

Goshawk as predators of grey squirrel in Gloucestershire

by Anna Field

Summary:

The Gloucestershire Raptor Monitoring Group has been studying the diet of goshawk using nest trail cameras for the five years 2017-22. In many nests the non-native grey squirrel constitutes a high proportion of prey delivered by the adults. Grey squirrel can cause significant damage to trees, recently estimated to cost £37 million a year across

England and Wales, and considerable time and money is spent on grey squirrel control. It is expected that a breeding pair of goshawk can provide a form of natural pest control of grey squirrel in the woodland in which they nest, and this article discusses ways in which woodland managers can support them.

Introduction

The northern goshawk *Accipiter gentilis* (referred to throughout this article as 'goshawk') will be well known to many foresters because of the protection afforded it under Schedule 1 of the Wildlife & Countryside Act 1982, and the consequent need to plan forestry operations around any nesting pairs. The goshawk, often referred to as 'the phantom of the forest' due to its secretive habits, is a large hawk found primarily in remote forests although in recent years it has started to colonise smaller woodlands and more populated areas as population size increases and pressure from persecution reduces (Rutz, 2008).

Goshawk were persecuted to extinction in the late 19th

century but in the 1960s were unofficially reintroduced by falconers and several populations established throughout the UK (Marquiss and Newton, 1982). The most recent Rare Breeding Bird Panel Report shows the UK population continuing to increase, with an estimated 712 breeding pairs in 2020 (Eaton et al., 2022). It is the opinion of the Gloucestershire Raptor Monitoring Group (GRMG), however, that their secretive lifestyle means that they are under-recorded and the true population size is larger, although still probably below carrying capacity (the maximum population size of a species that can be sustained by that specific environment) in most regions (British Trust for Ornithology, 2018). This is supported by the discovery of 25+ previously unknown breeding pairs during surveys in Gloucestershire from 2017 to 2022.

Gloucestershire is one of the UK's strongholds for goshawk with over 100 known breeding sites, contributing approximately 14% of the UK's total breeding birds. The majority of these are found in the Forest of Dean, with an increasing number of pairs scattered throughout the rest of the county. Members of GRMG have been monitoring the population for over 25 years, gathering information on the distribution of breeding pairs, timing of breeding and productivity. In 2017, in an attempt to increase the number of ringing recoveries of the project, GRMG started to colour ring chicks and use trail cameras at nests and baited winter sites to re-sight ringed birds ('re-sight' is a sighting of a ringed bird in the field). As well as providing a wealth of information on movement of ringed birds and behaviour, the nest trail cameras have given a fascinating insight into the diet of the goshawk.



Figure 1. Adult female goshawk.
(Photo: Anna Field via nest trail camera)



Figure 2. Goshawk chick surrounded by a glut of grey squirrel prey brought in by its parents. (Photo: Anna Field via nest trail camera)

Goshawk diet

Only a handful of studies have looked at goshawk diet in the UK to date due to the difficulties of conducting field studies. However, the increasing availability and reliability of trail cameras is starting to change this, and trail cameras are currently thought to be the least biased method for studying diet composition, despite some limitations around prey identification and underestimation of smaller prey (Garcia-Salgado et al., 2015).

Toyne (2008) looked at goshawk breeding season diet in Wales between 1991 and 1993. A total of 2,230 prey items were analysed, and 11 species found to be important: feral pigeon *Columba livia*, woodpigeon *Columba palumbus*, carrion crow *Corvus coronet*, rook *Corvus frugilegus*, magpie *Pica pica*, jay *Garrulus glandarius*, mistle thrush *Turdus viscivorus*, song thrush *Turdus philomelos*, blackbird *Turdus merula*, grey squirrel *Sciurus carolinensis* and rabbit *Oryctolagus cuniculus*. Grey squirrel were the fourth most important species in terms of biomass ingested (10.8%) and were predated on in higher numbers in smaller woods (<1000ha) than large forests. An analysis of prey found at or near goshawk nests in Thetford Forest found grey squirrel made up 52% of the 129 prey items, woodpigeon 19% and corvids 17% (British Trust for Ornithology, 2018).

The analysis of prey data from GRMG's nest trail cameras tells a similar story, with grey squirrel contributing a high proportion of the diet of many pairs – in some cases, by far the most frequent item and constituting over half of all prey items. An analysis by Barron (2022) of the prey brought in to ten nests in the Cotswolds found that out of 261 prey items, 81 (31%) were corvids, 73 (28%) were grey

squirrel and 31 (12%) were woodpigeon, with 21% unidentifiable; however, the split varied between years and nests. In 2019 corvids were the highest proportion of prey type, whereas in 2020 and 2021 it was grey squirrel – showing how diet can vary with prey availability from year to year. Similarly, some nests clearly favoured avian prey whilst others favoured grey squirrel, with several nests provisioning young with over 50% grey squirrel. Figure 2 shows a goshawk chick at approximately five weeks of age surrounded by a glut of grey squirrel prey brought in by its parents. When trail cameras are retrieved from nests at the end of the season, grey squirrel remains are often present in the nests – Figure 3 shows at least 15 individuals.

After grey squirrel, corvids and woodpigeon, it is

“It is expected that many nesting pairs of goshawk will significantly reduce grey squirrel numbers.”

interesting to note that a wide variety of other species are taken in much smaller numbers. Other species recorded by trail cameras or identified from remains at the nest by members of GRMG include sparrowhawk *Accipiter nisus*, kestrel *Falco tinnunculus*, tawny owl *Strix aluco*, barn owl *Tyto alba*, jay, feral pigeon, stock dove *Columba oenas*, lesser black-backed gull *Larus fuscus*, coot *Fulica atra*, moorhen *Gallinula chloropus*, mallard *Anas platyrhynchos*,

woodcock *Scolopax rusticola*, red-legged partridge *Alectoris rufa*, pheasant *Phasianus colchicus*, lesser-spotted woodpecker *Dryobates minor*, great-spotted woodpecker



Figure 3. The remains of at least 15 grey squirrels in a goshawk nest from which chicks have recently fledged. (Photo: Mark Sharples)



Figure 4. Goshawk eating a woodpigeon, another frequent prey item. (Photo: Anna Field via trail camera)

Dendrocopos major, blackbird *Turdus merula*, mistle thrush, song thrush, rabbit and brown rat *Rattus norvegicus*. Small birds are only taken in small numbers, probably opportunistically rather than targeted, and we often note that passerines such as firecrest *Regulus ignicapilla* and spotted flycatcher *Muscicapa striata* nest close to goshawk nests at a much higher frequency than could be expected by chance – perhaps because the resident goshawk pair provide protection against nest predators such as corvids and grey squirrel. It is apparent that adult goshawk rarely take gamebirds in the breeding season (1.2% as per Barron, 2022) but we acknowledge from numerous conversations with landowners and gamekeepers that fledgling juvenile goshawk can target newly released gamebird poults in July and August – although it is considered that the estimated losses of gamebirds to raptors are generally relatively low, between 1-8% (Park et al., 2008), with some exceptions (Kenward, 1977).

Grey squirrel predation

Grey squirrel is a non-native species, introduced from the USA around 150 years ago and now occupies England, Wales and much of southern Scotland. Recent estimates suggest there are 2.7 million individuals in England (Natural England, 2018). A 2021 survey of woodland owners and managers in the UK found that grey squirrel was perceived to be the greatest threat to broadleaf trees, ahead of pathogens and deer (Royal Forestry Society, 2021a). They are well known to damage trees by bark-stripping to feed on the sap beneath. Bark damage can create open wounds in trees that can provide an entry point for tree diseases

and, in the worst cases, can directly kill trees if the bark and underlying tissue is removed in a complete ring around the tree ('ring-barking'). Beech *Fagus sylvatica*, sycamore *Acer pseudoplatanus*, birch *Betula spp.* and oak *Quercus spp.* are particularly susceptible. Grey squirrel damage is estimated to cost £37 million a year in lost timber value in Wales and England, reduced carbon capture, damage mitigation and replacement of dead trees (Royal Forestry Society, 2021b). It is thought that grey squirrel cause particular problems when numbers are greater than five squirrels per hectare (Mayle et al., 2007) and consequently landowners and managers often spend significant time, effort and money trapping and controlling squirrels to below this number prior to and during the peak bark-stripping period of late April to late July.

The grey squirrel is also thought to be a significant predator of the eggs and young of songbirds – although evidence in the UK is largely anecdotal rather than from scientific studies, and a recent comprehensive literature review determined that current evidence does not show grey squirrel to be significant predators of nesting birds – though advises that further studies are required (Broughton, 2019). Grey squirrel can also compete with some bird species for nest cavities and food (Hewson and Fuller, 2003).

The goshawk is a natural predator of the grey squirrel in its natural range in the USA (Sheehy and Lawton, 2015) and so it follows logically that this relationship would continue in other regions where goshawk is present naturally and grey squirrel has been introduced. As goshawk nest from early April to early July, with chicks in the nest from mid-May



Figure 5. Goshawk chick with newly fitted GPS satellite tag. (Photo: Ben Locke)

onwards, it is expected that many nesting pairs will significantly reduce grey squirrel numbers in their home range and so will make a positive contribution to any squirrel control programme during this key time of year.

GPS satellite tagging

Alongside colour ringing and use of trail cameras, in 2019 and 2021 GRMG deployed tiny 'Movetech' GPS satellite tags onto 16 goshawk chicks in collaboration with the British Trust for Ornithology (BTO). The BTO have also deployed a number of these tags onto goshawk chicks in Thetford Forest. The solar-powered tags take regular high precision GPS location fixes and store them until they are ready to transmit data via the mobile phone network and allow the goshawk's use of the landscape to be tracked. One of the aims of this is to better understand use of the countryside away from nesting areas – in particular home range size, seasonal movements and the extent of the goshawk's reliance on non-forest habitat (BTO, 2018).

It will be interesting to see the results of these studies as it will help us understand the size of the area impacted by goshawk predation and how far any control effects on grey squirrel reach – to date few studies have looked at the home range of breeding Goshawk, and those that have are in habitats too different from Gloucestershire to be useful (such as urban parks in Hamburg or Swedish forests) (Kenward, 2006). The BTO will carry out and publish a detailed analysis of the tracking data in due course.

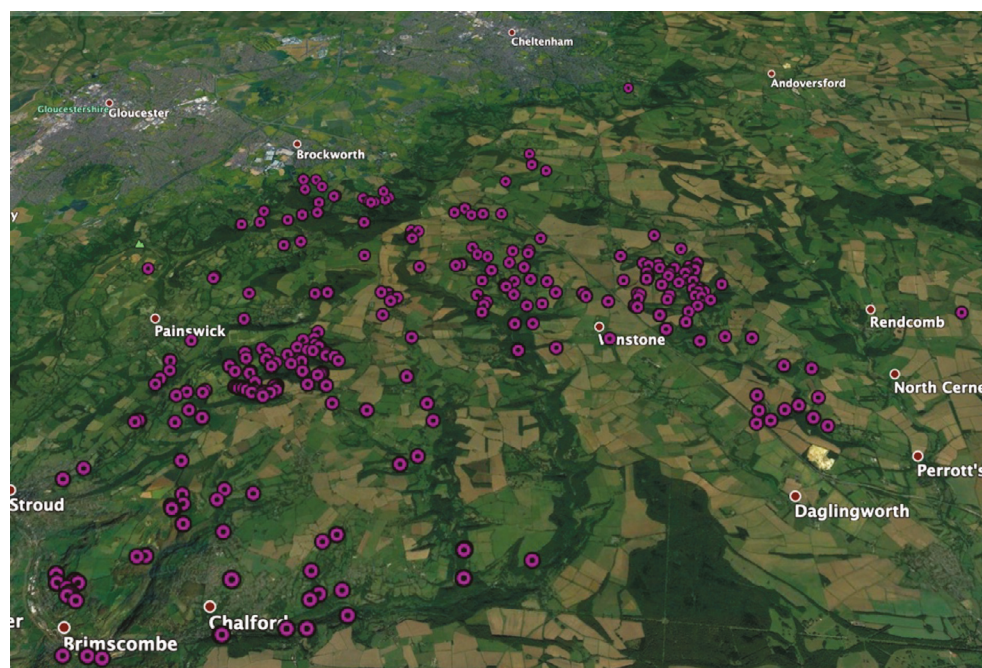


Figure 6. Movements of a juvenile goshawk in the Cotswolds in the months following fledging. (Nest site not shown).



Figure 7. Adult female goshawk breeding in the Cotswolds identified from its metal ring to have been ringed as a chick in the New Forest, a juvenile dispersal of 102km. (Photo: Anna Field via nest trail camera)

Management of woodland for goshawk

As the goshawk population size continues to increase, more and more woodlands across the UK will be recolonised. Young goshawk range widely in their quest to find vacant woodland territories and so will expand out from existing population strongholds relatively quickly if free from disturbance and persecution. Figure 6 shows the wide-ranging movements of a young GPS tagged goshawk in the Cotswolds in its first six months following fledging in 2019 (nest site not shown). In 2019 the trail camera on a nest in the Cotswolds revealed the breeding female to have been ringed as a chick in the New Forest in 2012, showing a juvenile dispersal of 102km (Figure 7). The BTO's goshawk monitoring project has recorded similar large movements by young females (BTO, 2018). It is worth noting that juvenile goshawk tend to avoid woodlands with established breeding pairs, presumably seen off by the territorial adults, and so having an established breeding pair of goshawk in a woodland will reduce the number of inexperienced juveniles visiting woodlands, and consequently the

impact on gamebird poults.

Whilst it is difficult to be definitive about the habitat requirements of goshawk as there is a lot of variation between available habitat and individual pairs, there are certain woodland characteristics that most pairs prefer. There is a strong preference for mature conifers for the nest tree. Out of 38 goshawk nests monitored by the author in 2021, 37 (97%) were in conifers, with larch *Larix decidua* and Douglas fir *Pseudotsuga menziesii* the favoured species – although Scots pine *Pinus sylvestris*, Corsican pine *Pinus nigra* and Norway spruce *Picea abies* are also used regularly. Goshawk will occasionally nest in broadleaf trees such as oak and beech but this is currently uncommon in Gloucestershire. Figure 8 shows a typical goshawk nest, high in the whorls of a mature larch. It follows that woodlands with stands or scattered mature conifers will be selected preferentially by goshawk, and goshawk could be encouraged to nest or remain in woodlands by ensuring that some mature conifers are retained following forestry thinning or felling programmes. Newly planted areas could also include a small proportion of these species for the future. This will also tend to benefit other bird species that utilise conifers such as cross bill *Loxia curvirostra*, siskin *Spinus spinus* and firecrest/goldcrest *Regulus regulus*. Goshawk also tend to prefer woodland compartments that are relatively open, with widely spaced trees to allow for easy access and hunting. The goshawk individuals who have survived the persecution pressures of the last century are generally timid, tend to avoid people and often select nest sites away from public footpaths and other pressures. Therefore, retaining mature conifers away from such areas will be particularly attractive.

Where goshawk are already present in woodlands they can be sensitive to disturbance during the nesting period from February to July and consequently are protected under Schedule 1 of the Wildlife & Countryside Act 1982 from “intentional or reckless disturbance at or near an active nest”. During this time, it will be necessary to minimise disturbance by planning any forestry or other works so they are a safe distance from the nest as set out by Petty (1996). In larger woodlands this rarely poses a problem as other areas can still be worked during the nesting period, and there is no restriction on forestry work near nests in autumn/early winter once any goshawk chicks have fledged. Other Schedule 1

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Figure 8. Typical goshawk nest, high in the whorls of a mature larch. (Photo: Anna Field)

species such as red kite *Milvus milvus* and hobby *Falco subbuteo* are similarly protected. If landowners or foresters are in any doubt as to the presence or location of these species of raptors in their woodlands, please contact your local raptor or ornithological society who will often be happy to help you locate nests.

Conclusion

The goshawk is a fantastic apex predator of British woodlands and, with its population rising year on year, it is clearly here to stay. Although historically it has had a bad reputation among some landowners and foresters for its apparent disturbance and predation of gamebirds and the need to cease forestry operations around nesting pairs, our data shows that gamebirds only constitute a very small proportion of the diet of goshawk chicks and, with cooperation between landowners and local raptor enthusiasts, disturbance to

forestry operations can be minimised with a little forward planning. The recent work by Gloucestershire Raptor Monitoring Group has shown that the main components of the diet of goshawk are pest species such as grey squirrel, woodpigeon and corvids and this positive aspect of goshawk ecology is not widely known. We hope that more landowners and foresters can start to view goshawk in a more positive light and appreciate the beneficial effects that breeding pairs can have on woodlands and forests.

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