

The lynx in Britain's past, present and future

Experience from other European countries shows that a well-planned lynx reintroduction could bring both ecological and economic benefits to the human-modified landscapes of Scotland.

DAVID HETHERINGTON

The calls to reintroduce Britain's extinct mammals have been born of an eagerness to repair the damage done by our ancestors and to restore the missing ecological functions these species performed. Scientific and public discussion of species restoration in Britain has continued to intensify, but until very recently, the Eurasian lynx *Lynx lynx* was often overlooked in favour of other species, especially the wolf *Canis lupus*, largely because of the lynx's rather obscure history in Britain. However, developments in palaeontology, in particular the use of radiocarbon dating, are beginning to paint a much clearer picture of the species' historical occurrence and extinction in Britain. This, along with environmental and societal changes that have occurred in the British countryside, means that a stronger case for lynx reintroduction can now be built.

The history of the British lynx

We know from bone evidence recovered from limestone caves that the Eurasian lynx once roamed Britain from the south coast to the north coast. These bones now tell us that the species survived in North Yorkshire until at least the 6th century AD.¹ Cultural and linguistic evidence further suggest that the species was being hunted in the Lake District during the 7th century AD, and that the Gaelic inhabitants of the Scottish Highlands were still observing its movements into later medieval times. These faint traces of Britain's lost cat are significant in that they point the finger of blame for the species' extinction, not at natural climatic processes which occurred millennia before, but instead at the activities of humans. Under these circumstances, there is an ethical argument for considering reintroduction.

The lynx is a solitary ambush hunter requiring large areas of cover from which to launch a surprise attack on small ungulate prey, such as roe deer *Capreolus capreolus*. It cannot tirelessly run down its prey in open habitats in the same manner that a pack of wolves can. The very severe deforestation carried out over the centuries by Britain's human inhabitants, not only removed the cover that the lynx required, but also led to the depletion of the woodland deer that formed the lynx's prey. Remnant forests were grazed with high densities of domestic livestock by subsistence farmers, thus placing enormous pressure on dwindling woodland



'The Lynx back in Harz.' The lynx is used as a key marketing symbol for the visitor economy of Germany's Harz mountains.

Photo: Harz National Park

deer populations. Lynx would have had little choice but to prey on sheep and goats, and that transgression would have been the final nail in its coffin. The eastern Grampians are likely to have been the last area of Britain to support lynx, as this landscape was last to relinquish its tracts of forest and never entirely lost its roe and red deer *Cervus elaphus*.

Why consider reintroducing lynx?

International treaties, such as the Bern Convention (1979) and the Rio Convention (1992), oblige the UK to encourage the restoration of populations of native species, while the EC Habitats Directive (1992) obliges the UK to consider the desirability of reintroducing such former British natives as the beaver *Castor fiber*, bear *Ursus arctos*, wolf and Eurasian lynx. Guidelines on reintroductions drawn up by the IUCN state that the factors responsible for a species' extinction should no longer be operating, if it is to be considered for reintroduction.² Britain, and in particular Scotland, witnessed a sudden and large-scale process of reforestation during the twentieth century, as well as the problematic growth and spread of woodland deer populations, both native and exotic. Research I carried out for my PhD suggests that environmental conditions over much of Scotland today are suitable for lynx.³ Forest cover is now sufficiently extensive, well connected and stocked with suitable prey populations that a viable population of lynx could survive in

mainland Scotland north of the Central Belt. A smaller, less viable population could exist in the Southern Uplands and extend across the border into the English portion of Kielder Forest.

The lynx as a hunter of deer

The obvious ecological function of most large carnivores is to kill and eat large herbivores. Lynx focus on the smallest species within an ungulate community and right across its huge range from Western Europe and Siberia, the roe deer is the single most important prey species for the lynx. They are, however, capable of taking larger ungulates, and regularly do so, especially in areas where roe deer are scarce or absent. In Finland, lynx hunt introduced white-tailed deer *Odocoileus virginianus*, while right across northern Scandinavia they prey on semi-domesticated reindeer *Rangifer tarandus*. In the forests of Eastern Europe, lynx often take red deer hinds and calves, while in the Jura Mountains and in the Alps, they frequently take chamois *Rupicapra rupicapra*. In Scotland, roe deer are especially well distributed, occurring in every 10 km square on the mainland, usually at higher densities than those found in lynx-inhabited regions of Europe. Red deer and sika deer *Cervus nippon* are both widespread and numerous in forest habitats in the Highlands, as well as in parts of the Southern Uplands. Given that Polish red deer are considerably larger than Scottish woodland red deer, and that chamois are around the same size as introduced sika deer, then a lynx population in Scotland would certainly encounter an abundance of prey throughout the habitat available to them. Scotland's deer populations are controversial and their browsing and grazing causes problems and can inflict costly damage on forestry, agricultural and natural heritage interests. It has been argued that Britain's deer populations have recovered too well from their historical suppression and that they are out of balance with their environments. It has also been suggested that the return of Britain's native top predators could bring about a reduction in deer populations, thus instilling a more harmonic balance. In some parts of Europe, such as in Norway and eastern Poland, lynx do exert a control on roe deer populations, but densities of roe are much lower there than those encountered in most of Scotland. It is likely that Scottish deer populations have grown too far to be controlled by a reintroduced lynx population. However, experience from areas where lynx occur in forests with high ungulate densities, such as in the Swiss Alps, shows that lynx can have a significant impact by changing the behaviour of its prey.^{4,5}

Large carnivores had been absent in Switzerland for around a century before lynx were reintroduced in the 1970s. Prior to the lynx population expanding into new areas, both chamois and roe deer occurred at especially high densities at favourable sites, usually where food was abundant. Colonising lynx would exploit these clusters by repeatedly targeting the naïve prey time and time again. The home ranges of colonising lynx were far smaller than those of lynx in the more established core of the population, because all their prey requirements were being met in a much more concentrated area. After a while, sustained lynx predation brought about considerable local decreases in both chamois and roe densities. After about five years, the remaining chamois and roe had developed stronger anti-

predator behaviour and had become much more evenly distributed through the landscape. The lynx responded by greatly expanding their home ranges. If, as in Switzerland, lynx in Scotland focus their predation on those areas that support the highest concentrations of deer, they could bring about a substantial reduction in localised deer densities by changing deer behaviour. Young conifer plantations and areas of naturally regenerating woodland often attract high densities of roe deer and are vulnerable to browsing damage, while thicket stage plantations often harbour high densities of sika deer which can have dire economic consequences for forestry. It is quite feasible that lynx could focus their feeding on areas as compact as a young conifer plantation. One female lynx with kittens in the Swiss Jura Mountains, spent several months in one area of windfall woodland, killing roe deer after roe deer, while a male lynx spent almost a year in 4 km² of woodland on the edge of Zürich, where it killed 40-50 roe deer.⁶

So by restoring lynx, we would be restoring predation on our deer populations, something that, for centuries, has only been achieved by humans with rifles or opportunistically by the odd fox *Vulpes vulpes* or eagle. By killing a deer a week all year round, and leaving what it doesn't eat on the forest floor, including meat, bones and rumen, the lynx also regularly provides food for other species in a way that humans and the opportunistic predators tend not to do. A study in a Norwegian forest found a greater abundance and richer diversity of beetles around a roe deer carcass than elsewhere in the forest.⁷

The function of deer predator could also be performed by our other two missing large carnivores, the wolf and the brown bear. The lynx, however, has several advantages over these two other species, which I believe make it a more realistic candidate for reintroduction. The first of these, and perhaps the most fundamental, is that it is easier for human populations to live alongside it. At around 20kg, the lynx is not a threat to human safety and is not perceived as such. Its relatively small size and its extreme wariness of humans have resulted in no recorded attacks by lynx on people in Europe. Bears are much larger and wolves hunt in packs so that humans tend to perceive these species as a much greater threat to their own safety than lynx. Furthermore, the evidence from Europe shows that lynx cause far fewer problems with livestock than wolves and bears do. In areas such as the Slovakian and Romanian Carpathians where all three species occur in good numbers, the shepherds are most concerned about the depredations of wolves and bears. The measures the shepherds employ to protect their sheep from wolves and bears are extremely effective at limiting losses to lynx, which are negligible.

Another advantage of lynx reintroduction is the greater level of technical experience and advice to call upon. Other than one project in Georgia on the very fringes of Europe, the wolf has not been subject to a European reintroduction project. It has instead relied on its impressive dispersal ability to return to some of its former haunts in Scandinavia, Germany, France and Switzerland. The bear has been the subject of restocking projects in France, Italy and Austria, but always to areas where they already occurred, albeit in very low numbers. On the other hand, a series of lynx reintroduction projects has taken place since the early 1970s in

areas of Switzerland, France, Germany, Italy, Austria, Slovenia, Poland and the Czech Republic from where the species had been totally extirpated. Not all of these projects have been successful, but useful lessons can be learnt from the failures as well as the successes. The successful projects have seen the return of the lynx to several human-modified landscapes of western and central Europe, most of which have far higher human population densities than are encountered in either the Scottish Highlands or the Southern Uplands.

The human dimension

Perhaps understandably, a human population unused to living alongside large carnivores will have concerns about their return to the countryside. It is essential for the success of a reintroduction that all sectors of the rural community are involved and allowed to contribute to discussions about the project. A lack of public involvement in the governmental project to reintroduce lynx in Switzerland in the 1970s led to a sense of disenfranchisement, particularly among sheep farmers and hunters. As a result, the illegal killing of lynx in Switzerland still regularly occurs and is a significant source of mortality for the lynx population there.

Those people who are most unfamiliar with lynx may be unclear about their size and habits, and assume that lynx pose a physical threat to them. The dissemination of good quality information on the species is essential to prevent the formation of myths and public concerns about safety should be straightforward to allay.

The interactions of lynx with wildlife and livestock

Gamekeepers and conservationists alike may be concerned about potential impacts on wildlife. Their reluctance to stray far from cover means that lynx are most unlikely to make a nuisance of themselves on the open expanses of the grouse moors. There are, however, likely to be concerns expressed about the effect that lynx would have on threatened populations of the forest-dwelling capercaillie *Tetrao urogallus*. It is true that in the boreal landscapes of Scandinavia and Russia where deer densities are very low, and where woodland grouse are abundant, lynx supplement their diet with capercaillie. However, in western and central Europe where deer are much more abundant and where capercaillie densities are typically much lower, capercaillie is a very rare feature of lynx diet. An intensive 10-year study of the diet of 29 lynx in the Swiss Jura Mountains, where capercaillie are more abundant than in the Scottish Highlands, recovered the remains of 617 individual prey animals using snow-and radio-tracking.⁸ As expected, roe deer and chamois represented the bulk of the remains, but in the 10 years of the study, only one capercaillie was found to have fallen prey to the local lynx population. Interestingly, 37 foxes also fell prey to the lynx in the study. Aside from killing large herbivores, large carnivores also frequently kill smaller carnivores. I suspect that 37 foxes would have a greater negative impact on the local capercaillie population than the loss of the one bird attributable to the lynx. Lynx very occasionally kill wildcats *Felis sylvestris*, and one was recorded in the Swiss study. It could be argued that feral cats *Felis catus*, which pose the most serious threat to wildcat populations through

interbreeding, are at a relatively greater risk of predation by keen-eyed lynx, because domestication has dulled their anti-predator behaviour and robbed most of them of the camouflaged pelage of their wild cousins.

A central aim of discussions of reintroducing lynx to Scotland should be to allay the fears of farmers that lynx will ignore the ample deer in favour of even more ample livestock. Lynx don't kill calves, but attacks on sheep, particularly lambs, are known from several European countries. It is important, however, to put this in perspective. As already mentioned, levels of lynx depredation on sheep in the Carpathians, where livestock-guarding dogs and intensive shepherding are employed, are negligible in number. The opposite end of the scale is the rather unique situation encountered in Norway, where no protective measures are taken, but where 2.5 million sheep are grazed free-range and unshepherded during the summer in forested habitats, where the lynx occur.⁹ Densities of roe deer are very low, and sheep are many times more abundant and even replicate roe deer behaviour by occurring singly or in small groups, and not in flocks. This scenario results in the loss to lynx of round 6000 sheep, mostly lambs, each year, and nearly every lynx is killing sheep. Despite their relative scarcity compared to sheep, however, the most common lynx prey species is still the roe deer. Unlike Norway, the vast majority of forest in Scotland contains no sheep, and the vast majority of sheep are grazed in open habitats. A far more likely scenario for Scotland is the one that occurs in the Jura Mountains and Alps of France and Switzerland. Just as in Norway, very few anti-predator measures are adopted, but the major difference is that the sheep are grazed in open pasture. Here, only a small number of lynx within the population kill sheep, and only at very specific locations or 'hotspots'.

Numbers of sheep killed or wounded by lynx in the French Jura vary from around 100-400 each year, but studies have shown that more than 70% of attacks occurred in nine small hotspots representing 1.5% of the area affected by lynx attacks.^{10,11} The majority of affected sheep flocks in the French Jura experience only a very low level of depredation, i.e. 1-2 attacks per year. In the Swiss North-western Alps, 350 of the 456 (77%) sheep pastures experienced no incidences of depredation by lynx in 20 years.¹² A further 15% experienced only one incidence of depredation during this time. The distance of the pasture from woodland or scrub has a strong bearing on levels of depredation. In the Swiss Alps, 88% of lynx kills occurred within 200m of the forest edge, and 95% within 360m. Sheep less than one year old are more susceptible than older sheep, with 78% of those killed falling into this age group. Of those sheep owners who lost livestock in the Swiss Alps from 1979-1999, 80% lost three or fewer sheep during this period. In the French Jura, it was discovered that shooting a nuisance lynx would often solve the problem for a few months, but that ultimately a new lynx would take over the home range of the dead lynx and sheep depredation would commence once again. In these circumstances it is clear that site-specific, environmental factors are determining the likelihood and extent of depredation.

In this last scenario, most lynx depredation occurs to a geographical pattern and to an extent is predictable in its location, allowing steps to be taken to manage the



A donations box in Harz National Park at a hotel which lies next to an enclosure where two lynx are kept. The two lynx were considered unsuitable for reintroduction and so give visitors a chance of seeing the animal they have heard so much about. The hotel owner advertises his hotel as being "with lynx enclosure" and is grateful for the extra custom that the lynx bring to his establishment. He encourages his customers to put money towards the conservation of the lynx in the National Park.

Photo: David Hetherington

problem. The grazing of sheep, particularly lambs, away from the forest edge reduces the risk considerably. The pattern of hotspots and problem individuals, which affects only a small number of sheep flocks, also allows a targeted response. Problem lynx repeatedly taking sheep can be shot under licence, while those hotspots that appear to be predisposed to depredation by a succession of lynx, justify the use of more costly protection measures. The use of shepherds, or guarding animals such as livestock-guarding dogs, donkeys and llamas are all recommended for reducing lynx depredation of sheep, and are most cost effective where there is an acute problem such as at hotspots. Recently in Switzerland government funds have been used to reduce conflict between lynx and sheep farmers by encouraging changes in animal husbandry, subsidising protection measures and compensating for losses. This has been effective, with the annual number of lynx-killed livestock in Switzerland dropping year by year from a high of 219 kills in 2000 to just 36 in 2005.¹³

The economic opportunities

The tourism economy is especially important in Scotland's remote, rural areas. The wildlife tourism sector in particular is expanding quickly and is likely to continue to do so, with over 3000 people now directly employed within the sector.¹⁴ Large carnivores have the potential to bring economic benefits to rural areas through visitors and tourists, either directly, as people seek opportunities to catch a glimpse of such charismatic species, or indirectly, by acting as a powerful icon of wilderness. Large-carnivore tourism is being developed in several areas of Europe, and since the reintroduction of the lynx to the Harz National Park in Germany in 2000, authorities and businesses have moved quickly to utilise the lynx as a marketing tool. On the German tourism agency's web-site, potential visitors to the Harz Mountains are invited to experience "Incredible wilderness in the Kingdom of the Lynx".¹⁵ Images of lynx are also used extensively on brochures, posters, t-shirts, books and signs promoting the park, and visitors are lured by the possibility of glimpsing a lynx and by an increased perception of the area's wildness. By being similarly marketed in Scotland, especially to UK visitors who represent the leading

market for Scottish tourism, reintroduced lynx could bring real economic benefits to remote rural areas. The chairman of the national tourism agency, VisitScotland, recently stated that he felt that discussion of the reintroduction of large carnivores to Scotland was a "hugely positive development".¹⁶ Another advantage of the human fascination with charismatic large carnivores is that there exists a much greater potential to attract sponsorship from private sources. If marketed prudently, a lynx reintroduction project could attract considerable funding which would otherwise not be available to nature conservation, thus considerably reducing the need to divert limited funds away from extant conservation priorities.

Lessons from the sea eagle

Encouragingly, we already have a template in this country for the successful assimilation of a reintroduced and iconic large predator into the rural economy. Persecuted to extinction as vermin, the white-tailed eagle *Haliaeetus albacilla* is now highly valued and jealously protected by the islanders of Mull despite the odd lamb being taken now and then. These losses to the local economy are more than offset by the considerable revenue brought to the island by wildlife tourists who come to see the thriving eagle population. The Mull Eagle Scheme recently launched by Scottish Natural Heritage offers financial support to hill sheep farmers who manage their lambs in a way that reduces the likelihood of predation by the eagles.¹⁷ Furthermore, the scheme rewards farmers who improve habitat and help safeguard the eagles by monitoring their nests. It is this kind of positive agri-environmental funding which could permit the painless absorption of lynx into the human-modified landscapes of modern Scotland.

Conclusion

Extrapolating current trends in afforestation, deer abundance, agri-environmental spending, and public attitudes towards wildlife and the environment, would seem to indicate that conditions are likely to become more and more favourable for lynx reintroduction in Scotland. Indeed it is possible that the reintroduction of Eurasian lynx to Scotland, in addition to restoring natural processes in the forest ecosystem, may actually bring economic opportunities in rural areas. Despite the suitable ecological conditions, reintroduction of lynx in Scotland will only succeed in the long-term if the human population is closely involved and is willing to co-exist with lynx.

References

- 1 Hetherington, D.A., Lord, T.C., & Jacobi, R.M. (2006) New evidence for the occurrence of Eurasian lynx (*Lynx lynx*) in medieval Britain. *Journal of Quaternary Science*. 21: 3-8.
- 2 IUCN (1998) *Guidelines for Re-introductions*. Prepared by the IUCN/SSC Re-introduction Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK.
- 3 Hetherington, D.A. (2005) *The feasibility of reintroducing the Eurasian lynx (Lynx lynx) to Scotland*. PhD thesis. University of Aberdeen.

4. Haller, H. (1992) Zur ökologie des Luchses (*Lynx lynx*) im Verlauf seiner Wiederansiedlung in den Walliser Alpen. *Mammalia depicta*, 15, 1-62.
5. Breitenmoser, U. & Haller, H. (1993). Patterns of predation by reintroduced European lynx in the Swiss Alps. *Journal of Wildlife Management*, 57, 135-144.
6. U. Breitenmoser, personal communication.
7. Melis, C., Teurlings, I., Linnell, J.D.C., Andersen, R. & Bordoni, A. (2004) Influence of a deer carcass on Coleopteran diversity in a Scandinavian boreal forest: a preliminary study. *European Journal of Wildlife Research* 50:146-149.
8. Jobin, A., Molinari, P. & Breitenmoser, U. (2000). Prey spectrum, prey preference and consumption rates of Eurasian lynx in the Swiss Jura Mountains. *Acta Theriologica*, 45, 243-252
9. Odden, J., Linnell, J.D.C., Moa, P.F., Herfindal, I., Kvam, T. & Andersen, R. (2002) Lynx depredation on domestic sheep in Norway. *Journal of Wildlife Management*, 66, 98-105.
10. Stahl, P., Vandel, J. M., Herrenschildt, V. & Migot, P. (2001) The effect of removing lynx in reducing attacks on sheep in the French Jura Mountains. *Biological Conservation*, 101, 15-22.
11. Stahl, P., Vandel, J.M., Ruette, S., Coat, L., Coat, Y. & Balestra, L. (2002) Factors affecting lynx predation on sheep in the French Jura. *Journal of Applied Ecology*, 39, 204-216.
12. Angst, C., Olsson, P. & Breitenmoser, U. (2000) *Übergriffe von Luchsen auf Kleinvieh und Gehegetiere in der Schweiz - Teil I: Entwicklung und Verteilung der Schäden*. Bericht 5. KORA, Muri.
13. KORA web-site. Lynx and livestock damage statistics for Switzerland.
<http://www.kora.unibe.ch/en/proj/damage/damagemain.html>
14. A & M [Training & Development] (2002) *Review of Wildlife Tourism in Scotland: main report*. The Tourism and Environment Forum, Inverness.
15. <http://www.germany-tourism.de/e/6293.html>
16. Lederer, P. (2002) Living dangerously will whet tourists' appetite. *Scotland on Sunday*, 30th June 2002.
17. Scottish Natural Heritage (2004) *Mull Eagle Scheme*. SNH, Battleby.

David Hetherington recently completed a PhD at the University of Aberdeen which examined the feasibility of reintroducing the Eurasian lynx to Scotland. He now works as Ecology Advisor for the Cairngorms National Park Authority. The views expressed here are his own. davidhetherington@cairngorms.co.uk