

Research Information Note 254

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MERLINS AND FORESTRY

by Steve J. Petty



Abstract

The merlin is a small bird-eating falcon breeding in the uplands. Concern has been expressed about the impact of afforestation on the relatively small British population. The purpose of this Note is to review the requirements and status of merlins, concentrating on research that has examined the relationship between merlins and forestry. Two recent studies have been funded by the

Forestry Authority (Parr, 1992 and 1994) and Forest Enterprise (Little and Davison, 1992). The conclusion is that afforestation in Northumberland and Wales has had little detrimental effect on merlins, and is unlikely to do so providing that extensive moorlands remain close to forests. This situation may be similar throughout the rest of the merlin's range in Britain.

Description

The merlin is comparable in size to the more familiar and abundant sparrowhawk and kestrel. Like most raptors the female is the larger sex, weighing 220/270 g (during the breeding season) compared to 160/170 g for the male (Newton *et al.*, 1984). In the adult male the back colour is a slaty-grey (Plate 1),

while the upper parts of females (Front cover) and first-year birds of both sexes are predominantly dull brown. Merlins have much shorter tails than either the sparrowhawk or kestrel, and in silhouette are more like miniature peregrine falcons. Merlins fly fast with rapid wing beats.

Legislation

The merlin is listed on Schedule 1 of the Wildlife and Countryside Act 1981, which imparts full protection throughout the year. In addition it is illegal to disturb occupied nests intentionally. Scottish Natural Heritage, English Nature and the Countryside Council for Wales may issue licences to visit nests for scientific and photographic purposes. Such licences are conditional on the landowners' or their agents' permission

having been obtained. Additional protection is given to merlins and their breeding habitat under the European Community Wild Birds Directive, in which merlins are listed on Annex 1. Great Britain and Ireland hold virtually all the breeding merlins in the European Union (EU). This position will change substantially once Scandinavian countries join the EU.

Distribution and status

Merlins are widely distributed throughout the boreal forest zone in North America, Europe and Asia, where five races are recognised (Cramp and Simmons, 1980). They also breed on prairies. In Britain, merlins breed in upland areas, from Exmoor in south-west England, through the Welsh uplands, through the Pennines, to the Southern Uplands, and the Highlands and Islands of Scotland, including Shetland and Orkney Isles (Gibbons *et al.*, 1993).

The last published survey of merlins was carried out in 1983/84, and estimated the breeding population in Britain at 550/650 pairs (Bibby and Nattress, 1986). In five

areas with sufficient long-term data, numbers had declined during the previous ten years. In three of these areas where reproductive data were available, the decline was associated with poor breeding success (Bibby and Nattress, 1986).

Since then a general improvement in the British population has occurred in a wide range of localities including Northumberland (Little and Davison, 1992), the Peak District (Haworth and Fielding, 1988), Shetland (Ellis and Okill, 1990), and Orkney (Benn, 1991; Morton, 1992). The reason for this recovery is not clear but, because of its widespread nature, may well be associated with climatic

Front cover.

Female merlin brooding chicks in an old crow's nest in a Sitka spruce along a forest edge in Wales (R.J.C. Blewitt).

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Plate 1.

Male merlin at a ground nest (in an old crow's nest) on a heathery crag (D.S. Whitaker).



factors and/or decreasing chemical contamination. Bird-eating raptors, such as the merlin, sparrowhawk and peregrine falcon, were severely affected by organochlorine pesticides in their avian prey (Newton, 1979). DDT led to reduced productivity, due to egg-shell thinning and increased embryonic mortality, while cyclodiene compounds (aldrin and dieldrin) resulted directly in adult deaths. The widespread use of these chemicals in

agriculture was reduced progressively from 1962 (Newton, 1986), but because of their persistent nature it has taken many years for them to decline in food chains. The spectacular recovery of sparrowhawk and peregrine falcon populations over the last 20 years has been linked to this reduction in use. Merlins had higher average levels of these compounds than other bird-eating raptors (Newton and Haas, 1988), so it is reasonable for them to have taken longer to recover.

Habitat requirements

The main feature of merlin habitat everywhere is open-ness. They need wide open areas with an abundance of small birds to hunt. Given such hunting areas, they can nest on the edges of nearby forest (as in the boreal zone), in clumps of trees or isolated trees (as in the prairies), on crags (as in various tundra areas), or among tall ground vegetation (as on tundra and heather moors).

In Britain they presumably nested whenever forest adjoined open ground, such as bogs or sparsely wooded mountainous areas. Following deforestation by man, the main change was probably a decrease in the proportion of tree nests to ground nests. Merlins adapted to these treeless areas by nesting on the ground, often in long ericaceous vegetation, and hunting moorland-based prey (Plate 2).

Merlins do not build their own nests, being dependent on a suitable site where they can scratch a hollow to lay their eggs. Their main nest sites can be in disused nests of other species (particularly crows and magpies), on crag ledges, and on the ground in long vegetation (such as heather). Crows are one of the most important nest providers for merlins. When trees are abundant, crows build a new nest each year, but when only isolated trees are present, crows will often reuse the same nest year after year. Disused nests remain

suitable for merlins for up to five years.

This relationship with crows may have other benefits for merlins. Crows may give merlins prior warning of potential predators, particularly the larger raptors such as peregrine falcon, buzzard and goshawk. Although merlins often nest in close association with crows, they attack crows fiercely if the crows stray too close to their nests. Because of this response, crows are unlikely to get close enough to an occupied merlin nest to steal eggs or small chicks, and therefore offer little threat to merlins.

The highest breeding density and productivity occurs on heather moorland managed for red grouse. Intense persecution of foxes is probably the main reason why merlins are so successful in this habitat. Foxes are the main predator of ground-nesting merlins; they are capable of killing incubating adults, but more often take the clutch or brood. Merlins breeding on heather moors where foxes are not controlled produce far fewer young, and will revert to using crow or magpie nests in isolated trees and adjacent conifer forests if these become available; breeding success is then usually higher (Newton *et al.*, 1986; Little and Davison, 1992). Merlins also nest on grass moors grazed by sheep, provided that suitable tree nests are available.



Plate 2.

An unmanaged heather moor in northern England. Merlins hunt over the area and nest in the long heather surrounding the crags (S.J. Petty).

Diet during the breeding season

Merlin diet largely comprises birds of less than 100 g body weight (up to the size of a song thrush), with most in the range 10/40 g, which are mainly caught in prolonged aerial chases (Newton *et al.*, 1984). Large day-flying moths (emperor and northern egg) are regularly taken, and small mammals occasionally. Nestlings and fledglings are also important in their diet, and the radio tracking of adults in Wales suggests that merlins may use a 'sit and wait' hunting technique to capture these prey (Parr, unpublished data).

Studies in widely separated parts of Britain have shown that meadow pipits are the most

frequent prey, followed by skylark and then a variety of other moorland, woodland and farmland species (Figure 1). The most intensive work on merlin diet has been done in Wales (Bibby, 1987) and Northumberland (Newton *et al.*, 1984). Here woodland-based birds accounted for 15/18% of the total bird prey (Figure 1), and were more important in April, just prior to egg-laying, than later in the breeding season (Figure 2). Woodland birds are probably caught along forest/ moorland edges, in very open woodland such as the *ffridd* in Wales, or when they overfly moorland. Gamebirds and their young are unimportant in the diet of merlins.

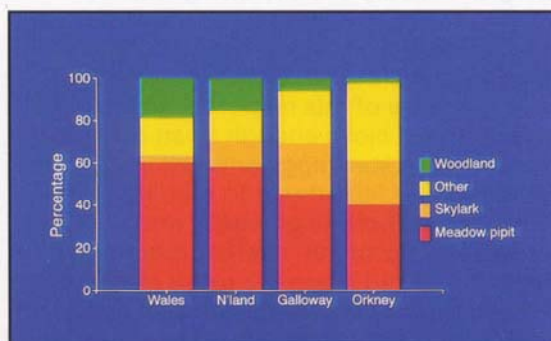


Figure 1.

The bird food of merlins during the breeding season (April-July) from four British studies (Bibby, 1987 for Wales; Newton *et al.*, 1984 for Northumberland; Watson, 1979 for Galloway; Meek, 1988 for Orkney). Other = other moorland/farmland bird prey; Woodland = woodland bird prey. (This follows the classification of Newton *et al.* (1984), except that house sparrows are placed in the 'other' category.) The amount of woodland prey in merlin diet broadly reflects the amount of forest present in each study area, with Northumberland and Wales having the most and Orkney the least.

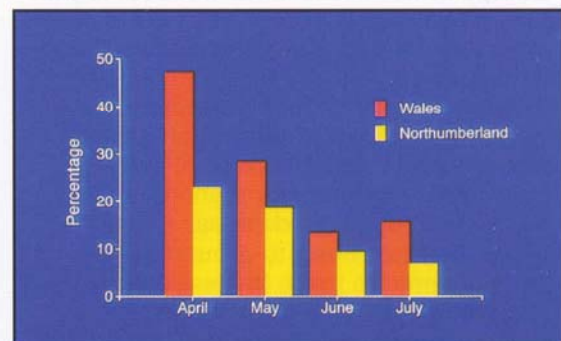


Figure 2.

Percentage of woodland/scrub species in the diet of merlins in Wales and Northumberland during the four months of the breeding season (from Bibby, 1987). Most of these prey samples will have come from merlins breeding on moorland rather than along forest edges.

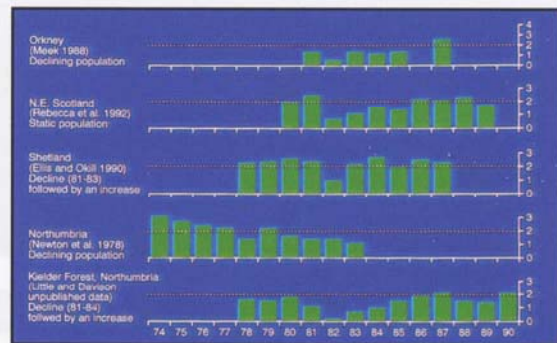
Breeding phenology and productivity

Like other birds, merlins time their breeding to coincide with peak food abundance at the time when young are being fed. They are one of the latest raptors to breed in the uplands because their bird prey also breeds late. Displays over nesting areas commence in earnest in March and April, and most egg-laying starts in early May. The incubation period, the nestling period, and the post-fledging period before independence each take about 30 days, so that juveniles start to disperse from late July. After breeding, merlins move out of the uplands to lowland and/or coastal areas where they spend the winter. Most travel no more than 100 km from their breeding area (Heavisides, 1987).

Figure 3.

The mean number of chicks reared per pair per year from five long-term studies of merlins in Britain during the period 1974/1990. The best productivity was in the mid to late 1970s and late 1980s, and the poorest in the early to mid 1980s when productivity fell below two chicks per pair in all areas.

The most frequent clutch sizes are of 3/5 eggs, producing broods of 2/4 chicks at fledging. However, the important reproductive parameter is the average number of chicks produced by each pair in a population, including those pairs that fail at some stage in the nesting cycle. Long-term studies of merlin from five areas in Britain show that on average 1.0/2.5 chicks are produced per pair (Figure 3). They also showed that merlin productivity was at its lowest in all five populations in the early 1980s, and this was often associated with declining populations. Most populations later recovered, particularly once the average number of chicks reared per pair per year exceeded 2.0.



Influence of forestry

Concern has been expressed about the possible detrimental effects of afforestation on merlins (Thompson *et al.*, 1988; Ratcliffe, 1990). Three studies have recently indicated how the establishment of extensive coniferous forests in the uplands may affect merlins.

In Wales, Bibby (1986) analysed vegetation within 4 km of 138 nest sites that had been used by merlins. Not surprisingly, heather moorland came out as being favoured, with a higher proportion of sites being occupied in this habitat, particularly when near to improved farmland. Conifer forests had little impact on either occupancy or productivity of nest sites. This may have been related to the size and dispersal of forest blocks in Wales. Where large areas of moorland are interspersed with forests, merlins seem to be little affected. In fact, there may well be some beneficial effects. Merlins arrive back on moorland territories before their main prey, the meadow pipit. At this time woodland-based prey species feature more highly in their diet. This is a crucial period for merlins, as the male needs to increase his hunting to provide food for the female as egg-laying approaches. If there is insufficient food, the female may not come into breeding condition, or fail if she does.

Bibby (1986) indicated that the breeding population in Wales had declined by 30/40%

during 1970/1989, and that ultimately this was caused by declining habitat suitability, including the overgrazing of heather moors and their conversion to grass. More recent work in Wales by Parr (1991, 1992 and 1994) has suggested a different explanation. Occupancy rates of traditional merlin nest sites, the only ones that were monitored, did decline between 1970 and 1991. But, during this period many merlin pairs switched to breed in conifer forests, and these had largely been overlooked by Bibby (1986). By 1986/91 around 50/55% of Welsh merlins were breeding in old crow and magpie nests along the edges of conifer forests, and the total Welsh population of 60/70 pairs was similar to that in the 1970s. Whether an overall decline occurred in the transitional phase in the mid 1970s to early 1980s is unclear.

A similar series of events occurred in Northumberland. Here merlin numbers declined at traditional ground nest sites between 1974 and 1983. The decline was more pronounced at sites near to young forests than at those surrounded by moorland, probably because merlins were more productive on kept ground (Newton *et al.*, 1986). This work also suggested that mammalian predators were one of the causes for lower productivity of ground nests in non-kept areas. Pesticide contamination may

have further reduced productivity in all habitats.

The situation had substantially improved by 1990 (Little and Davison, 1992). In the main forest habitat at Kielder, merlins switched to nesting in young conifers once they were tall enough for crows to build nests in (Plate 3). Tree nesting was first recorded in 1979, and by

1990 over 50% of known merlins were breeding in crow nests. During this shift to tree nesting, the productivity of merlins significantly improved and the known breeding population almost doubled (Figure 4). This recovery was likely to be linked to declining levels of both mammalian predation and organochlorine contamination.



Plate 3.
A forest edge in Northumberland along which merlins regularly breed in disused crow nests. Merlins perch on the fence posts to pluck their prey (B. Little).

Conservation implications

The main requirements of merlins during their 4/5 month breeding season in the uplands are for suitable open foraging habitat rich in small birds and safe nesting places.

Foraging habitat

The abundance and availability of prey are probably the main factors determining whether merlins are present or absent. Merlins have evolved to catch birds in open habitats, and so fulfil a similar ecological role to the sparrowhawk in woodlands. The present evidence suggests that the future of merlins is closely tied to the amount and quality of moorland habitat available, as meadow pipits are by far their most important prey, and these are most abundant on such areas. What is unknown, at present, is the average size of hunting area required by a pair, and the minimum number of pairs needed to sustain a viable population.

Interestingly, the studies in Wales and Northumberland have suggested that even extensive conifer forest may have relatively little impact on the breeding density of merlins, provided that large areas of moorland remain in the vicinity of forests. Such forests do reduce the amount of potential moorland foraging habitat, but may provide a food source early in the breeding season, at a time when moorland prey are scarce. Some planted land may not have been heavily hunted by merlins prior to afforestation, because it was heavily grazed and held

relatively low prey densities. This may explain the patchy distribution of merlins in some areas. Nevertheless, large conifer forests which lack adjacent moorlands are unlikely to be attractive to merlins.

Nest sites

Ground nesting opportunities on heather moors will only be limited when heavy grazing or burning reduces the height of heather over extensive areas. On moors managed well for grouse there should always be sufficient long heather, and the area around traditional merlin nesting sites should be left unburnt. Ground-nesting may well persist on heather moors that are kept, even when tree nesting opportunities are present. But where predator control is insufficient to reduce mammalian predators and their impact on nests, merlins may gradually switch to tree-nesting if suitable sites become available. However, effective keeping reduces crow numbers, hence tree-nesting opportunities may not always exist.

Along the edges of conifer forests crows invariably breed at higher densities than merlins. So each merlin pair will be able to select a suitable nest from a number of crow territories. Thus, along forest edges merlins may well be more mobile than at traditional ground sites, because of the need to move between crow territories to find a suitable nest. As few conifer forests lack crows, most will provide old nests suitable for merlins.

This is supported by work in Kielder Forest where 150 artificial crow nests were provided 500 m apart along forest edges (Little and Davison, 1992). None was used for nesting, although merlins did breed along these edges, but in natural crow nests. This indicates that the provision of artificial nests for merlins in forests is unnecessary, except in special circumstances where trees are present but not crows and magpies and their old nests (Rebecca *et al.*, 1991).

Throughout the merlin's range in Britain, it is probably only on extensive, treeless grass moors that breeding density and/or range is limited by a lack of nest sites. Merlin breeding densities are lower in this habitat, whereas potential bird prey appears to be almost as abundant as on heather moors. So, the planting of trees on grass moors may well give merlins the opportunity to extend their breeding range, provided that a balance is maintained between forest and open ground.

Disturbance and forestry operations

Merlins breed in secluded areas where human disturbance associated with recreational activities is unlikely to be a major problem. Forestry activities close to merlin nests may disrupt parental activity, leading to nest desertions or reduced productivity. Whenever possible, it is recommended that disturbance-free zones should be established around active nests from April to July (inclusive). These

should measure 300 m radius around ground nests and 200 m radius around tree nests in conifers (Petty, 1987). However, the main problem in implementing this advice is that merlin nests in conifers can be extremely difficult to locate, even for experienced merlin workers (Little and Davison, 1992). Most nests along forest edges are within 100 m of the forest/moorland edge, but others can be up to 2.5 km into the forest (Figure 5).

Clear-felling has the potential to destroy or cause unacceptable disturbance to merlin nests. Therefore, it is important that an experienced person should check areas that are to be clear-felled during the breeding season (April-July) for signs of active merlin nests, particularly areas that have been used for nesting in the past. Signs to look for occur around plucking posts on boulder tops, fence posts and in trees, where feathers plucked from prey accumulate together with pellets and white droppings from the adult birds.

To ensure that sufficient breeding habitat is available for merlins, trees old enough for crows to breed in should be available in every 1 km along forest/moorland edges, as this is about the closest that merlins will nest to each other in many forests. In Wales there was some indication that merlins were more productive when nesting in younger (thicket-stage) crops than in older ones, probably because the dense crowns provide more protection from the weather and avian predators (Parr, 1992).

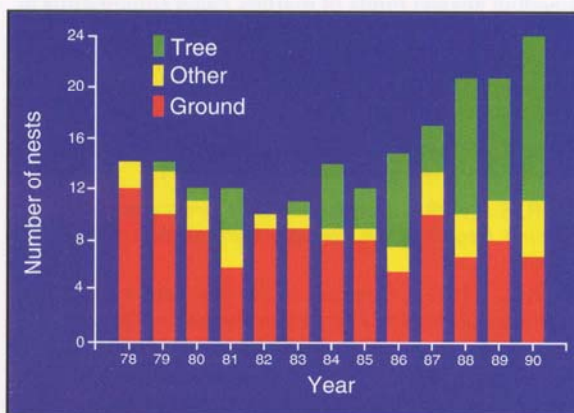


Figure 4. The number of merlin nests located annually in Kielder Forest, Northumberland (Little and Davison, 1992; and unpublished data). Prior to 1979, all merlins bred at traditional sites. After 1979 the number of ground nests slowly declined while the number in crow nests at the forest edge increased. Ground = traditional nest site on the ground in heather; Other = traditional heather nest sites, but in a tree nest; Tree = crow nest in a conifer along the forest edge.

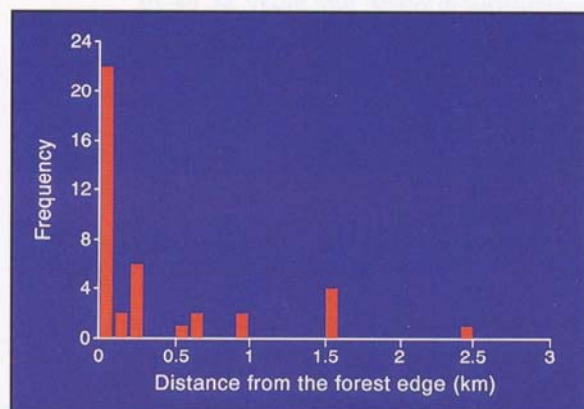


Figure 5. The distance of merlin nests in trees from the forest/moorland edge in Kielder Forest during the period 1979/1990 (Little and Davison, 1992; and unpublished data)

Further research

There are four priorities for further research to provide a better understanding of the relationship between merlins and forestry.

Foraging habitat use

It is poorly understood how merlins use foraging habitat, and whether open areas within forests are used. Large clear-felled

areas in the northern uplands hold substantial meadow pipit populations, together with other potential song-bird prey. The only way to quantify the use of these areas by merlins would be with a radio-tracking study. It would also provide a better insight into how and where merlins obtain their woodland prey.

Home range size

A radio-tracking study would also provide information on the size of hunting area required by a pair of merlins. This has important implications when recommending the amount of open ground needed to support both a pair and a viable population of merlins.

Forest nesting

It is important to establish whether forest nesting is commonplace in other areas, particularly in north and east Scotland where much high quality heather moorland is present.

Population dynamics

Much is known about the breeding performance of merlins but little about the survival of juveniles to first breeding or the survival of adults in Britain. Without these data, it is impossible to calculate accurately the number of chicks that need to be reared to replace adult losses. Previous studies have assumed that 2.5/2.6 chicks per pair per year need to be reared to maintain numbers (Bibby, 1986). These estimates are based on inadequate data as many British populations produce fewer than this, and yet are now increasing or stable (Figure 3). The only way to obtain these data is by ringing chicks, and marking and recapturing adults over a series of years.

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