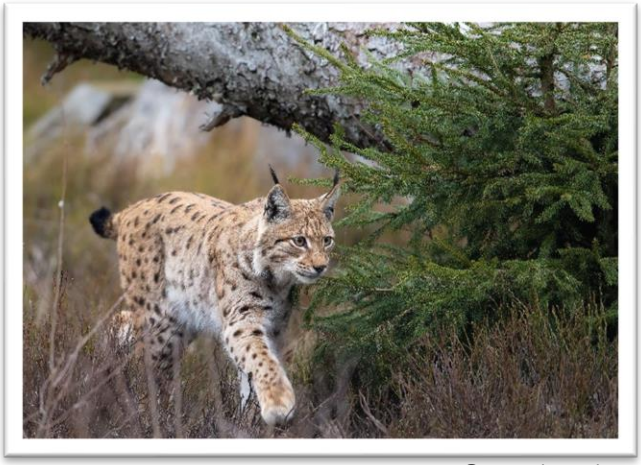
RESEARCH SUMMARY:

ASSESSING WHETHER REINTRODUCING EURASIAN LYNX TO BRITAIN IS ECOLOGICALLY FEASIBLE

THE MISSING LYNX PROJECT

A summary of the original technical report by Dr Joe Premier, Dr Deborah Brady, Dr Hugh Robinson, Adam Eagle, Dr Julian Oeser, Prof Dr Stephanie Kramer-Schadt and Prof Dr Marco Heurich, *"Ecological feasibility of Eurasian lynx reintroduction to Britain".*

Context



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Eurasian lynx (*'Lynx lynx')* has been absent from Britain for hundreds of years, and by the middle of the 20th century lynx had also been lost from much of Europe.

Managed lynx reintroductions in Europe began in Central and Western Europe in the 1970s and over the following 50 years have further re-established populations of lynx in most European countries. These reintroductions offer a blueprint for a potential reintroduction of lynx in Britain.

Research aims

Several previous research studies have investigated whether there is enough suitable habitat for lynx in Britain (often focusing only on Scotland), concluding that there probably is. The aim of our research was to go further, examining in-depth whether a managed release of lynx in Britain could lead to a viable wild lynx population (i.e. one that survives and thrives for at least 100 years), and therefore whether lynx reintroduction would be 'ecologically feasible'.

Using advanced computer modelling techniques and the most recent and detailed data on both the lynxes' ecological requirements and Britain's

landscapes, we tested various scenarios for a reintroduction. The outcome of our work is a collection of information describing the ecological conditions under which a lynx reintroduction is likely to be successful.

The modelling

We constructed a computer model known as a 'spatially explicit individual-based population model' (or, 'IBM' for short). This type of model allows us to simulate how every released lynx moves, behaves, and uses the landscape.

Essentially, we created a simplified virtual Britain for simulated lynx to live and move about in. The simulated lynxes' lives are set by rules imposed in the model. Setting these rules relies on a good understanding of the ecology of the species (which we have from over 50 years of close monitoring of European lynx populations), and good knowledge of the landscape, especially the lynxes' preferred woodland habitat (which we have from satellite imagery and previous research studies).

But because lynx are currently absent from Britain and we do not have perfect knowledge of every aspect of the landscape, we have to make some assumptions. These include, for example, the availability of their main prey (roe deer), typical lynx breeding success, survival and death rates at different ages, habitat suitability for lynx, and barriers to lynx movement.

Making the assumption about habitat suitability required a specific approach. We actually used two different approaches in parallel, each named after the respective modelling method they originated from: a 'global' model and a 'local' model. These two model types have different strengths and limitations, and generate slightly different maps of habitat suitability. Given this, we always repeated our modelling using both the 'global' and 'local' derived habitat suitability maps.

The assumptions are otherwise all based on published information from Europe or, where possible, from Britain. We then tested these assumptions to understand how important they are to the overall predictions (i.e. how much the predictions would alter if our assumptions were under or overestimated). This shows us how robust the model's predictions are to variation in the assumptions and rules within it.

Alternative reintroduction scenarios tested

We tested different reintroduction scenarios by adjusting the location, timing, number and genetic diversity of lynx, and the ratio of females to males for a release.

The locations tested in Scotland followed the convention of locations tested in previous research so that our results would be comparable to what had been done before. For England and Wales we tested a release location in every habitat patch that was large enough, resulting in us testing a total of 10 locations across Britain (see list in Figure C).

As we were interested in how wild lynx would fare in Britain decades into the future, we also tested an alternative scenario of future woodland creation, to see whether this made much difference to the lynxes' long-term fortune.

Finally, we also tested how much of an effect any additional non-natural causes of lynx death (such as road traffic or train collisions, or illegal killing) had on the developing lynx population.

Criteria to judge ecological feasibility

The main criteria for judging ecological feasibility is whether there is at least a 95% chance of the population surviving at least 100 years (in other words, the chance of extinction is below 5% during this time). This is based on international guidelines for assessing wild animal population viability. We were also interested in the genetic health of the developing lynx population and the size of the population after 100 years.

Is lynx reintroduction to Britain ecologically feasible?

In a word, yes. The IBM showed that lynx reintroduction to Britain is ecologically feasible. To achieve this, ideally at least 20 'founder lynx' would be released in total, using lynx from diverse origins and with releases staggered over several consecutive years.

The Highlands of Scotland (Cairngorms), Northern England (Kielder Forest), and Southern Scotland (Galloway) would each be suitable release locations in isolation, with the first two maintaining genetic health slightly better than a release in Southern Scotland. Ideally, more than one of these release locations would be used together as this results in a healthier lynx population over time, but it is not essential.

If parallel releases are used, then the combination of Northern Scotland with Northern England (rather than Southern Scotland) results in a slightly better genetic composition in the resulting populations. This is because a lynx population released in Kielder Forest grows slightly faster than in Galloway, and the lynx are predicted to travel between Northern and Southern Scotland via a 'habitat corridor' lying east of the M74, where Kielder Forest is located. The best long-term solution for a British lynx population would therefore be a release in both the Highlands of Scotland and Northern England, although either location would work in isolation.

Previous research had suggested that in the region of 230-450 lynx could survive in the wild in Scotland, but our research suggests that about 200-250 lynx in Northern Scotland is more likely (based on a Cairngorms release), and around 50 lynx in Northern England / Southern Scotland (based on a Kielder Forest or Galloway release). These figures would likely increase if more woodland were created in future, but the amount we have currently is still sufficient for lynx.

What does this mean?

This means that, ecologically-speaking, lynx reintroduced to Britain in the Cairngorms, Kielder Forest, or Galloway would survive and develop into a healthy wild lynx population. There are many other factors to consider in the decision-making, but the ecological aspect is well-understood and looks positive.

The 'central urban belt' of Scotland is a significant barrier to lynx population development, which is partly why the ideal reintroduction scenario would include releases in both Northern Scotland and in Northern England in parallel.

Any isolated population has the potential to experience gradual decline in genetic health, but with a good genetic diversity among founder lynx, a British lynx population would fare much better after 100 years than some European populations have fared after 20-50 years post-release.

A reintroduced lynx population in Britain could be viable without future interventions (e.g. we would not have to release more lynx in future decades), but good conservation practice is to intervene if the population needs it.

Next steps

We are looking ahead to repeat this research for other potential release locations in Scotland and in due course, if it becomes apparent that lynx reintroduction could go ahead in Britain, use the model on specific proposed locations for lynx release. Following conversations with the local community it will be possible to refine the testing of the practical scenarios too (such as the numbers of lynx to be released and their sex ratio).

Where can I find out more?

This briefing note summarises a much more extensive and detailed scientific paper that is being prepared for submission to a peer-reviewed journal. An abridged 55-page version of this paper is available upon request.

There are several focus groups that will be presenting more detail and discussing potential reintroduction plans that you would be most welcome to attend. You

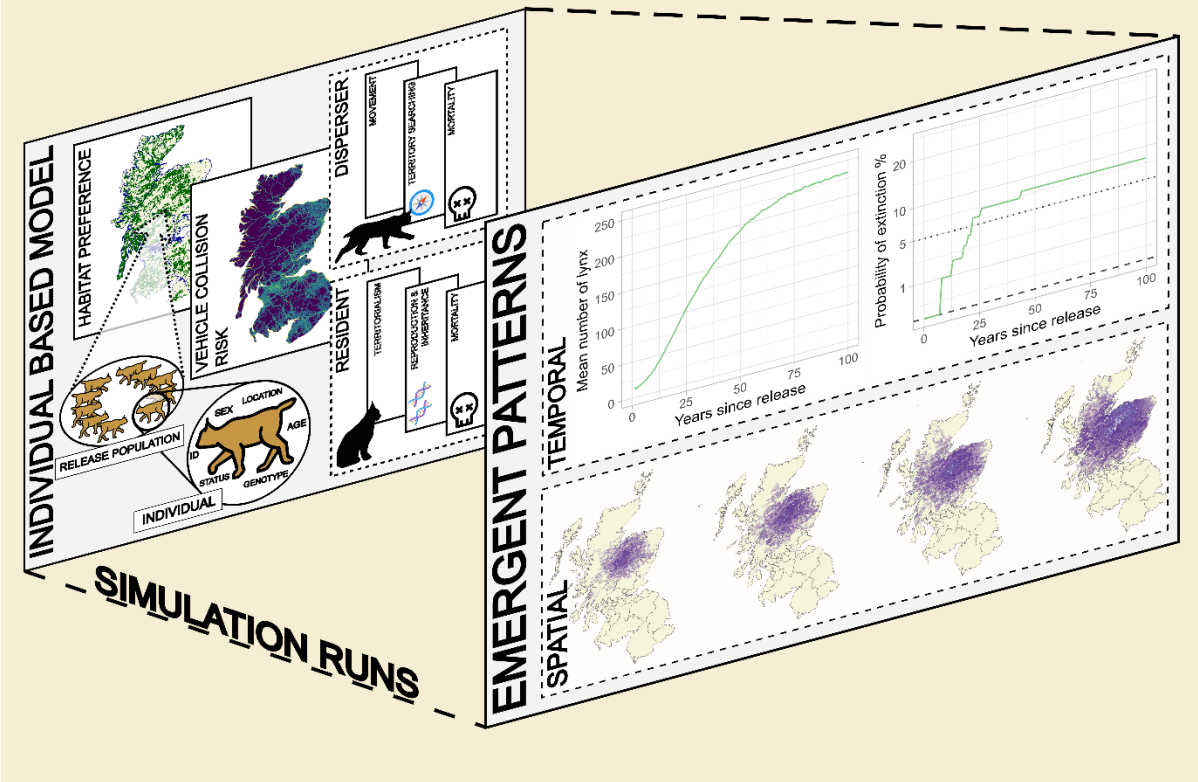
can register for these by emailing us. For all enquiries, or to register interest, please email **info@missinglynxproject.org.uk.**

Further reading on some of these topics can be found here

Premier *et al.* 2020. The boon and bane of boldness: movement syndrome as saviour and sink for population genetic diversity. Movement Ecology doi.org/10.1186/s40462-020-00204-y (IBM) ▪ Oeser *et al.* 2023. Integrating animal tracking datasets at a continental scale for mapping Eurasian lynx habitat. Diversity & Distributions doi.org/10.1111/ddi.13784 (lynx habitat suitability map) ▪ Bradfer-Lawrence *et al.* 2021. The potential contribution of terrestrial nature-based solutions to a national 'net zero' climate target. Journal of Applied Ecology doi.org/10.1111/1365-2664.14003 (future woodland cover data) ▪ International Union for the Conservation of Nature (IUCN) Standards & Petitions Subcommittee. 2019. Guidelines for using the IUCN Red List Categories & Criteria, v14. www.iucnredlist.org/documents/RedListGuidelines.pdf (population viability criteria)

Endorsements

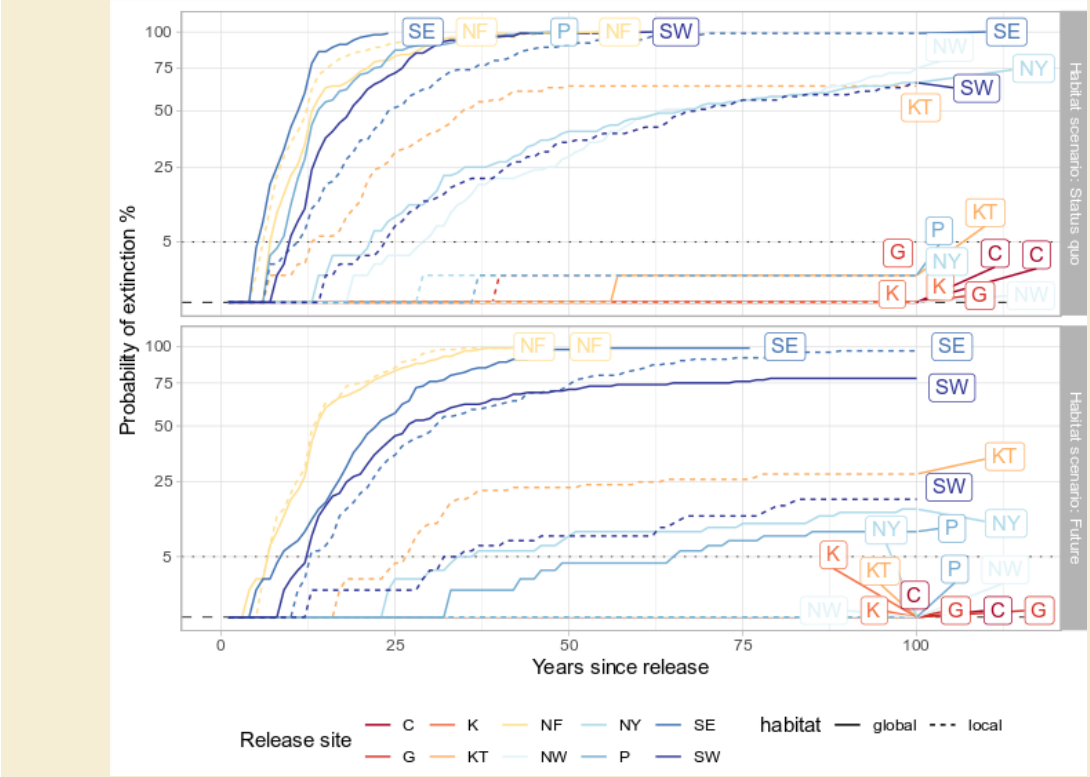
This research is not yet published in the scientific literature, however it has been reviewed and endorsed by experts in lynx ecology including Dr Urs Breitenmoser (Co-chair of the IUCN/SSC Cat Specialist Group), who commented: *"This is so far the most comprehensive feasibility study based on the most advanced modelling techniques and can be considered the ultimate ecological / technical assessment of the potential to reintroduce the Eurasian lynx into Great Britain."*

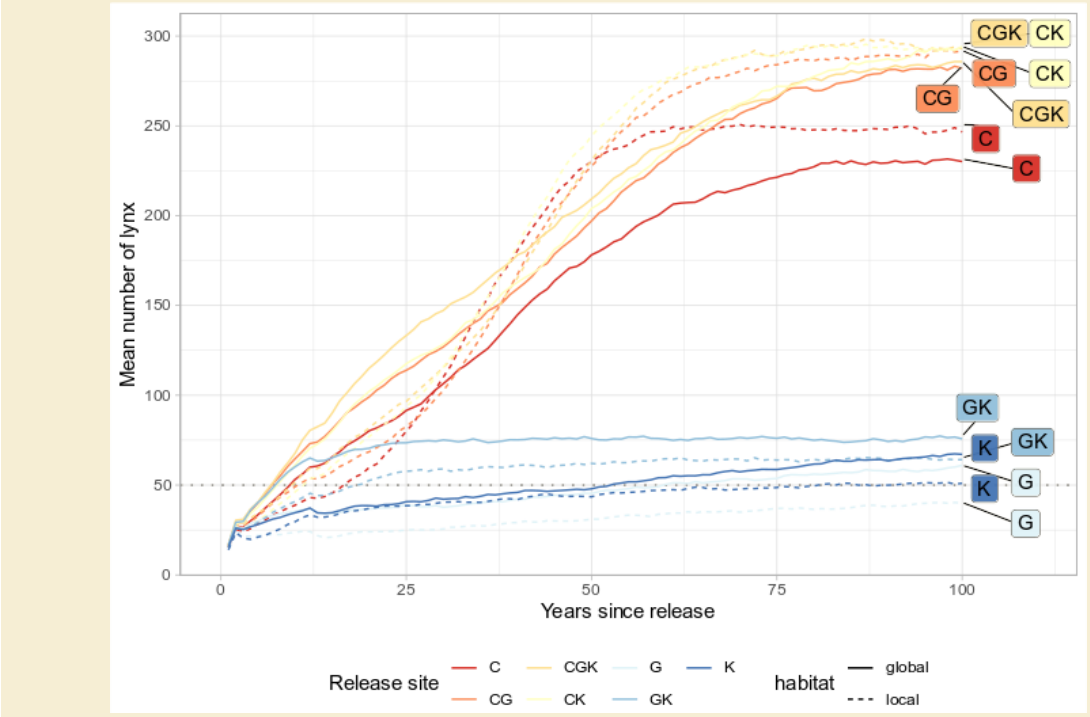


A. Simple representation of how the 'spatially explicit individual-based model' (IBM) works to predict how a population of reintroduced lynx in Britain might develop over time (here showing example of a release in the Cairngorms).

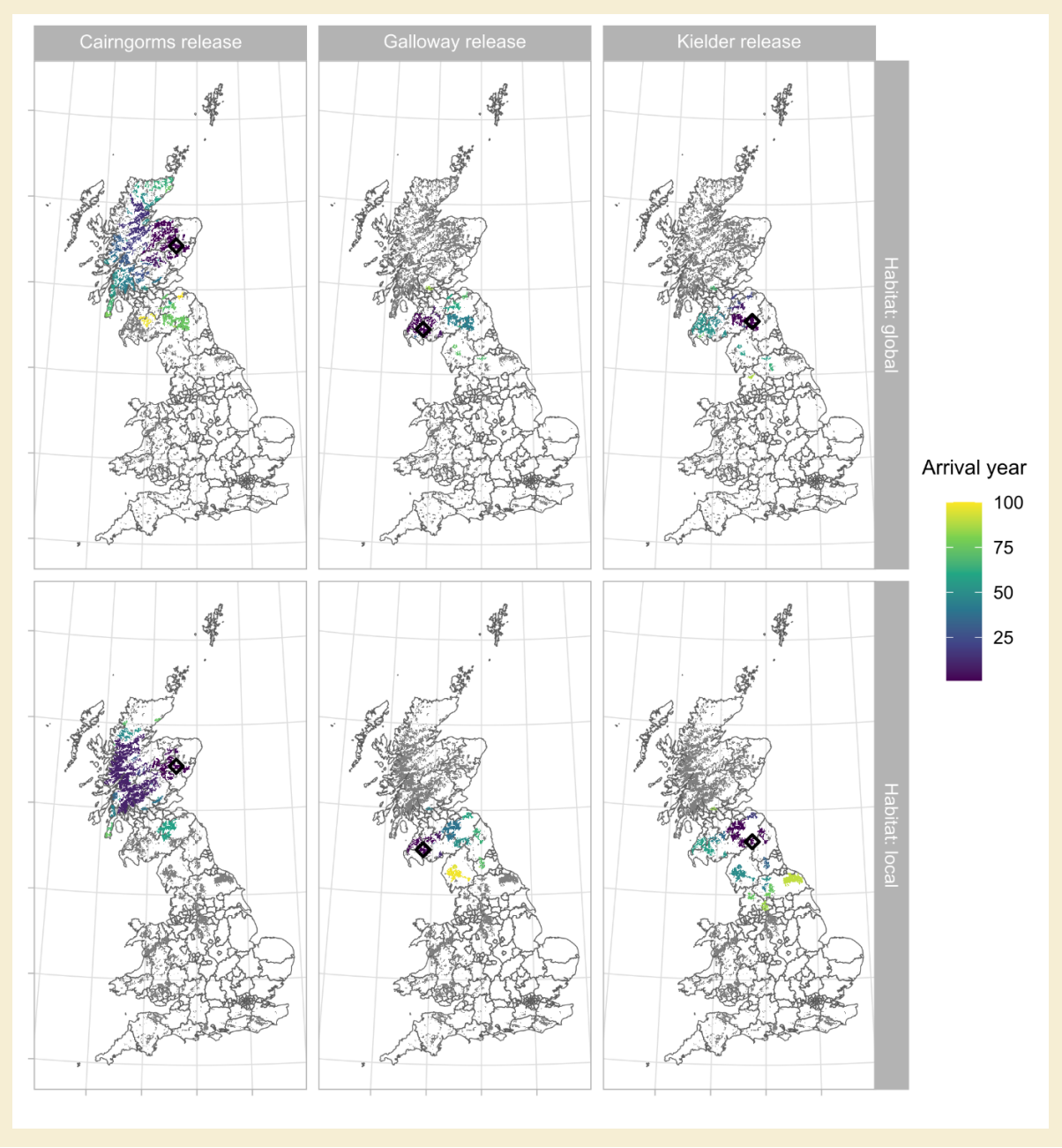
B. Summary of the lynx reintroduction scenarios tested.

Release location (or combination)	10 tested (3 Scotland, 5 England, 2 Wales)
Sex ratio (m : f)	1:1, 1:3
Number released	10, 20, 40
Years releases are spread over	2, 3, 6
Genetic diversity of lynx released	High, low
Habitat availability	Status quo, future woodland creation
Unnatural mortality	High, medium, low





C. Top: reintroduced lynx extinction risk for all ten locations (Cairngorms - C, Kielder Forest - K, New Forest - NF, North York Moors - NY, Southeast England - SE, Galloway – G, Kintyre – KT, North Wales - NW, Peak District - P, and South Wales - SW). Bottom: population growth from combinations of the three viable release locations.



D. Map of predicted lynx population development over time based on releases in Cairngorms, Galloway, and Kielder Forest.