger than a rugby ball. With more and more twigs added to create a firm structure, the lattice work has a roof of moss, leaves and sometimes dead tree bark added. Within the woven structure is a small chamber which is lined again with moss, grass and other soft and insulating materials. This is where the red squirrels will sleep and where the young are born and reared.

It may take an animal a day to build the main body of the nest and then several days adding material to complete the drey. These nests must be strong enough to survive the fiercest of storms and heavy rain, low winter temperatures and the general ravages of the weather. Each squirrel will

Above *Looking inside a wooden nest box. The squirrels have made their nest deep inside the hay*

Right *A typical squirrel drey made from leaves and twigs*

have three or more nests, some of which may be shared with other animals. This time-share option sometimes extends to two or more animals sleeping in a nest together, a behaviour which may help animals keep warm in the winter months.

Dreys are quite conspicuous evidence of red squirrel presence in a woodland. However, they can be quite difficult to find if built in the dense needle foliage of conifer trees or amongst ivy clad boughs. From the ground they can also be easily confused with the nests of crows, pigeons and other large birds. Even more complicating is the fact that red squirrels may use such bird nests as the base upon which to fashion a drey.

Above *On warm spring or summer days, squirrels will often doze on a branch (image is of a grey squirrel)*

Nevertheless, drey counts can give a guide as to the size of the local red squirrel populations. Unfortunately, grey squirrels build slightly larger but otherwise similar nests, and consequently it is difficult to tell these apart from red squirrel nests. Grey squirrels do have a greater tendency to use live branches and those with green leaves and the presence of such material in a structure can help guide the observer.

In addition to the drey, squirrels will construct more temporary resting places from twigs. These take the form of a light platform upon which a squirrel may doze in the warmth of a summer afternoon. Often a breeding female will spend sometime away from her young when they approach the age at which they will wean. At this time, she may rest up on a platform or on a large branch to avoid the continued pestering of already well fed offspring in a nest elsewhere.

Both red and grey squirrels will use tree dens as a nest site. A tree den is a cavity or chamber formed within a hollow tree trunk or large branch. They tend to be found in old oak, beech, sycamore and ash trees because the hollow wood is formed by fungal decay which takes a long time to eat away the timber. Squirrels will enter through an existing hole on the

Above *Squirrels will sometime make their home inside attics or abandoned chimneys (image is of grey squirrels)*

outside of the tree in order to access a large hollow inside, or will chew at a hole that is too small in order to enlarge it. They will bring in bundles of grass or leaves to create a nest. When doing this, the squirrels will often take great care in shaping the bundle they have in their mouths so that they can retain good balance as they take the material up into the trees. Tree dens are much more difficult to locate than the average drey.

Finally, red squirrels will use nest boxes. In the 1980s it was reported that they occasionally used goldeneye duck and tawny owl nest boxes, and since then squirrels have been reported to use a wide range of boxes. If the box is large enough to fit a football inside then it will be attractive to red squirrels. An entrance hole of 8-10cm is big enough for even the largest red squirrel to enter. More typically holes are 5-7cm in diameter. Where grey squirrels or pine martens are present, a 48mm diameter nest box hole will exclude adults. It is advisable to fix a metal plate also with a 48mm hole cut in it, so the metal surrounds the entrance hole and prevents animals chewing and enlarge the hole.

It is advisable to loosely pack the inside of the box with hay or straw so as to provide a nice snug structure within which the squirrel can nest. It

is also a good idea to have the entrance hole in the top corner on one side of the box rather than on the front of the box (like bird boxes). If the hole is on the side then the squirrel can easily enter from the tree trunk. Note - red squirrels do not like to be seen entering a nest, so the more discreetly they can get inside then the more attractive the box will be.

If you do decide to put up a nest box for a red squirrel, be advised that should they use it, then legally you must not disturb the box when it is occupied. The box should be securely fixed to the trunk of a large tree that has a canopy that is overlapping the branches of neighbouring trees so that animals can move to and fro without having to come to the ground. If the box is placed in an isolated tree then it may not be used. Site the box six or seven metres up. If it is fixed any lower than five metres, then again, the probability of the box being used will be reduced. If possible, position the box so that the entrance hole is sheltered from the prevailing wind.

A step by step guide to the construction of a nest box is available at the end of this booklet.

Chapter 8

Numbers and population change

Left *Large amounts of tree seed in the autumn leads to good overwinter survival and large squirrel populations the following year*

HOW MANY SQUIRRELS are there in the forest? The answer to this common question really depends on the age and the mixture of different types of trees that are present in the woodland.

As a broad rule of thumb there might be one adult red squirrel for every 150x100m area of mature deciduous or coniferous woodland where pine or larch are present. Within Sitka spruce dominated habitats, there might be one red squirrel for every 300x100m or even 500x100m of forest area because the amount of available food is much lower than in other woodlands. In birch and willow dominated scrub, red squirrels will also be quite rare as these trees produce a very tiny seed which is too small for red squirrels to consume.

Where red squirrels are absent and only grey squirrels are found, we often see a similar pattern of squirrel numbers. In general, Sitka spruce forest will contain low numbers of animals compared with pine dominated forests, and at the same rates we find for red squirrels. However, in broadleaved woodland, grey squirrels are found in numbers much higher than red squirrels would ever be. We might find four or five adult grey squirrels per 100x100m area. In part, this reflects the ability of grey squirrels to extract more of the goodness and nutritional value from seeds like acorns that contain large amounts of a compound called tannin. Tannin makes

Right *Red squirrels are designed for a life in the tree tops and spend up to 70% of their time amongst the branches*

acorns taste bitter, and these chemicals make it hard for animals to digest the seed when they have eaten it. Grey squirrels are better adapted to deal with tannin than red squirrels. Consequently, where oak is present, the amount of seed available in the autumn has a beneficial effect on grey squirrel winter survival and rates of breeding in the following spring. Large amounts of acorns available mean good grey squirrel survival and high breeding spring rates, whilst low abundance of acorn means lower survival and less breeding. Red squirrel numbers are less influenced by the availability of acorns and instead they change in response to hazel nut crops.

Red squirrels spend 70% of their foraging time active in the tree tops, whilst grey squirrels only spend 30% of their time active in the trees. Even where large amounts of food is available at garden bird tables, red squirrels still spend 50% of their time in the trees. Red squirrels do not like woodland where the canopies of trees are spaced apart so that the animals must come to the ground repeatedly to get from one tree to another. Where forest cover is broken up and fragmented like this, red squirrels will seldom be found. In contrast, grey squirrels seem to be quite happy in these areas.

Both red and grey squirrel numbers change in response to the amount

of seed produced each year by trees, and they are also affected by weather conditions. Very cold and wet winters coupled with little available tree seed results in populations declining quite severely to a low in the following spring. As squirrels breed and their young wean in the summer and early autumn, their populations increase steadily. In fact the highest numbers of squirrels are found in the autumn months. This is the time when young squirrels disperse from the woodland area where they were born and they may travel several miles in search of a new home.

Chapter 9

The squirrel year

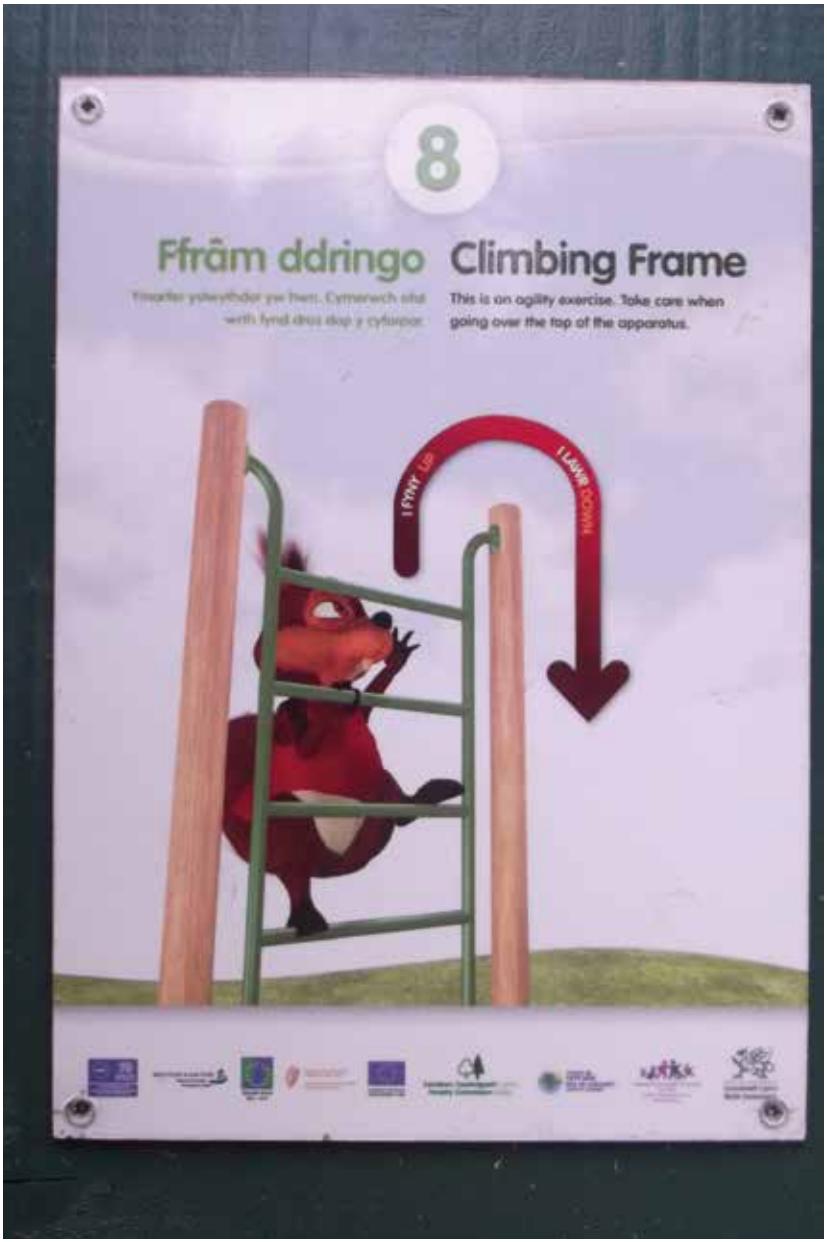
***Left** Foraging amongst oak boughs*

RED SQUIRRELS DO not hibernate or 'go to sleep for the winter'. In fact, even in the depths of the harshest winter these little creatures will be active, though they may choose to stay in the warmth of their nest for a day or so. In the winter months, red squirrels are usually active just after dawn through to midday. During that time they will forage for buried (cached) food stores, consume seed from the cones adorning coniferous trees and they may repair any damage to their dreys.

As spring approaches, squirrels are increasingly active throughout the day until an hour or so before dark. This is the time when the first young are born and therefore many breeding females will spend a lot of time looking after their young. Males range widely as they are busy monitoring females for any sign that an animal is ready to mate. In particularly cold or wet spring weather, activity may be reduced as animals take shelter. During warm and sunny days, the squirrels will be incredibly active and busy, it is at this time that you may notice almost constant visits to bird tables and garden feeders.

The summer brings long days and often very warm weather. Red squirrels are out in the first light of day and will remain active all morning. During the heat of midday they will rest up on branches or light twig platforms that they have constructed, activity will cease and you will be lucky to see

Right *Both red and grey squirrels are active throughout the year and do not hibernate*



any animals foraging. The mid-afternoon soon sees a second phase of activity through until the early evening. This means if you want to go and watch red squirrels at this time of year, look for them early in the morning or late in the afternoon to avoid disappointment.

Autumn brings the most intense period of activity as animals prepare for the approaching winter months. Red squirrels will be active all day but may suddenly ‘disappear’ from gardens. The reason for this is the wide availability of tree seed. Squirrels need to fatten up and store food in this season and tree seed is favoured over peanuts and sunflower seed. Don’t worry, the animals will return to gardens in the early winter months.

Chapter 10

The social lives of red squirrels

RED SQUIRRELS LIVE in a world full of scent and smells that signal the presence of the different animals that live locally. They have cheek and anal glands which are rubbed on branches to leave scent across the woodland environment. In addition to a highly developed sense of smell, these little animals also have keen hearing and good eyesight.

With eyes on the side of their heads they have a much wider field of view than predators, and they also have everything in perfect focus. If you watch red squirrels in the tree canopy they will often stop and flick their tails and/or stamp their feet at the sign of danger or a perceived threat, including when we approach them. They are very sensitive to movement, but if you stand still they often come within five or six metres of you without noticing your presence. They also have a range of vocal alarms which will alert other squirrels to be aware and on guard. So they live in an environment within which sight, smell and sound are used by individuals to communicate to others.

Red squirrels live quite solitary lives. A male and female don't form a pair. This is a species where the male plays no part in the rearing of young. The local population will have an established hierarchy with the more dominant animals getting preferential access to the best feeding areas in the forest. A red squirrel will remain in a pretty fixed area (known as a home range) of forest within which they will be familiar with the location of different sources of food and across which they'll have a number of dreys. They are not territorial and do not defend an area from other squirrels. Different parts of the range area will be shared with other squirrels and a mature adult male may have a range that completely encompasses the ranges of several females. When a female has dependent young she will become very aggressive towards other squirrels in the immediate vicinity of the nest containing the kittens. For several months, this small part of the forest will not be shared with any other squirrel until the young are weaned.

When feeding at a bird table or wooden squirrel feeder the social status of animals can be discerned if you watch carefully - especially if individual animals have different coat colours. The most dominant animals will command the location and displace other animals which are feeding. Some animals will be reluctant to visit the feeder until all the other visiting squirrels have had their fill and have left. The smaller and younger animals are at the bottom of the social hierarchy, the larger and older animals at the top.

Above *Red squirrels will occasionally use a range of different nest boxes*

Image of a grey squirrel

Chapter 11

The mating chase

ADULT RED SQUIRRELS do not live together in male and female pairs, instead the breeding biology is 'promiscuous'. This means that a female can choose to mate with any local male in any particular year. Even though there is usually a pretty even mix of the two sexes in any forest, only a small proportion of the mature males will breed. If an adult female is able to attain a good body weight and favourable condition, she will then become fertile and enter what is known as oestrus - which means she will be ready to mate.

As we described earlier, each female home range will be overlapped by male squirrels, and each of them will be aware of her approaching oestrus by the scent marking that she does and which they encounter. The female comes into oestrus on a specific day, typically in the period January to March and then, if she has a second litter, she will also come into oestrus in May to July. The majority of adult male squirrels will be in breeding condition from January through to October, but in the late autumn and early winter months they do not breed.

Squirrel 'courtship' is a rather chaotic process and at times a noisy affair as several males compete to get close to the oestrus female as she moves through the forest canopy. She may stop on a branch or tree bough and gently flick her tail as the most dominant male tentatively approaches. She will then frequently move through the trees only to stop again. As she does this, all the various males are rushing around to try and get near her whilst at the same time trying to avoid the most dominant animals. We have seen four or five males following an oestrus female and whilst more dominant animals are chasing each other through the tree tops or spiralling around a tree trunk, lower ranking males will quickly try and approach the female only to have their path blocked by the return of a dominant animal. The spectacle is quite frantic at times. Ultimately the female will allow a male to mate with her, and in fact genetic studies have shown that a litter can contain kittens with different fathers, clear evidence that multiple mating occurs with different males.

Right *Several male grey squirrels compete to mate with a female grey squirrel*

Right *Mating grey squirrels*

Chapter 12

Raising a family

Left *When lactating and suckling young, a female will have very visible teats*

PREGNANCY LASTS FOR around 38 days, and in any particular year there are typically two main periods of birth. The first is February to April (known as spring born litters) and the second June-August (known as summer born litters). The young (called kittens) are born in the warmth and security afforded by a drey or a tree den. The nest within which they are born will have been carefully selected and provisioned with a thick interior layer of leaves, moss and soft grass.

Red squirrel young are born blind, deaf and naked. Usually there will be two to five babies in a litter but sometimes only a single baby will be born, and occasionally there will be up to six. For the first few weeks the mother nurses the young for the majority of the day and all through the night. If the nest is damaged, becomes waterlogged, or is disturbed by a potential predator, then the mother will move the litter to an alternative nest site. She will carefully, but firmly, pick one of them up in her mouth, holding the youngster by the chest and gently turning them so they are facing her. The juveniles instinctively grasp around her as she gracefully carries each one through the trees tops to the new nest. In this way she will systematically move the entire litter. There are cases where an entire litter has been moved between nests three times.

Right *Young red squirrels wean from the age of eight weeks and whilst they are still quite small*

Whilst the young are dependent on the mother, she will challenge any other red squirrel which approaches the nest they are within. This aggression is not without good cause as red squirrels have been known to kill and partially consume small young.

Whilst in the nest, young squirrels will pick up fleas and some viral infections from their mother. Occasionally a youngster will die in the nest before the litter weans. If this happens the body is generally not removed from the nest, but remains inside. It will eventually become covered with leaves and other bedding material, including material chewed by siblings, and eventually the body will decay in the bottom of the nest. The bodies are small and so decay quickly leaving only bone and dried skin.

As the young develop, their eyes open, they begin to hear well and they grow a coat of fur. At first the fur is no more than a fuzzy, light covering like velvet. By the age of six weeks it is developing into the characteristic coat with longer hairs. The tail however still has quite short hair so it looks more like a pipe cleaner than the bushy bottle brush appearance seen in adults. At this age, the youngsters are quite active inside the nest and may begin to make their first exploration outside. They are quite ungainly and slightly wobbly, however their long sharp claws give them an ability to grip on tight when venturing outside.

Growing fast, they have a thirst for greater and greater quantities of milk and once they have consumed all their mother can provide, she will leave the drey during the day. The periods of her absence steadily increase as first she forages more in order to obtain the energy required to produce increasing volumes of milk her young require, and then as the weeks progress, she feeds them less as they begin to wean. The juveniles will progressively become more and more active out of the nest and in the canopy of the tree in which it is located. In their ninth and tenth week they will be frequently venturing to the forest floor and also exploring more widely through the tree tops. It is now that they cease being fed by their mother and they begin to hone the skills and knowledge required to survive on their own. They need to develop the grace and dexterity required to forage amongst the lightest of branches and to leap between adjacent tree tops. They must now grow fast to put on the size and weight needed to withstand periods of bad weather. And of course, they face danger from the numerous predators that may be watching in the air and from the ground.

Left *Breeding females will regularly visit garden feeders to eat peanuts or sunflower seed. It is useful to provide a good source of calcium such as boiled bone, antler or cuttlefish*

Image of a wild ferret

Chapter 13

Predators

Above *Squirrels will use hedges and roof tops to move around in suburban habitats in order to avoid domestic cats*

RED SQUIRRELS ARE fast, alert and agile. They are however still vulnerable to being caught and killed by a variety of predatory animals. In the tree tops they fall victim to goshawks, a large bird of prey that can fly fast and manoeuvre with great skill through the branches. These birds rely on catching their prey by surprise. They have keen eyesight and their brown and mottled plumage allows them to blend in as they sit and watch for potential prey.

Buzzards may also catch red squirrels when they are active on the ground. This bird of prey will sit for long periods commanding a good view of a woodland glade or gap in the forest. Just like the goshawk, it has adopted a strategy of waiting to catch an animal unawares and off guard. Scientific studies have shown that although red squirrels feature in the diet of both of these birds, they catch them relatively infrequently and certainly not in enough numbers to make a meaningful impact upon their overall population.

Right *The pine marten is highly adapted to catching squirrels*

A range of carnivorous mammals also eat red squirrels. Red fox, stoats, pine martens and both feral and domestic cats have all been known to catch squirrels, but are unlikely to have a significant impact on the population. In suburban habitats domestic cats are both numerous and highly adapted to preying on squirrels. They will stalk an unsuspecting animal, slowly creeping up on it before pouncing with claws outstretched.

Although it is likely that domestic cats are the main predator in suburban gardens, it is unlikely that that they will have a significant impact on populations. Fitting a collar with a bell to 'Felix' would make it more difficult for the cat to catch a squirrel. In addition, try and feed red squirrels so they can reach a wooden feeder or bird table without having to venture down from the trees and across open ground to reach it.

The pine marten is as much at home hunting in the tree tops as it is hunting on the ground. They do predate red squirrels although they have a very diverse diet and typically red squirrels make up a small percentage of their diet. This predator is currently absent across much of England and Wales, although is increasingly widespread in Scotland. Whether it may heavily impact small red squirrel populations living in very fragmented and isolated habitats is yet to be determined. In extensive forest habitats which support large red squirrel populations, the pine marten is unlikely to greatly depress squirrel numbers.

Which animals are most likely to be caught?

Predators tend to catch sickly or young red squirrels more than healthy adults. When red squirrel kittens wean they are particularly vulnerable as they have neither adapted the sharp reflexes or the rapid speed that older animals possess. Unsurprisingly they are most at risk during this phase of their lives. However, they will show a range of alarm calls and tail flagging behaviour to warn other squirrels of the presence of a threat. Sometimes, they will get agitated at the most obscure things, for example a discarded child's football they have spotted in the undergrowth.

Chapter 14

Diseases and causes of mortality

Left *Many animals, including rats, will visit red squirrel feeders or bird tables. Therefore it is important that surfaces are regularly cleaned*

ONE OF THE most frequently questions asked is 'how long would a red squirrel live for in the wild?' Around 20-40% of juveniles might survive the winter months and be alive in the spring of the following year. Once they have matured and reached adulthood their chances of survival improve to 50-60% in a year when seed and other foods are plentiful. However, poor food supplies and harsh winter weather can result in much lower survival rates. Populations fluctuate in size as a result, and competition for space and resources changes seasonally and across the years. The upshot of this is that very few animals reach the age of five or six in the wild.

Earlier we mentioned the range of potential predators that prey on red squirrels and highlighted the fact that generally their activity does not affect red squirrel numbers. The majority of red squirrels die from other causes of death. Exposure, malnutrition and starvation will claim far more lives. In addition there are a range of infections and diseases that affect red squirrels. Some of these diseases are brought on by the animal becoming weak from lack of food, whilst others may lead to the death of otherwise healthy squirrels.

Squirrels can develop cancerous tumours which eventually kill them because the growth interferes with blood supply or vital function of tissue. Red squirrels carry a range of intestinal infections including small protozoans (a one-celled organism) known as coccidia which can

Above *Road signs are useful to warn drivers about the presence of red squirrels*

Centre *It is important to notify your local red squirrel group if you see a sick squirrel*

Right *Unfortunately red squirrels are regularly killed on the roads*

contribute to mortality by damaging the gut wall and so interfering with the digestion of food.

We now know that whilst adenovirus can be carried by red squirrels without causing them any obvious harm, sometimes this infection causes lesions in the intestines and has been known to rapidly kill animals. This type of virus may also be carried by grey squirrels, however, whether it is spread between squirrel species is unclear. It is suspected that stress in red squirrels may trigger the onset of disease but again, there is much more to be learned about this.

It has recently been discovered that a small number of red squirrels in England and Scotland are infected with the bacteria which cause leprosy. It remains unclear how they pick up and spread the infection, and despite the presence of the disease, populations have not declined.

In areas where grey squirrels are absent, red squirrels have never had the squirrelpox virus. This deadly infection only occurs in red squirrels when an infected grey squirrel is present. Once the infection is picked up by red squirrels they die within three or four weeks. During the last weeks of their life, they will have significant open skin lesions around the face, inside the mouth, on the paws and elsewhere on their bodies. They become highly infectious to other red squirrels and hence the disease can rapidly form an epidemic. In some outbreaks 80-90% of the adult red squirrel

population may be lost. It is therefore vitally important that grey squirrels are not allowed to occupy woodlands containing the native red squirrel.

The remains of the majority of red squirrels that die in any year will not be found. Many animals will die in nests or in parts of the forest where people are unlikely to find the corpse. A proportion of bodies will be scavenged and eaten by other animals. As a result we must be careful when trying to gauge the impact of road traffic upon populations. A dead red squirrel lying on a main road is much more likely to be seen and reported than an animal concealed in undergrowth.

Many red squirrels fall victim to road traffic, and mortality often peaks in the autumn and winter months when squirrels are more active on the ground hiding and retrieving buried foods. In some places conservationists have erected rope bridges to try and limit the number of red squirrels killed by cars. Road signs alerting motorists to the presence of red squirrels are also helpful at reducing collisions and squirrel deaths.

What to do if you find a dead squirrel

Red squirrel bodies are used for a variety of scientific research projects. These include assessing population genetic diversity and age structure and of course investigating the causes of death in an area.

- If you find a red squirrel body please contact your local red squirrel group (see useful addresses section at the back of the booklet).
- If possible, pick up the body using a plastic bag. Only collect red squirrel carcasses from roads if it is safe to do so. Do not place yourself in any danger.
- Make a note of the date, location and any other information and contact the local red squirrel group to arrange collection of the body.

Image of a grey squirrel

Chapter 15

Bark stripping behaviour

Left *Grey squirrels frequently strip the outer bark of trees to access the sap beneath*

SQUIRRELS WILL OFTEN pull off dead bark from branches in order to eat nutritious fungi that sometimes grows beneath. This behaviour is particularly common on sycamore and oak trees. It doesn't affect the tree because the branches are already dead. However, there is another habit which can cause significant damage to trees; this is when the squirrels chew through live outer bark and peel off strips in order to eat the sweet sap beneath. Red squirrels have very sharp incisor teeth and quite powerful jaw muscles and so they can gnaw through thin bark quite easily.

On Anglesey there is some evidence that hornbeam can be damaged by red squirrels. More notably, in the period 1890-1920, red squirrels were culled in the Highlands in order to protect timber crops. However, although damage can occur, it is relatively infrequent and at a much lower scale than that of the introduced grey squirrel.

Little is known about why some red squirrels might decide to strip tree bark. In the grey squirrel, such a behaviour may be learned. It has been suggested that aggressive interactions between grey squirrels can cause individuals to chew at bark in frustration and this is how they discover

Right *On Anglesey there is evidence that red squirrels have damaged a small number of hornbeam trees by stripping the bark*

that there is a sweet sap beneath. Why do grey squirrels strip bark more frequently than red squirrels? They live at higher densities so this may help to explain, but also the larger grey squirrel is a much more powerful animal with a stronger jaw muscle and this may allow it to tear apart bark on tree species where the bark is relatively tough.

Chapter 16

Interactions with songbirds

Left *The chewed remains of young great tits found in a nest box used by red squirrels*

RED SQUIRRELS WILL eat the eggs of a variety of small woodland songbirds. They are a rich source of both calcium and protein. This is an occasional habit, and we cannot consider red squirrels as being a specialist or expert nest raider.

They will come across many nests as they are venturing around in the trees, and will generally completely ignore the eggs or chicks they see inside. In part, this is perhaps because they will be put off by the defensive adult birds scolding and chastising them. We have observed red squirrels constructing nests inside nest boxes that were occupied by nesting great tits and where the squirrels have not eaten the abandoned clutches of eggs.

Red squirrels live at much lower numbers than grey squirrels do in broadleaved woodlands. As grey squirrels also eat birds' eggs, their higher numbers mean that potentially they will have a greater impact on songbirds than native red squirrels. There are some studies that indicate egg predation is having an effect on certain species including jay and blackbird which construct a cup shaped nest. Eggs in these nests are more easily accessible to squirrels than they would be if the nest were concealed away in a hollow branch or tree. Scientific research into this

Right *Birds nesting in a cup shaped nest maybe more vulnerable to predation by red squirrels than those nesting in holes*

is quite limited and there is a need for further study if we are to fully understand the extent to which, if any, red or grey squirrels have an impact on nesting attempts made by specific types of songbirds.

Red squirrels also often interact with songbirds at garden bird tables and at squirrel feeders. The squirrel will often ignore birds, although they are invariably wary of the squirrel. A bold nuthatch may feed on a bird table alongside a squirrel, or dash in to a squirrel feeder in the hope of picking up spilt food from the moment a squirrel leaves. Blue tits, great tits and robins may also briefly fly in to grab a morsel, but in the main they will also wait until the squirrel has left before alighting at a feeder to feed at length. In this way, the presence of the squirrel prevents birds from feeding. If squirrels were at a bird feeder all day long then this would clearly be detrimental, but squirrels will stay for seldom longer than half an hour and so there is still plenty of time for birds to feed - if the squirrel has left them anything to eat!

Whilst at a feeder, red squirrels will often be aggressive towards larger birds such as doves, pigeons, crows, magpies and pheasants. Dashing towards them to make them move away. It can be quite entertaining to watch the to and fro that goes on as a squirrel chases a bird away only for it to fly back in a minute or so later and the process repeats.

Given the fact that so many different animals may congregate at a feeder, and all the creatures can potentially carry a variety of different infections and diseases, it makes sense to regularly clean bird tables, nut hangers and squirrel feeders to prevent the risk of disease spread.

Chapter 17

Gardening for red squirrels - how you can help shape habitat

Above *Both red and grey squirrels will use wooded gardens*

RED SQUIRRELS WILL happily pilfer a little of your soft fruit crop. They like to eat plums, apple, pears, peaches, raspberries and strawberries. They also occasionally consume fruit blossom and at times may dig up the odd garden bulb to nibble on. As we have described earlier, this is an animal that will eat a wide variety of items and there are ways in which you can help it by establishing shrubs and trees that it likes. Here are some tips:

Small to medium sized garden

- Dog rose produces flowers and hips that are readily eaten by red squirrels.

- If you are replacing or establishing a hedge consider using a hazel and hawthorn mix. This can produce a nice dense hedge which is easily shaped and pruned. If you let it grow a little wilder then it will produce nuts and fruit which are perfect for red squirrels and other wildlife.

- Modern apple, pear and plum cultivars are often grafted onto a root stock which means the tree will not grow more than three or four metres in height. The light foliage doesn't produce a heavy shade

and of course the fruit can be enjoyed by you and some of your local wildlife.

- Red squirrels will occasionally eat crocus bulbs and these pretty flowers brighten up the winter garden.

Larger gardens

If you have space to establish a tree or group of trees then there is a wide variety of species that will benefit red squirrels:

- Hazel, damson and mountain pine will produce a four to five metre shrub when fully mature. Hazel nuts are a fabulous food for red squirrels whilst mountain pine produces large volumes of cones which contain highly prized seed.

- Where a garden can accommodate much larger trees then Scots pine and European larch are ideal candidates. They will produce seed within a decade if they are planted in good soil and in a sunlit area.

- Walnut, beech, sessile oak, small leaved lime and sweet chestnut produce seed that is eaten by red squirrels.

***Right** Red squirrels will feed at bird tables*

Chapter 18

Tracks and signs

Left *Split hazel nut shells are a good sign of squirrel activity*

THE PRESENCE OF red squirrels in woodland can be revealed by their dreys. There are also tell tale signs in the food material that they discard on the ground or drop from branches above whilst feeding. Conspicuous bitten off green shoots, tree flowers and the remains of chewed pine cones and split nuts are all signatures of the presence of the red squirrel.

When feeding on fallen pine cones, squirrels will often collect a cone and then carry it to a nearby stump or log that has become a favourite dining table. These locations can quickly become surrounded by piles of chewed cones and the outer scales that the animals have removed in order to access the seed held beneath. Mice and voles will also consume conifer seed in cones. There is a difference in the appearance of squirrel and vole/mice eaten cones. Squirrels have the strength to bite and then pull off the cone scales leaving scraggly edges to the remaining cone core, whereas mice and voles have to gnaw all the way through these scales leaving a much neater chewed cone.

Right *Bone provides a good source of calcium*

Far right *Stripped pine cones on the forest floor*

Right *Winter signs of a squirrel feeding on pine cones*

Far right *A discarded hazel nut shell*

Far left *An open pine cone and stripped cones*

Left *Sitka spruce cone eaten by a squirrel whilst on a tree stump*

Squirrels quickly learn to split hazel nuts in half by chewing off part of the small pointed end and using their teeth to twist the shell here so that it splits in two. In the autumn, mushrooms chewed away at their stalk and then positioned securely amongst branches is another good sign of squirrels. It is not possible to distinguish food remains left by red compared with grey squirrels.

If you look very closely at the bark of beech, sycamore and ash trees you may notice many groups of long parallel scratched lines that betray the passage of a red squirrel moving down the tree using the double jointed ankles of their rear paws.

Around bird tables and beneath trees that have cast seed onto the forest floor you may also see a series of random small holes about an inch in diameter and an inch deep. These are the signs of animals digging up buried food cached by them or other squirrels. At times the ground may look peppered by these small marks.

Chapter 19

Moulting

WHETHER A RED squirrel has a dark brown, black, chestnut or a ginger coloured coat, it will moult it twice a year. There is a noticeable difference in the light summer coat and the denser winter pelt with which the red squirrel has its resplendent 3cm long ear tufts and luxurious tail hair.

Spring moult takes between five and seven weeks to complete. It often starts at the front of the animal, on the shoulders and legs and progresses backwards to the saddle and hind quarters. The new coat looks quite dull and coarse whilst the tail is a sparser affair especially in mature males. If you see any individuals with a bottle brush like tail in the summer it will almost always prove to be an adult male. Historically, in many British red squirrel populations the tail hair would fade and turn to a golden yellow in the summer but due to the importation of animals from other parts of Europe in the last few centuries, this characteristic is often absent.

Monica Shorten described the autumn moult in her 1954 publication 'Squirrels' as taking 'place in the reverse direction; the posterior half of the back changes first, the winter hair spreads to the upper surfaces of the thighs and then to the forepart of the back, over the flanks and forelimbs and lastly to the belly.'

Very often people spot animals that are in the midst of a moult and, seeing patchy fur and sometimes bare skin, they voice a concern that the animals have a disease; perhaps mange or a serious skin infection. Although squirrels can have hair loss caused by lice, invariably the symptoms are simply moult. Providing the animal is feeding well and moving normally, then there is nothing to worry about.

Chapter 20

How to tell a red from a grey squirrel

Left *Red squirrels range in colour from black, grey and through a variety of shades of red and orange*

MANY PEOPLE CAN be confused by the fact that red squirrels quite often have grey coloured fur on the flanks and head, whilst the grey squirrel frequently has red fur on the head and flanks. This is particularly true in the autumn and winter months when both species sport their thick winter coats. Distinguishing between the two animals should not rely simply on the animal's colouration.

Red squirrels typically have very long (20-40mm) and quite pronounced ear tufts, especially in the winter months, whereas grey squirrels seldom have any tufts and if they do then the hair is only a few millimetres in length. Adult red squirrels are of course much smaller than their grey cousins (Table 1), but remember that a young grey squirrel will be a smaller or similar size to an adult red squirrel.

Grey squirrels have tail hair that is fringed with a white or silver edge. This is called a 'halo' and is quite characteristic irrespective of the prominence of red or grey hair elsewhere on the animal's body.

Right *An adult red squirrel with a very grey coloured coat. Note the long ear tufts and the absence of a white fringe or halo of hair on the tail.*

Table 1. The size and weight of red and grey squirrels.

	Red squirrel		Grey squirrel	
	Average	Range	Average	Range
Head & body length (mm)	220	180-230	245	230-270
Tail length (mm)	180	140-190	220	190-240
Weight (g)	280	260-350	530	450-650

Above *An adult grey squirrel - note the lack of ear tufts and the white halo of hair on the tail fringe*

Chapter 21

What to do if a grey squirrel is sighted in a red squirrel area?

IF YOU THINK you may have seen a grey squirrel in a red squirrel area, then contact the nearest local red squirrel conservation group. In north Wales this is Red Squirrels Trust Wales but there is a wide network of other organisations covering the whole of the current geographical range of the red squirrel. Let the group know the date and location where you saw the animal.

The grey squirrel is an invasive non-native animal that is highly damaging to British forests. It is an offence to catch, transport and then release a grey squirrel. This means that if you or someone else catch one in a trap, then the grey squirrel should be killed. Whilst in a trap, the animal is protected from cruelty and it is the responsibility of the person who set the trap to make sure the animal is killed using a humane method.

The best trap to use is a live capture trap. Although models may vary, generally they operate in the same fashion and they are usually rectangular in shape and constructed of weld mesh. Food is placed inside the trap at the back behind a metal treadle. Some other food is placed near the trap entrance. Squirrels find the food outside the trap and venture inside. The metal treadle at the back has a long wire bar that passes through a wire loop hanging from the trap roof and then sits holding a hinged and spring loaded door open. When the treadle is depressed by an animal as it reaches for the food, the metal bar is moved back far enough so that it is pulled out from under the door. The door shuts and is held shut by a locking mechanism so that it cannot be opened from the inside.

A captured squirrel can be shot or transferred to a heavy duty plastic bag, where it can be confined and then killed with a blow to the head. The body would then be useful for important scientific research into viruses and infections.

We would recommend that feeding of red squirrels in gardens stops if a grey squirrel is seen there. It is important to wash and clean bird tables, feeders and traps if a grey squirrel has been present. An antiviral wash such as Virkon is ideal.

Chapter 22

Places to see red squirrels on Anglesey and in Gwynedd

1. Location:	**Plas Newydd House & Gardens (Anglesey)**
Owner:	The National Trust
Grid reference:	SH 520 700
Postal Address:	Llanfairpwll, Anglesey, LL61 6DQ
Directions:	From the A55 take the A5 at west end of Britannia Bridge. At LlanfairPG turn and follow the A4080 for 3km and the property entrance is on the left. It is well signposted.
Red squirrel history:	Red squirrels were introduced to the parkland and gardens in 2008 and are now quite widespread if a little elusive in many parts of the woodland. The gardens to the west of the house are a good location to see red squirrels which are quite used to seeing people. There are several feeders, including one near the main entrance to the property.
Website:	See: www.nationaltrust.org.uk/plas-newydd-country-house-and-gardens for details of admission price and opening times.

2. Location:	**Treborth Botanic Gardens (Gwynedd)**
Owner:	Bangor University
Grid reference:	SH 5530 7108
Postal Address:	Treborth Coastal/Forest Path, Bangor LL57 2RX
Directions:	From the A5 in Gwynedd, take the left turn immediatly before the Menai Suspension Bridge. Follow the narrow road past the small industrial units and to the Treborth lodge. The road then passes through broadleaved woodland and there are several car parking bays (free).
Red squirrel history:	Red squirrels were first recorded in the woodland during 2009. They had crossed from the adjacent island of Anglesey. There is a dedicated red squirrel viewing area in the gardens with a small viewing hide.
Website:	www.treborth.bangor.ac.uk

Right *Squirrels can be seen across Anglesey*

3. Location:	**Henllys Woodland (Anglesey)**
Owner:	Holiday Property Bond (HPB)
Grid reference:	SH 6003 7763
Postal Address:	HPB Henllys, Beaumaris, LL58 8HU
Directions:	From the A55 in Gwynedd, follow the A5 to the A545 and Menai Bridge. From Menai Bridge follow A545 through Beaumaris and onto the B5109 and turn left at Llanfaes. Follow the signs for Henllys.
Red squirrel history:	Red squirrels were introduced to the woodlands in 2006. They are now a major feature and quite habituated to people. There are a number of feeding stations including one at a dedicated squirrel viewing area. The woodlands are well managed for red squirrels and HPB have an established webcam (www.redsquirrels.info).
Website:	www.hpb.co.uk/property-portfolio/henllys

4. Location:	**Llyn Parc Mawr, Newborough Forest (Anglesey)**
Owner:	Welsh Government (leased to Llyn Parc Mawr Community Group)
Grid reference:	SH 413671
Directions:	From the A55, follow the A4080 to Newborough village, continue through the village in the direction of Malltraeth. Once the forest is on either side of the roads there is a signposted car park on the right (Wildlife Pool).
Red squirrel history:	Red squirrels were introduced to the forest in a joint project between Red Squirrels Trust Wales & Forestry Commission Wales in 2004. Three feeders were established and maintained by the Trust for a decade and are now managed by the Llyn Parc Mawr Community Group.

Chapter 23

Useful addresses

For advice and guidance on red and grey squirrels in north Wales:

Red Squirrels Trust Wales
Red Squirrels Trust Wales
Bodorgan Estate Office
Bodorgan
Anglesey
LL62 5LP

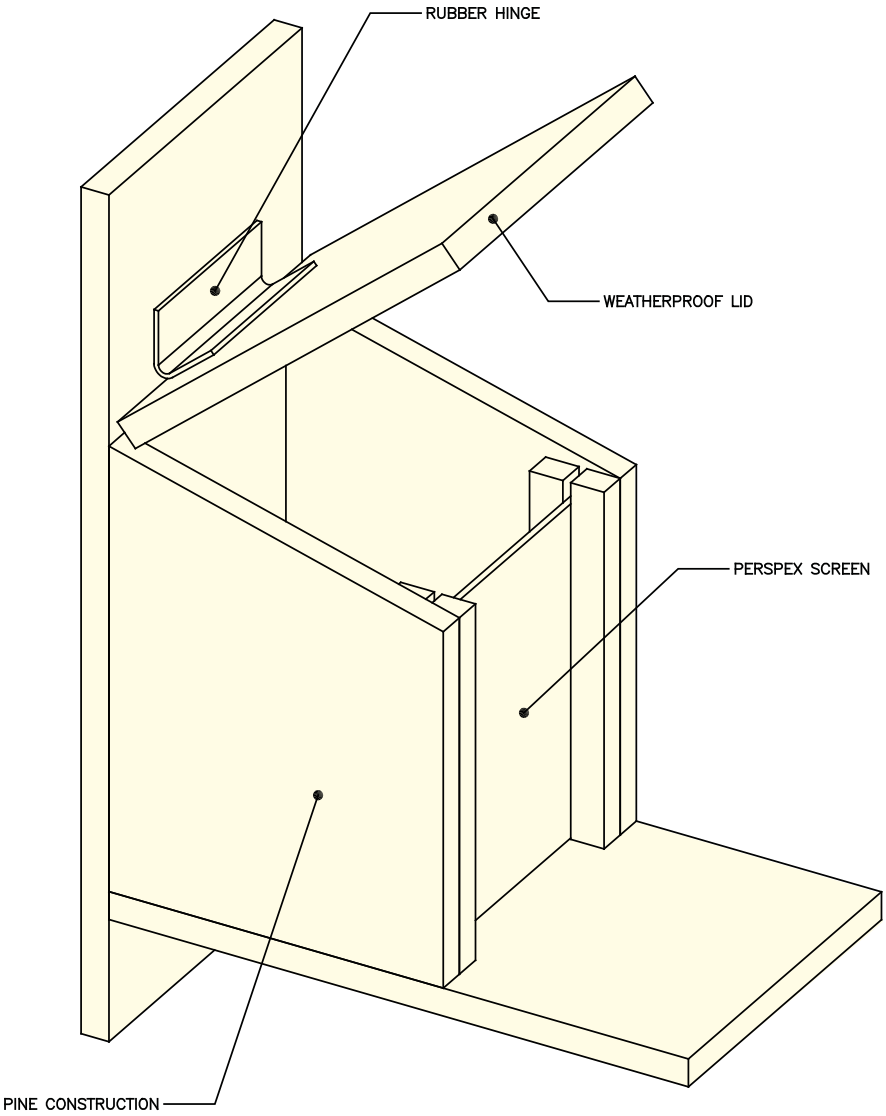
Email: Mail@redsquirrels.info
Telephone: 07966150847 (24hrs)
Website: www.redsquirrels.info
Facebook: Red Squirrels In Wales

If you're not in North Wales, your nearest red squirrel conservation group is:	
Name	
Address	
Email	
Telephone	
Website	
Facebook	

Chapter 24

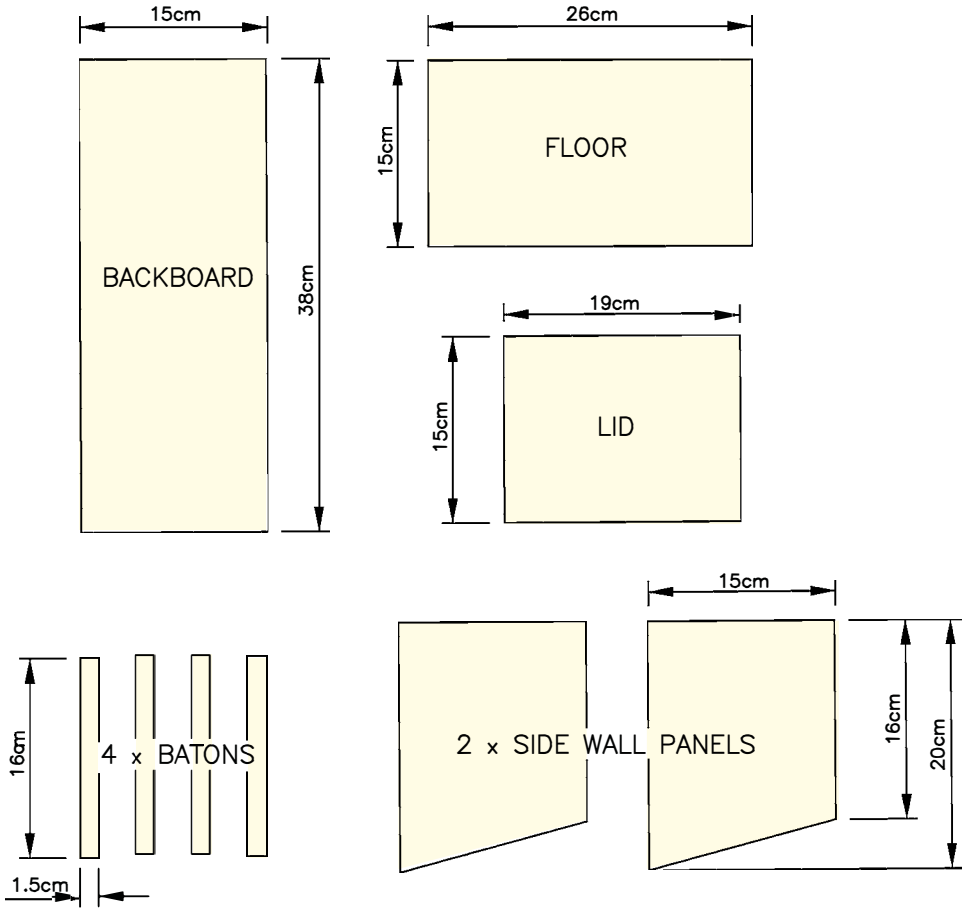
How to build a feeder

WHY NOT TURN your hand to building a red squirrel feeder with these simple to follow instructions from the *Red Squirrels Northern England* project.



List of parts

All wood to be 12.7cm (1/2 inch) softwood



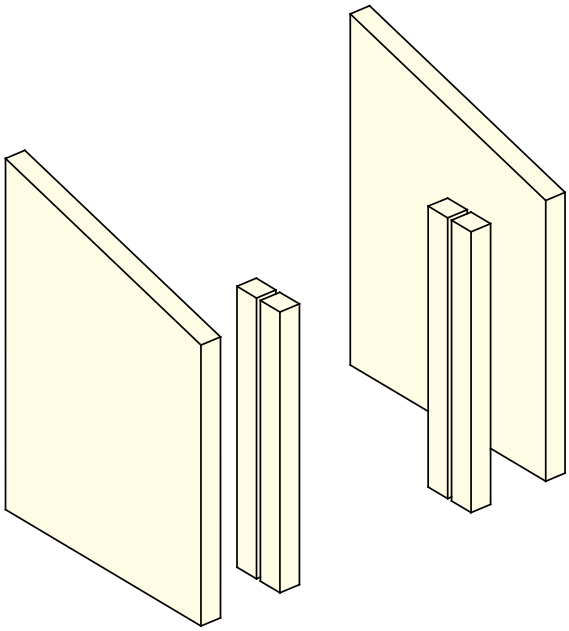
Also required:

Single 15cm x 12.5cm x 0.3cm piece of clear acrylic or perspex

14 x nails (or similar fasteners)

Hinge = recommended 8cm x 5cm rubber sheet

Water-based wood preservative



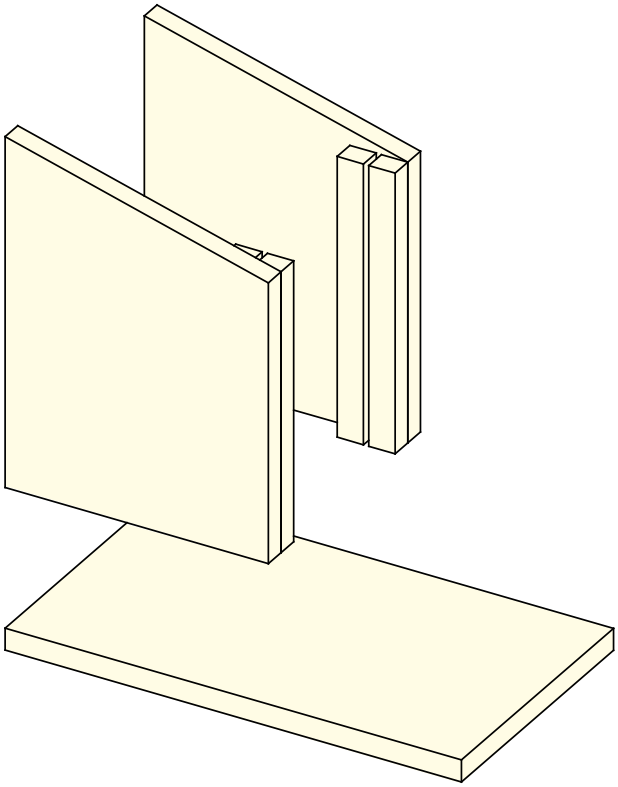
Step 1:

Affix the batons to the side panels.

There should be a 3mm gap between each pair for the perspex to slot in.

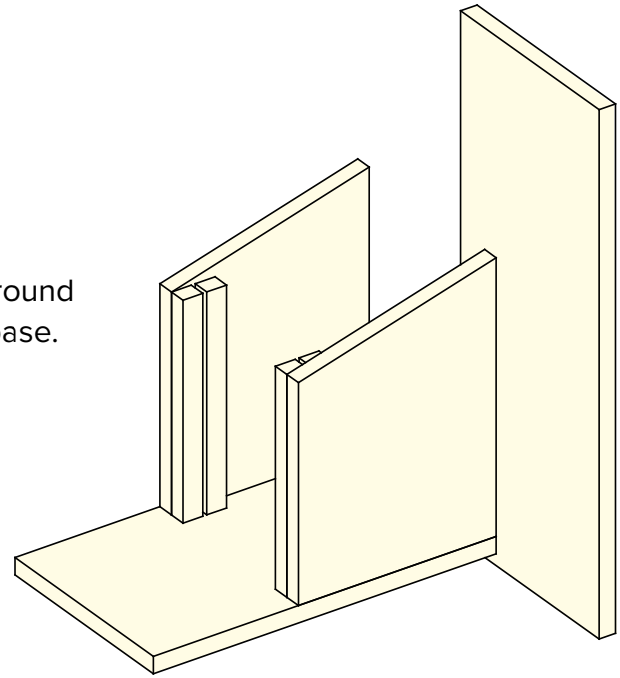
Step 2:

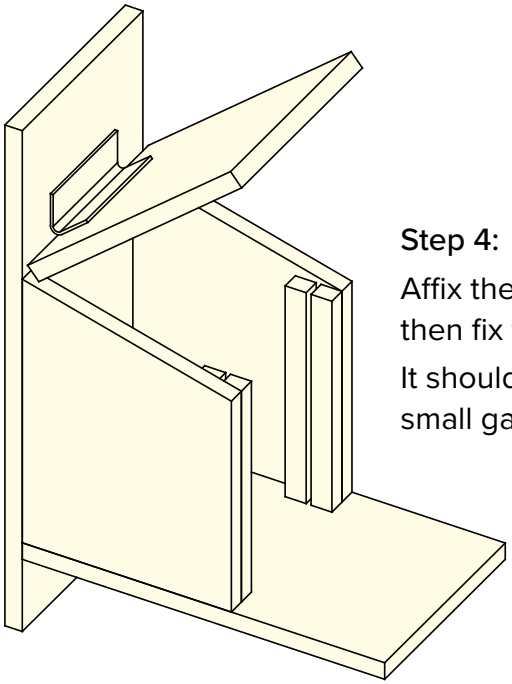
Affix the walls to the base, lining up the backs.



Step 3:

Attach the background to the walls and base.

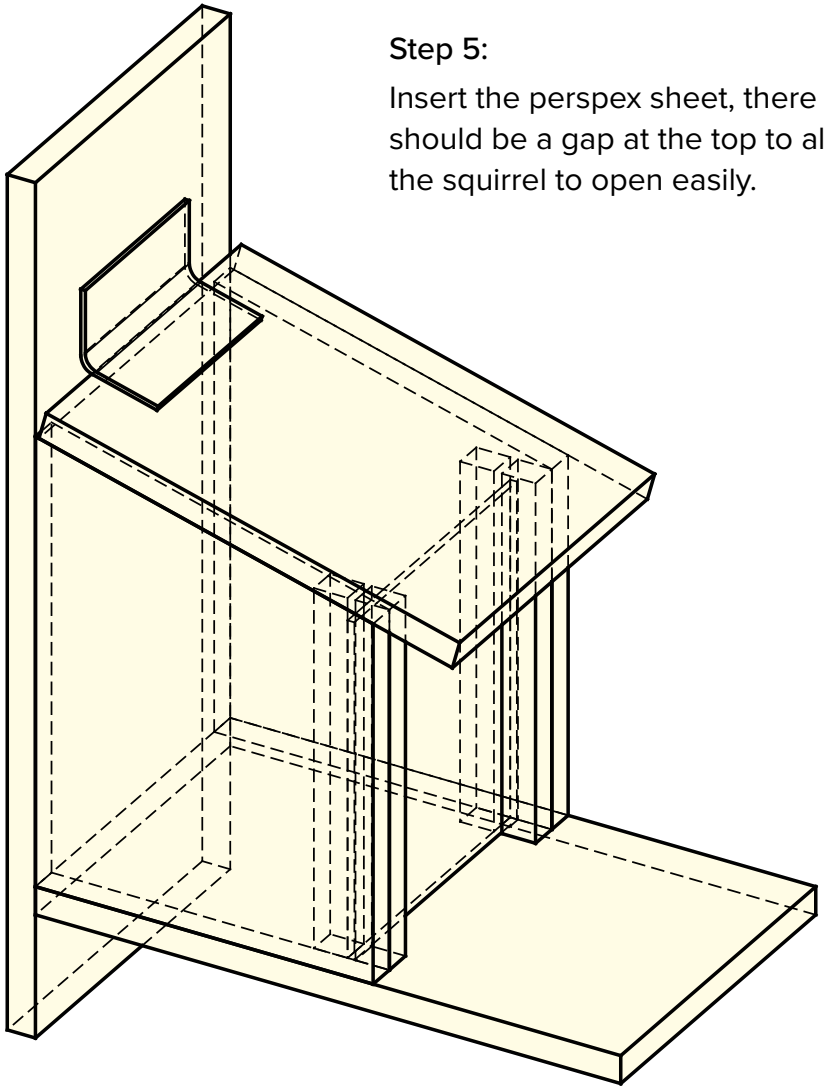




Step 4:

Affix the rubber hinge to the lid, then fix the hinge to the feeder.

It should flex and have only a very small gap at the top.



Step 5:

Insert the perspex sheet, there should be a gap at the top to allow the squirrel to open easily.

Chapter 25

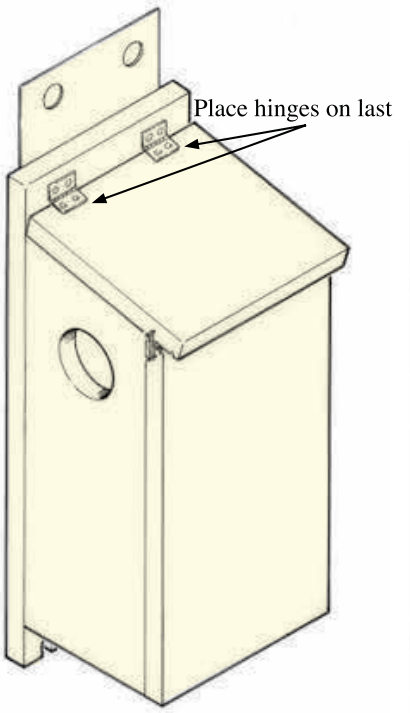
How to build a nest box

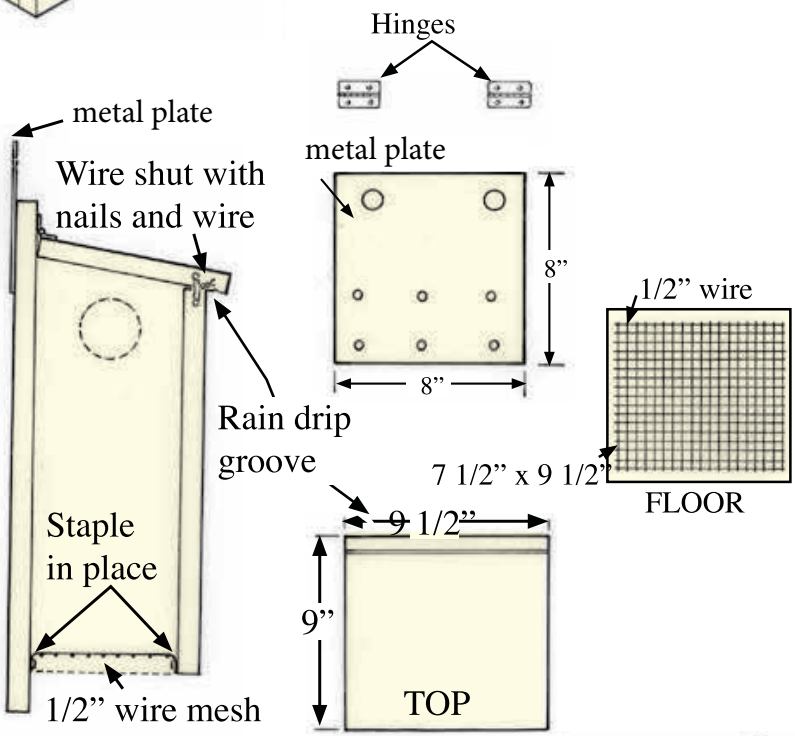
THE SQUIRREL NEST box should be erected at a height of at least 4 metres above the ground in a tree that is at least 10 inches in diameter. The entrance hole should face away from the prevailing wind.

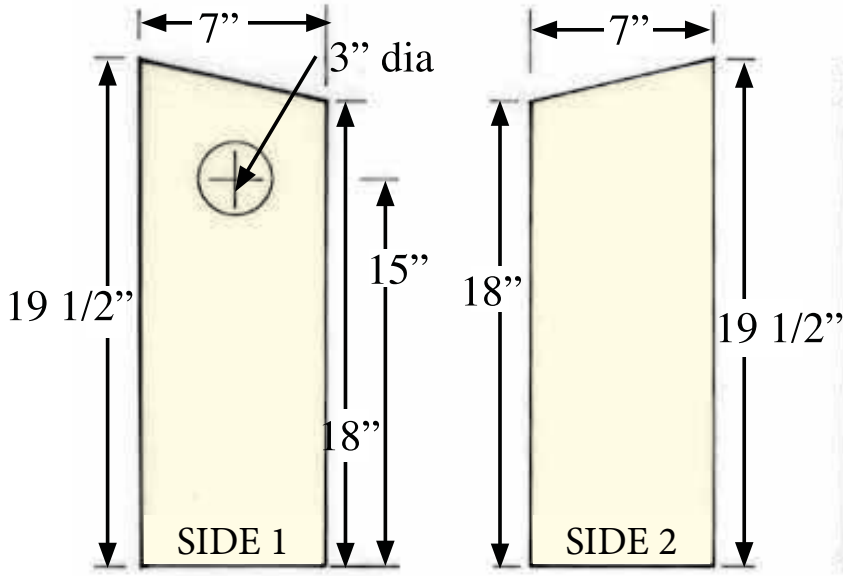
The squirrel nest box can be made more enticing to squirrels by filling it with dry leaves or hay. Attach the box to a tree using screws or wire.

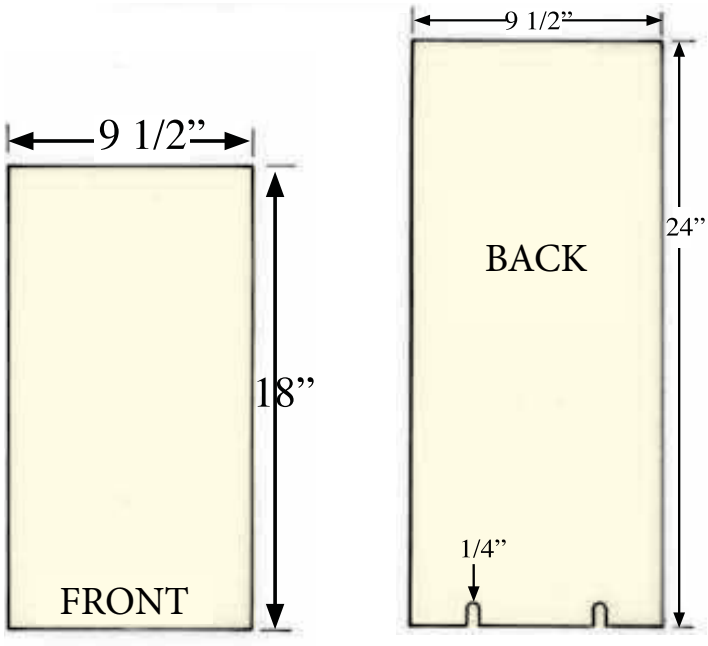
Boxes are used most frequently in the summer and autumn months..

Left *Red squirrel nest boxes*


Place hinges on last


Hinges
metal plate
Wire shut with
nails and wire
metal plate
8”
8”
1/2” wire
Rain drip
groove
7 1/2” x 9 1/2”
FLOOR
Staple
in place
9 1/2”
9”
TOP
1/2” wire mesh


7”
3” dia
19 1/2”
15”
18”
SIDE 1
7”
18”
19 1/2”
SIDE 2


9 1/2”
18”
FRONT
9 1/2”
24”
BACK
1/4”

Swimming grey squirrel

Chapter 26

Frequently asked questions

Can red squirrels swim?

Red squirrels can and do swim across rivers and lakes. In her 1956 book on squirrels, Monica Shorten described their swimming as a swift dog-paddle with the head held just above the water and the tail either submerged or held straight out behind the animal and just above the water. A few years ago a red squirrel was found swimming several hundred metres from the lake shore of Ullswater.

Do red squirrels pilfer from grey squirrel food stores?

Red squirrels will pilfer food buried by grey squirrels. However, as the local grey squirrel population grows in size, there will be many more grey than red squirrels and therefore their pillaging outweighs that of reds taking the grey squirrels' food stores.

What are the black squirrels that are sometimes mentioned on the news?

Both red and grey squirrels can be a variety of different colours. Occassionally there are black coloured red squirrels. In the south of England there are some grey squirrels that are completely black and these animals are often the subject of news reports. They are not a different species but simply have a different coat colour than grey squirrels usually do.

Do mothers 'teach' their young how to forage and cache food or is this behaviour instinctive?

When young red squirrels wean, they instinctively have the skills to build nests, bury food and strip pine cones to access the seed within. They will also watch other animals from a distance and learn from them.

Do kittens from the same litter have a "relationship" after they've left their mother or do they 'go their own way'?

Brothers and sisters may share nests for several weeks after they wean from their mother. They will then disperse out across the landscape with males tending to go further afield than females. They then lead very separate lives.

Have the rope bridges that some authorities have put in place to protect the squirrels from road accidents been effective?

Rope bridges reduce the number of red squirrels killed on the road. Unfortunately, even where bridges are present, sometimes squirrels will run on the road and are at risk of being killed by traffic.

Are scientists working on a cure for squirrelpox and, if so, how far away is a solution to this problem?

There is a potential vaccine but it requires a great deal more work and currently is not being funded.

Do pine martens help to keep the grey squirrel numbers down?

There is significant evidence that in parts of Ireland and Scotland, where there are large numbers of pine martens, there are few, if any, grey squirrels. Although it remains unclear exactly why this is, new research has shown that even at a low population density, the pine marten can reduce grey squirrels and benefit native red squirrels. Thus, whilst grey squirrels decline, red squirrels appear to be able to persist in the presence of the predator.

Chapter 27

Thank you

The authors would like to thank the Directors of Red Squirrels Trust Wales for their support in the production of this booklet. This publication complements work being carried out (2016-2019) in the EU Life14/UK/000647 SciuriousLIFE project in north Wales. This initiative seeks to encourage the innovative management of invasive species such as the grey squirrel.

We are indebted to Christina Allen, Lisa Condron, Paul Harry, Mary Munley, Roland Saunders, Sue Topping, Rebecca Clews-Roberts and Janet Watkin for their help in proof reading and commenting on early drafts.

Finally, we are grateful to local photographers for the use of their images and to those people who posted photos on Flickr™ with open source or non commercial use.

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