Wood Wise

REINTRODUCING LOST SPECIES

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WOODLAND TRUST

WHY & HOW TO REINTRODUCE SPECIES FOR CONSERVATION

WILL BEAVERS RE-ENGINEER BRITAIN'S LANDSCAPE?

PINE MARTEN POTENTIAL AS GREY SQUIRREL BIOCONTROL

IMPORTANCE OF ENSURING BIOSECURE TRANSLOCATIONS

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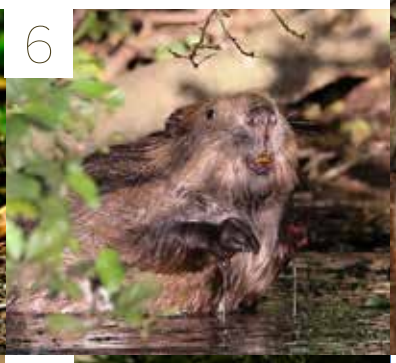

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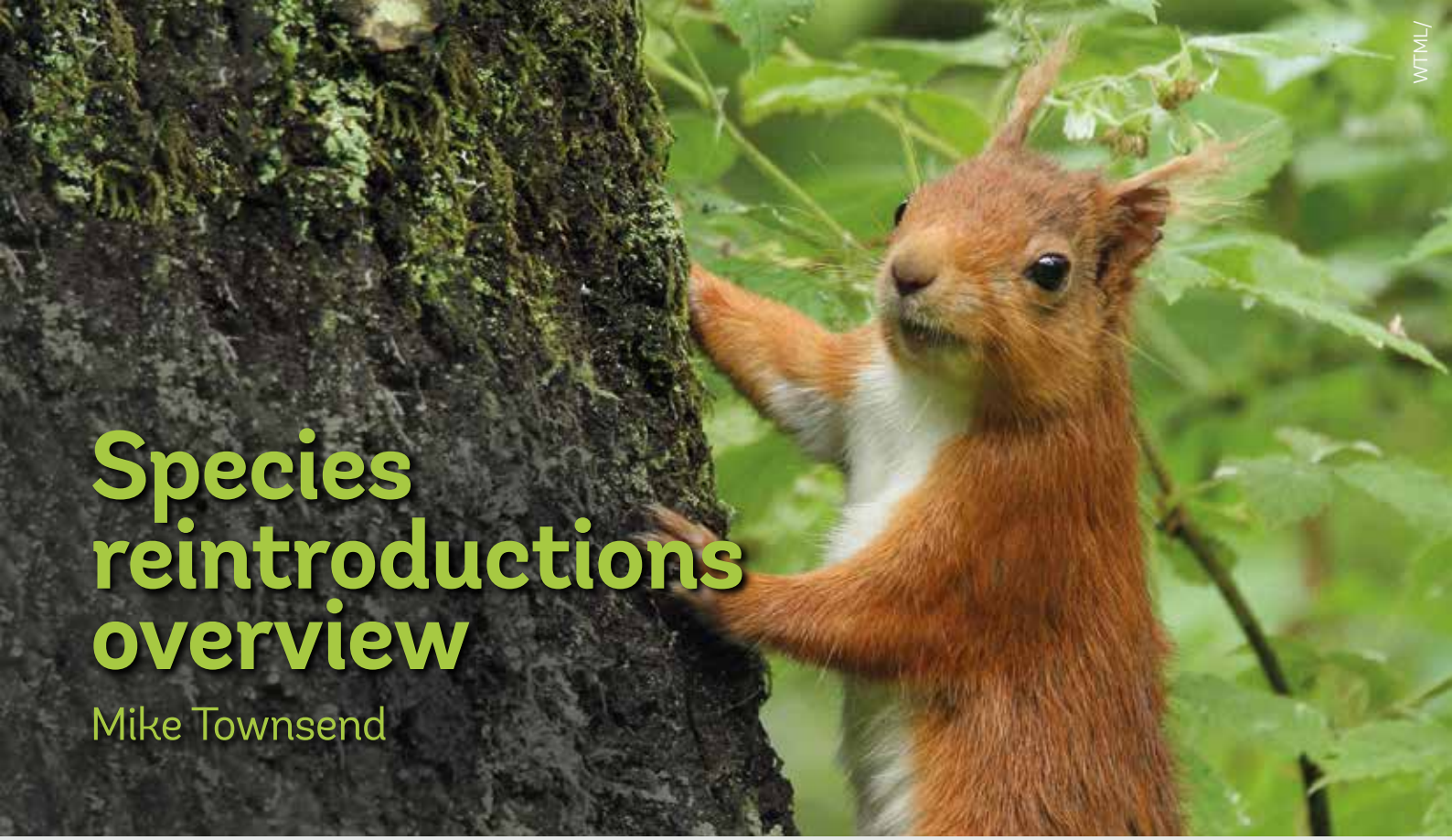


Species reintroductions overview

Mike Townsend

Red squirrels can benefit from pine marten reintroductions

There is a long history of humans moving species around for a variety of reasons, going back as far as the prehistoric translocation of animals for sources of food or trade. However, the movement of species for conservation purposes began towards the end of the last century.

Today, 'species reintroductions' and 'species reinforcements' for conservation objectives are increasingly seen as an important way to restore parts of the ecosystem that have been lost.

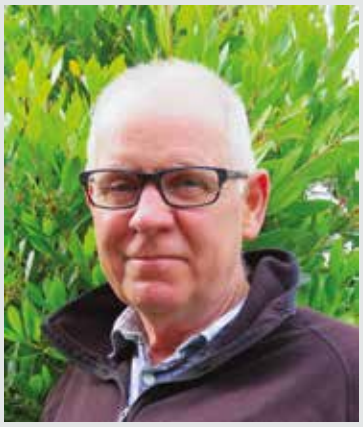
Among the spectrum of types of translocations, 'species reintroductions' are the reintroduction of a species within its native range from where it has previously been lost, with the aim of establishing a self-sustaining population.

'Species reinforcements' also represent a form of reintroduction within the native range of a species, where although some individuals may remain, they are felt to be too low in numbers or genetically too restricted to sustain a population. Together species reintroductions and species reinforcements can be regarded as 'population restorations'.

Why reintroduce species?

Species reintroductions may be of direct importance for the conservation of that species – when there is habitat loss in the current range or where establishment of a second population would increase the genetic resilience of a nearby population. In other cases they may be a keystone species in the functioning of a wider ecosystem; as a predator important for stabilising prey populations, an important part of the prey population for other animals, or in the way it impacts habitats and other species. For example, evidence shows the positive role reintroduced Eurasian beaver, *Castor fiber*, can have on the creation of wetland habitats that support greater numbers of invertebrates, amphibians, fish and birds (see page 6)[1].

Reintroduced species can also act as a focus for increasing public understanding of the broader ecosystem and for generating support for wider conservation measures. The reintroduction of pine martens, *Martes martes* to



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> Reintroduced species can also act as a focus for increasing public understanding of the broader ecosystem and for generating support for wider conservation measures.

mid-Wales by the Vincent Wildlife Trust (www.vwt.org.uk/) illustrates the critical role of a missing predator in stabilising prey populations, and the potential for red squirrel recovery through their predation of grey squirrels (see page 14).

The ecology and life cycle of pine martens also provide a way to communicate the need for woodland habitat restoration and connectivity across the landscape[2]. Pine martens need a well-connected habitat network of arboreal features – woods, well-formed hedges, riparian woodland and tree belts – to find food and denning locations, disperse from natal sites and establish new territories. This well-connected landscape is also vital for the conservation and adaptation of many other species including bats and small mammals, invertebrates and plants.

Learning lessons

There were early examples of successful species reintroductions, such as the red kite, *Milvus milvus*, in the UK during the 1980s. However, many initial attempts failed because of poor practices – numbers of animals released were too small, released captive-bred animals were unable to adapt to the wild, there was insufficient suitable habitat, continuing persecution, stress during translocation leading to increased mortality and so on. Lack of post-release monitoring made the situation worse, as reasons for failure were initially poorly understood and lessons were missed, so effective solutions were not implemented[3].

Pine martens return to Wales

Red kites successfully reintroduced to Britain

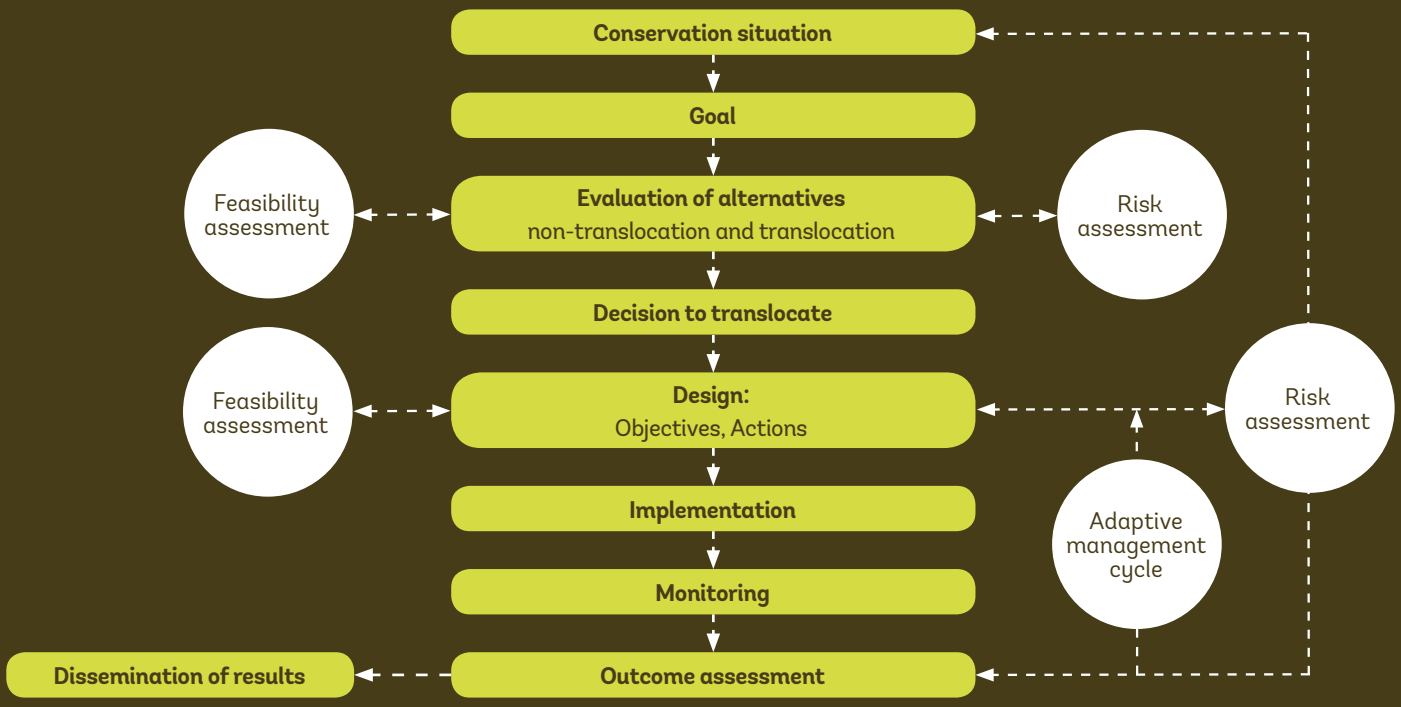
Successful reintroductions require careful planning and execution, and for some species a process of many years of release and monitoring. In 1998, as a result of inconsistent practice and failure of many early reintroductions, the World Conservation Union (now the International Union for Conservation of Nature, IUCN) set up a Reintroduction Specialist Group (RSG) and established a set of guidelines for reintroductions (updated in www.portals.iucn.org/library/efiles/documents/2013-009.pdf),[4] which are now widely adopted as best practice.

The guidelines require a full feasibility study of the planned reintroduction. This includes ensuring issues such as the reasons for the original extinction or depletion have gone or been substantially mitigated, that there is sufficient suitable habitat to support a population, there are no critical conflicts with other species or habitats, and that a robust source population exists to provide the animals or plants needed for the reintroduction.

Increasingly, modelling identifies how a reintroduced population might disperse through the landscape, where there are deficiencies in habitat or connectivity, which areas provide the best chances of success, where conflicts are fewest and where mitigation might be needed.

The conservation translocation cycle

Reproduced (with permission) from: IUCN/SSC (2013). Guidelines for Reintroductions and Other Conservation Translocations. Version 1.0. Gland, Switzerland: IUCN Species Survival Commission, viiii + 57 pp (https://portals.iucn.org/library/efiles/documents/2013-009.pdf).



Road casualties are a significant cause of mortality in pine marten and other species. Feasibility studies for release of pine martens in England and Wales have used modelling which combines habitat data with that for roads and traffic volumes. This helps to identify release sites where there is sufficient suitable habitat and a low density of roads and traffic volumes, giving the best chance for the founder population to survive and establish in sustainable numbers.

Engaging people

Critically, any feasibility for reintroductions should include a rigorous socio-economic appraisal and engagement with local communities and stakeholders. There are often concerns raised about reintroductions. Some are a result of a lack of knowledge of the species being reintroduced, but often there are genuine concerns and conflicts which need to be resolved or mitigated.

However, engaging people should not be seen simply as a way of smoothing delivery of the reintroduction, but as a genuine and important end in itself. It provides an opportunity to talk to individuals and communities about the importance of conserving species as part of a wider need to protect and restore nature.

While there is often a public view of nature as something that exists in nature reserves, often vicariously viewed through the medium of television, the reintroduction of species can provide a real chance to confront the issues that affect the future of the natural environment across broader landscapes. Particularly, how we ensure we are able to live with nature, to protect and restore what little habitat remains, to expand and create new habitat, and to understand the complex interactions and interdependencies within nature.

[1] Law, A., Gaywood, M.J., Jones, K.C., Ramsay, P. and Willby, N.J. (2017) *Using ecosystem engineers as tools in habitat restoration and rewilding: beaver and wetlands.* Science of the Total Environment 605–606 (2017) 1021–1030. Available online: https://www.sciencedirect.com/science/article/pii/S0048969717315929

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[3] Seddon, P.J., Strauss, W.M. and Innes, J. (2012) *Animal translocations: What are they and why do we do them?* In: Ewen, J.G., Armstrong, D.P.,Parker, K.A., and Seddon, P.J. (eds.) Reintroduction Biology. Oxford. Wiley-Blackwell. pp 1-32.

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Beavers in Britain

Alicia Leow-Dyke, Adrian Lloyd Jones and Róisín Campbell-Palmer

The tables have turned for beavers in Britain since their extinction in the 16th century. Reintroduction projects are now well established and provide support for the ecological and environmental benefits beavers bring.

Eurasian beavers are finding a home back in Britain



(Left to right) **Alicia Leow-Dyke** is the Welsh Beaver project officer for Wildlife Trust Wales (www.wtwales.org/) and **Adrian Jones** is the Welsh Beaver Project Manager (www.welshbeaverproject.org/). **Dr Róisín Campbell-Palmer** was the field operations manager for the Scottish Beaver Trial (www.scottishbeavers.org.uk/) and currently is an independent adviser on beaver-related projects for Scottish Natural Heritage (www.nature.scot/) and throughout Britain.

Since the 1920s the Eurasian beaver, *Castor fiber*, has been reintroduced (both officially and unofficially) to over 26 European countries, following its near extinction due to human persecution. Some of the early reintroductions focused on the restoration of the species for the fur trade, while others were prompted to restore a lost species[1]. Nowadays the purpose of reintroducing beavers is more for conservation and the ecosystem services they provide.

The reintroduction of beavers to Britain has long been debated. Britain, as an island, can be selective over the mammalian species it reintroduces, unlike the majority of Europe. While many people support the reintroduction of beavers, others still have reservations even after the first official beaver reintroduction to Britain nine years ago.

Through a partnership between Scottish Wildlife Trust, Royal Zoological Society of Scotland and Forestry Commission Scotland, three beaver families from Norway were reintroduced to Knapdale Forest, Argyll in 2009 for the Scottish Beaver Trial. In order to understand the impacts of beavers within the Scottish landscape, the population was monitored over a five-year trial period.

> We are at a stage in Britain where we are starting to see the natural dispersal of beavers and recolonisation of new habitats.

Licensing

In Britain, beavers are not classed as 'ordinarily resident' and therefore a government licence is required under the Wildlife and Countryside Act 1981 (as amended) for their release into the wild. As of December 2017, a licence is also required for release into enclosures in England. Prior to the start of the Scottish Beaver Trial, no standard format existed for such a reintroduction[2], but this pioneering project paved the way for beaver reintroductions in Britain.

However, some view this licensing system for species reintroductions, especially for a species such as the beaver, as time consuming, expensive and bureaucratic. This can cause frustration, and anecdotal evidence suggests that unofficial beaver releases may have occurred as a result.

Since 2009, beavers have been discovered in Tayside, east Scotland and the River Otter, Devon, outside of any official reintroductions. Subsequently, these populations have been incorporated into official reintroduction projects. The Tayside beavers were monitored alongside the official Scottish Beaver Trial and their presence has since been accepted by the Scottish Government, and in 2015 Natural England granted a licence to Devon Wildlife Trust for a five-year trial on the River Otter beavers.

While these unofficial beavers may have sped up the process of reintroducing beavers to Britain, it can cause some concerns and undermine the work of official projects. Those working on beaver reintroductions want to see beavers back in the landscape, but these releases can polarise people's perceptions and opinions towards beavers even further. In addition, there are concerns over health risk and welfare issues for individual animals. There is also a worry that animals may be released into unsuitable habitat, which could cause problems for land managers, or that the wrong species (North American beaver, *Castor canadensis*) may be released.

However, we are at a stage in Britain where we are starting to see the natural dispersal of beavers and recolonisation of new habitats. Tayside is the best-known example of this in Britain, where beavers are dispersed throughout the catchment[3].

Benefits

With the right management, the Eurasian beaver can have positive impacts on wetland ecosystems, where their activities can benefit many species, including humans. Beavers are often referred to as 'keystone species' or 'ecosystem engineers' because of their ability to modify and manage wetland habitats. Through their activities beavers can create diverse landscapes, which can benefit a range of wildlife from fungi, plants and invertebrates to fish, amphibians, reptiles, birds and mammals[4,5,6,7].

The benefits for people, known as 'ecosystems services', are many. Research from Exeter University has shown that beaver dams can reduce flood risk, increase water storage and improve water quality through filtering pollutants and trapping sediments[8]. This could have important implications when considering land management or flood defence options, especially now due to the higher frequency and severity of flooding events caused by climate change.

In Britain natural flood management solutions are gaining traction, with 'leaky dams,' pond creation, and tree planting becoming attractive options, rather than relying on conventional flood defence mechanisms. Beavers can be part of these nature-based solutions. Despite the political uncertainty in Britain at the moment, including around environmental legislation and land use policies, there is an opportunity for positive change. If public money is used for public goods, land managers could be paid to have beavers on their land in order to deliver ecosystem services.

Beaver dam

Beaver feeding signs

Considerations

While beavers can provide many ecological and environmental benefits, the full range of these may not be realised until beaver populations are fully established within catchments across Britain. Some landscapes in Britain may not be suitable for beavers and as numbers increase and individuals disperse to new areas, an increase in human-beaver conflicts is likely, such as untenable localised flooding from dams or unwanted tree felling.

These impacts must be taken seriously, but mitigation measures are available and have been tested in other countries, such as Germany. Beavers were reintroduced to the Bavarian state of Germany in the 1960s and once successfully established, a beaver management network was set up to manage human-beaver conflicts. The level of management required is case dependant, but can include protecting trees, installing electric fencing, modifying dams and live trapping.

The other practicality over reintroducing beavers to Britain is health and welfare. Health screening is an essential part of any reintroduction project to ensure that only healthy individuals are released. The main risk is from the unofficial release of animals from unknown origins, which may not have been health screened. Like any other animal, beavers may acquire common wildlife diseases already present in Britain, such as leptospirosis. However, there is a concern with the release of directly imported animals from central Europe, which have not been health screened and the introduction of new pathogens, for instance the fox tapeworm, *Echinococcus multilocularis*. Again, it is unauthorised beaver releases that pose the greatest worry as the health status of these animals is unknown.

Beaver feeding signs

E. multilocularis is not found in the UK, but is present across much of continental Europe and has been reported in a small number of wild-caught Bavarian beavers[9]. Health screening techniques have been developed to detect the tapeworm and avoid transmission into British beaver stock[10] and retrospective health screening is also possible, as was undertaken on a sample of the Tayside and River Otter beavers following their discovery.

It is worth noting that beavers are the intermediate host for the *E. multilocularis* and this pathogen cannot be transmitted directly between individual beavers. For transmission to occur, it would require a canine host to scavenge on an infected beaver carcass. Whilst *E. multilocularlis* is of concern and we do not want it in Britain, it is a low-risk issue in beavers. The introduction of other host species, such as the illegal importation of puppies from continental Europe or improperly wormed pets are likely to pose a far greater risk.

> **Health screening is an essential part of any reintroduction project to ensure that only healthy individuals are released.**

Beaver tree guard

Eurasian beaver, *Castor fiber*

Opportunities

In November 2016 the Scottish Government announced that beavers in Knapdale and Tayside could remain in Scotland, following the 'Beavers in Scotland' report[11]. This was cause for huge celebrations amongst beaver supporters throughout Britain, but there is more work to be done. Further beaver translocations and releases in Scotland still require a licence and a decision has yet to be reached by the Scottish Government over the protective status of beavers.

As the debate continues, the support for their return seems to have increased. In recent months there has been a wealth of media attention, particularly after Michael Gove, the environment secretary, released beavers into the Forest of Dean. This is a three-year project to monitor flood risk management.

In England, the River Otter Beaver Trial (www.devonwildlifetrust.org/what-we-do/our-projects/river-otter-beaver-trial) is more than halfway through, with the trial due to finish in 2020. A decision will then be made on the status of these beavers. In Wales, Wildlife Trust Wales is currently working on a licence application to release beavers into a small catchment.

As official reintroduction projects become established and others are underway, natural spread is occurring and beavers are thriving in the wild. This provides an opportunity to monitor beavers in the wild and importantly, the impacts of these animals must be carefully considered before any action is taken to ensure the correct decisions are made.

There is still a long way to go and the debate will continue, but perhaps the beavers have beaten us to it. Rather than looking at the reintroduction of beavers, maybe we should now be discussing the re-establishment of beavers in Britain and find acceptable ways to co-exist with this incredible species once again.

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[2] Jones, S. and Campbell-Palmer, R. (2014). *The Scottish Beaver Trial: The story of Britain's first licensed release into the wild.* Final Report. Scottish Wildlife Trust and Royal Zoological Society of Scotland.

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[9] Barlow, A.M. Gottstein, B. and Mueller, N. (2011). *Echinococcus multilocularis in an imported captive European beaver (Castor fiber) in Great Britain.* Veterinary Record 169: 339 doi: 10.1136/vr.d4673.

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Helping dormice make a comeback

Ian White & Kay Haw

Due to loss of hedges and coppice woods, from 1885 the hazel dormouse, *Muscardinus avellanarius*, was pushed to extinction in 17 English counties. Recently, individuals of this now rare species have been reintroduced, but can they really make a comeback?

Image: Ian left, Kay right

Ian White is the dormouse officer for Peoples Trust for Endangered Species, where he manages the Dormouse Reintroduction Programme (www.ptes.org/campaigns/dormice/). Ian is also chair of the Hampshire Dormouse Group (www. hampshiredormousegroup.co.uk/).

Kay Haw is a conservation adviser for the Woodland Trust and the editor of Wood Wise (www.woodlandtrust.org.uk/WoodWise), which she started in 2011. Kay recently became Director of the UK Squirrel Accord partnership - Woodland Trust is a key signatory (www.squirrelaccord.uk/).

Hazel dormouse, *Muscardinus avellanarius*

Hazel dormice are charismatic rodents and endangered members of Britain's fauna. Although they are similar in size to wood mice, their long fluffy tails are quite different. Their name originates from the French/Spanish verb '*dormir*' meaning to sleep, as they spend the colder months hibernating in nests (generally November to April).

They are one of the smaller British mammals, with an adult body length of 6.5-8cm and weight of 20-35g (being heaviest when fattening up just before hibernation). In the wild they can live up to five years and typically have just one litter a year, in July or August. Litters average four young that are born in a woven nest made from strips of honeysuckle bark and protected by a layer of green leaves, and are weaned after about a month.

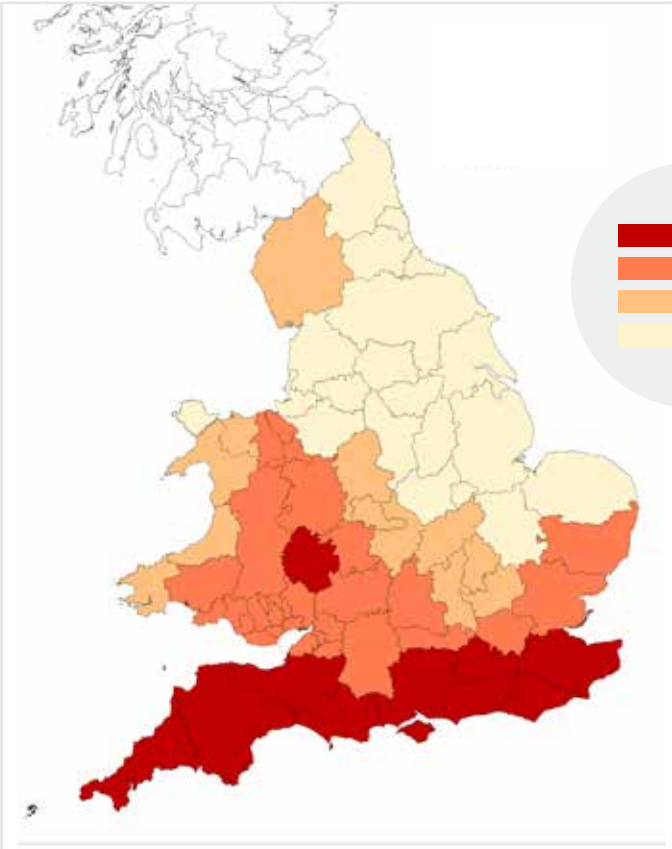
Where have all the dormice gone?

People's Trust for Endangered Species' (PTES) National Dormouse Monitoring Programme has been running for over 25 years. Hundreds of trained monitors collect records from monitoring sites in England and Wales. In 2017, 6,182 dormice were recorded across 414 different sites. As dormice are hard to detect, they are also working with Suffolk Wildlife Trust to trial a new monitoring method using footprint tunnels, rather than the usual nest box and tube surveys, and nut searches.

Despite their nocturnal and arboreal natures, these once called '*common*' dormice were well documented and observed across the country. Coppice workers would often find dormice hibernating on the ground when they cut hazel coppice, but this type of woodland management has almost died out and far fewer people spend such lengths of time in woods today. There has also been a severe decline in dormice numbers.

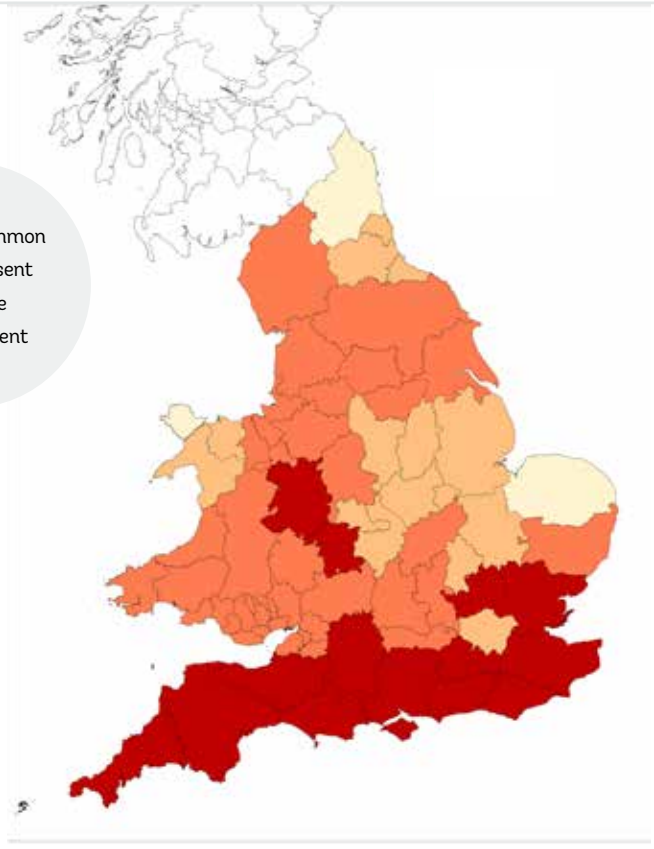
PTES collated its monitoring results in *The State of Britain's Dormice 2016 report*[1]. This showed a population loss of a third of hazel dormice since 2000, which relates to a 55% decline over 25 years. In Britain today they are now mostly restricted to southern England and Wales. Woodland habitat loss and fragmentation, the demise of coppice management and grubbing out of hedgerows are key factors in their decline. However, they can also suffer population declines of 60-80% over winter; this can be exacerbated in mild winters when they wake too often from hibernation and there are limited sources of food[2].

Victorian dormouse distribution in Great Britain

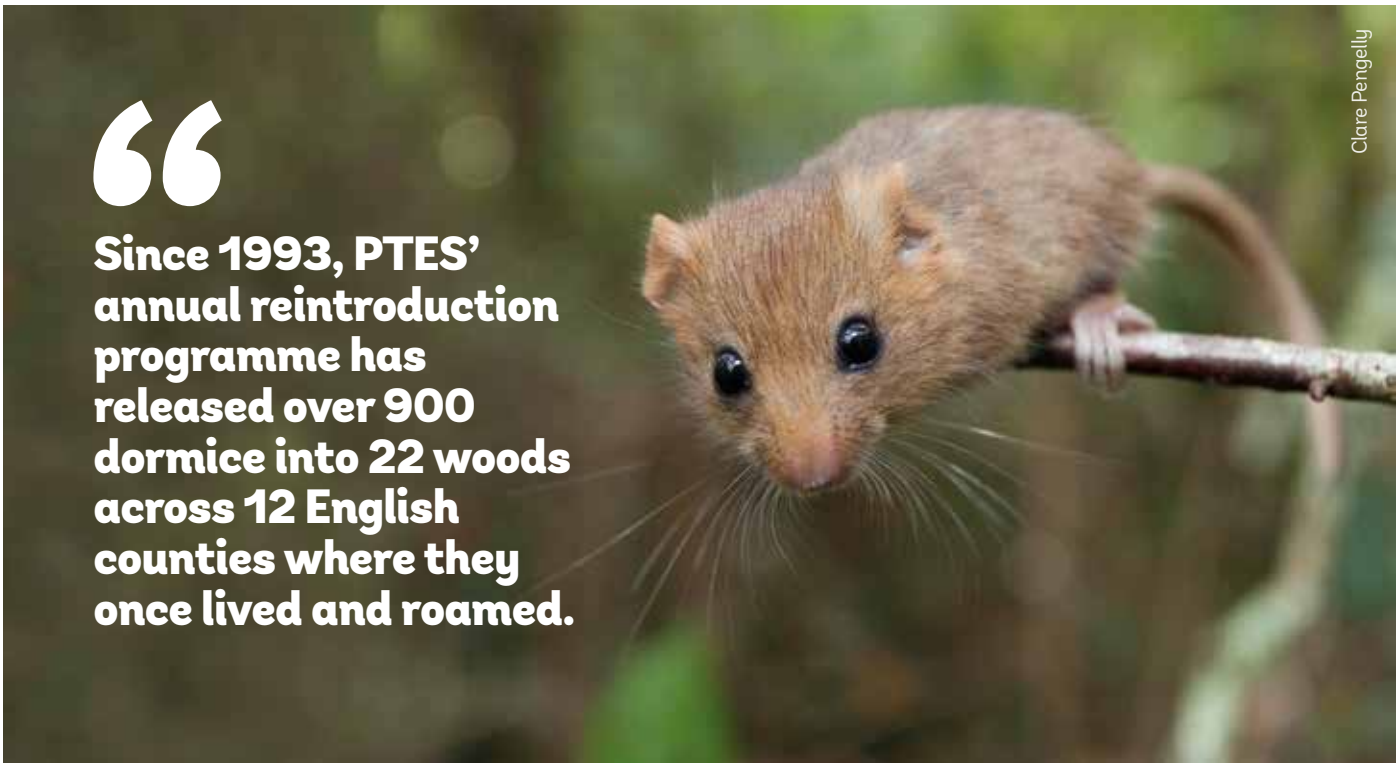


(Data from: Rope, G. T. (1885) On the range of the dormouse in England and Wales. The Zoologist, Vol 9, No.102 pages 201-213) and Victorian County histories)

Current dormouse distribution in Great Britain



(Data from: National Dormouse Database 2011-2015)



Since 1993, PTES' annual reintroduction programme has released over 900 dormice into 22 woods across 12 English counties where they once lived and roamed.

Clare Pengelly

Celebrating 25 years of reintroductions

Since 1993, PTES' annual reintroduction programme has released over 900 dormice into 22 woods across 12 English counties where they once lived and roamed, including Bedfordshire in 2001, Nottinghamshire during 2013-2015 and Suffolk in 2001 and 2006.

Key to the success of the project is ensuring the woods they are released into are appropriately and actively managed, including reviving coppice rotations, as dormice favour the successional stage of woody vegetation. The programme also works with landowners to restore dormouse-friendly hedgerows that act as corridors between woods and provide food, such as hazelnuts, blackberries and sloes, and the flowers of hawthorn and honeysuckle.

Returning dormice to Warwickshire

This year saw the second phase of a landscape project that began in Warwickshire last year, in partnership with Warwickshire Wildlife Trust, Natural England, Zoological Society of London, Paignton Zoo and the Common Dormouse Captive Breeders Group. It is hoped individuals from this second phase can connect to those released in another wood last year, through work with surrounding landowners to restore and create hedgerows to link the two.

In 2017, 20 breeding pairs were introduced to a secret woodland location in Warwickshire, then a further 20 into another wood in 2018. The woods are 1km apart and 2km from the location of the last natural dormouse population in the county. All 40 individuals have been PIT (passive integrated transponder) tagged and were initially kept in soft-release cages, being fed twice a day for ten days, which were left open to allow their dispersal.

PTES dormouse release 2018

A soft-release cage

Chris Redstall, Warwickshire Wildlife Trust's *Dunsmore Living Landscape Scheme* manager, says: "This year's woodland has been chosen as it is well-managed with a mixture of mature and coppiced woodland, which is the perfect habitat for hazel dormice. This, combined with ongoing sympathetic woodland management and a drive to improve surrounding hedgerow links, should help ensure the successful establishment of this new population. All the dormice released, as well as any future offspring, will be carefully monitored to see how they are faring."

In each wood 300 nest boxes are located in 10 clusters of 30, one cluster per habitat type, determined by the management regime. Ten of these will be fitted with PIT-tag readers in each wood and nest box checks will be carried out once a month, during April-October. Monitoring aims to answer questions around survivability of the population, lifespan, breeding success, dispersal post-reintroduction and if there is sexual bias, habitat and nesting box preferences, and other key questions.

Success depends on management

Reintroduction work has already proved to be successful at some locations, with breeding and dispersal to new areas known to have taken place. However, there have been some setbacks and losses. This occurred because the long-term management required to maintain coppicing and rides was discontinued at a small number of private sites.

> PTES continues to search for woods suitable for future hazel dormouse reintroductions, where the long-term management of the habitat is guaranteed to support their survival.

As the woodland aged and shading increased, the habitat became unsuitable and was sadly unable to support the dormice. However, at the vast majority of sites, positive management work has continued and populations are surviving and thriving.

Flagship species are often iconic or charismatic species used to raise awareness and support for the conservation of not only that species, but also the wider habitat and biodiversity it represents. It can be easier to sell the idea of saving a visually appealing dormouse than it can be the value of restoring coppice rotations for the benefit of wider species. Yet work to save the dormouse and restore its habitat needs can provide major benefits for coppice-loving species, such as Duke of Burgundy, *Hamearis lucina*, and pearl-bordered fritillary, *Boloria euphrosyne*, butterflies, or hedgerow species, such as goat moth, *Cossus cossus*, and brown hairstreak butterfly, *Thecla betulae*.

PTES continues to search for woods suitable for future hazel dormouse reintroductions, where the long-term management of the habitat is guaranteed to support their survival. They also need more dormouse monitors; those with dormouse licences can check nest boxes but anyone is welcome to join the annual nut hunt. More information about PTES' dormice work can be found on their website: https://ptes.org/campaigns/dormice/

[1] Wembridge, D., Al-Fulaij, N. and Langton, S. (2016) *The State of Britain's Dormice 2016*. Available online: https://ptes.org/wp-content/uploads/2016/09/State-of-Britains-Dormice-2016.pdf

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Dormouse in nest

Dr Christine Tansey is the research and evidence co-ordinator at the Woodland Trust (www.woodlandtrust.org.uk/blog/2017/03/phd-woodland-trust/).

WTML/ALAMY

Woodland Trust research update - pine martens return to Wales

Christine Tansey

The Woodland Trust underpins its conservation work with current and robust evidence, often gathered through research from universities and other research institutions.

In recent years the support the Woodland Trust offers to researchers around the UK has increased, in order to ensure the required evidence is available to make the right conservation decisions for trees, woods and people. This research informs the Trust's work around managing, planting and restoring woods, outreach work with various landowners, campaigns to protect existing woodland, and to inform future policy.

The role of species within woodland ecosystems is a key area of interest to the Woodland Trust, as they can significantly influence the health of habitats. This includes species that may have disappeared due to poor management practices, persecution and landscape change, such as the pine marten, *Martes martes*.

Gone but not forever

Pine martens are native to the UK. These cat-like carnivores are largely dependent on woodland habitats. Once widespread, they experienced historical declines across the UK, as forests were cleared and predator species controlled for game shooting[1]. By 1900 they were confined to just a few upland areas across Britain[2].

Thanks to changes in legal protection and forest cover, pine marten populations are naturally recovering and increasing their range from their north-west Scotland stronghold. However, unassisted colonisation from the north is likely to take many decades, being hampered by the large urban conurbations of north-west England, and

they currently remain absent from southern Britain.

In 2015, the Vincent Wildlife Trust (VWT) (www.vwt.org.uk/) initiated the Pine Marten Recovery Project[3] (PMRP) to re-establish a healthy population in Wales. Over three years, this project translocated 51 pine martens from a Scottish source population to suitable woodland locations in mid Wales. Monitoring and research of this population continues.

In partnership with VWT, the Woodland Trust is supporting two PhD projects to examine various impacts of reintroducing pine martens to areas from which they have been lost. The aim is to understand the ecological and social implications of returning this important woodland species to Britain's landscapes. Results from these research projects will inform a better understanding of the role pine martens play in healthy woodland ecosystems, and may impact future management.

Understanding pine marten translocation success

While working on VWT's PMRP, PhD researcher David Bavin is examining the factors that affect the success of pine marten translocations with the University of Exeter (www.exeter.ac.uk/news/featurednews/title_490678_en.html) and Chester Zoo (www.chesterzoo.org/conservation-and-science/where-we-work/uk-and-europe/pine-marten-recovery-project).

Wildlife translocation is increasingly used as an effective tool to halt and reverse the decline of extirpated and threatened species, or to extend the range of species to protect them from emerging threats such as climate change. Historically, translocations have had poor success rates. Some 'hidden' factors that affect the outcomes of projects, such as the effect of stress and individual personality/behaviour of animals, remain poorly understood.

David's ongoing research uses camera traps to study pine marten behaviours in their original environment in Scotland and at release sites in Wales. He aims to identify personality traits in pine martens and understand whether or not these traits affect their movement and survival after translocation.

Social feasibility of translocations is often overlooked or treated as a bolt-on consideration after biological and ecological feasibility have been established. David's research also examines the social implications of VWT's efforts to recover a native carnivore in the UK. He is investigating the perspectives of different stakeholders in Wales to gain an understanding of the support for and concerns around the PMRP.

By addressing the social and ecological factors that can impact their success, results from David's work will help inform future translocations in the UK.

"Wildlife translocation is increasingly used as an effective tool to halt and reverse the decline of extirpated and threatened species, or to extend the range of species to protect them from emerging threats such as climate change.

Collecting data in the field

Pine marten translocated from Scotland to Wales

Pine marten family in Scotland

> Previous work suggests that recovery of pine martens in Ireland is linked to the decline of grey squirrel populations and the resulting recovery of red squirrels.

Effects of pine martens on grey squirrels

Through her PhD with the University of Exeter (www.exeter.ac.uk/news/featurednews/title_490678_en.html) and Forest Research (www.forestresearch.gov.uk/), Cat McNicol's work focuses on understanding how pine martens disperse after translocation and what influence a recovering pine marten population has on the behaviour of grey squirrels, *Sciurus carolinensis*.

In the UK, grey squirrels are classed as an invasive non-native species and have displaced native red squirrels, *Sciurus vulgaris*, across most of England and Wales. Grey squirrels also damage trees through bark stripping, which

Grey squirrel, *Sciurus carolinensis*

can increase their vulnerability to disease and cause significant damage if girdling occurs.

Previous work suggests that recovery of pine martens in Ireland is linked to the decline of grey squirrel populations and the resulting recovery of red squirrels[4]. Therefore, it is important to understand the mechanisms and success of this control to help inform future conservation management. A similar pattern was also found in Scotland by researchers from the University of Aberdeen[5]. Cat's research aims to understand if the phenomenon is widespread and to reveal the mechanisms underlying this relationship.

Cat McNicol collecting grey squirrel data

Studying animals translocated through VWT's PMRP, Cat strives to understand the post-translocation movement and habitat selection of pine martens, as well as their diet in a new habitat. She is also investigating the space use and foraging behaviour of grey squirrels in the presence of pine martens. To do this, over 60 squirrel traps were monitored in Wales, where individual grey squirrels were microchipped and fitted with GPS collars to record their movements.

The findings will contribute to understanding whether or not pine martens can act as a 'biological control agent' for grey squirrels, and may ultimately influence the direction of future management.

If you are interested in finding out about the Woodland Trust's support of research (www.woodlandtrust.org.uk/blog/2017/03/phd-woodland-trust/), please get in touch: research@woodlandtrust.org.uk

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Nick Jarvis

Is it time for the return of the 'English wood-cat'?

Peter Cooper

With the situation in Scotland looking increasingly bleak for wildcats, *Felis sylvestris*, could we see the species restored to England and Wales?

A beast of Olde England

At St Peter's Church, in the South Yorkshire village of Barnburgh, stands a curious stone effigy of a man lying on a slab with a cat at his feet. The figure represents a local knight and his feline companion, who are the source of a particularly curious folk tale. In the 15th century, as Sir Percival Cresacre was riding back to the village, legend says a wildcat leapt from a tree onto his horse. A bloody battle ensued between the two that ended at the church, with both dying on the porch from fatal wounds.

This is more than an entertaining story; it highlights two important things. Firstly, that wildcats were familiar well outside Scotland. Archaeological and written records show the animal as previously widespread throughout England and Wales. Associated primarily with broadleaved woodland, its old English name translates as 'wood-cat'.

Secondly, while it is unlikely a knight was ever killed by an animal the size of a small dog, it highlights the fierce reputation wildcats held. Medieval hunting records certainly mention its aggression when cornered. Imagery like this led to the vilification of the wildcat and made them a prime enemy of anyone keeping livestock or game birds. The persecution inflicted on wildcats was so intense that by the turn of the 19th century they were exterminated across Britain from everywhere except the Scottish Highlands.

Birth of the 'Scottish wildcat'

Wildcats were left in a very perilous situation. The rise of grouse and deer estates created a spree of targeted killing that may have wiped the wildcat out in Britain for good, were it not for the First World War recruiting many of the gamekeepers from such places. Those remaining few wildcats ended up scattered, isolated and often in sub-optimal habitat. For miles around, the closest opportunities to breed were with the local croft cats.

Today, best estimates for wildcats in Britain indicate there might be a few genetically good-quality animals maybe numbering in the dozens. These are strewn among a population north of Scotland's central belt that is almost entirely hybridised, with crosses from wildcat to feral to hybrid and back persisting for well over a century.

Once hybrids are established in a population, it is very difficult to reverse the trend, as wildcats appear more likely to interbreed with these rather than domestic cats due to habitat overlap[1]. There is a clear need for wildcats to be established in hybrid-free zones in good quality habitat – something England and Wales could offer.

> The rise of grouse and deer estates created a spree of targeted killing that may have wiped the wildcat out in Britain for good.

Peter Cooper is an ecologist and researcher working for the Derek Gow Consultancy (www.watervoles.com/) on developing a strategy for the reintroduction of wildcats to England.

Scottish wildcat in the sun

Lessons from Europe

Would the same scenario happen again, this time south of Hadrian's Wall? There are no clear estimates for current numbers of feral cats in England, but they are out there, and that does not take into account all the un-neutered pet cats roaming the countryside.

However, clearer answers might be found on the continent. A look at European populations of wildcats shows the only other country that matches Scotland with a comparable scale of domestic hybridisation is Hungary[2]. The sheer numbers of domestic cats means it is practically impossible to find anywhere where there is zero hybridisation, but across most of Europe it appears to remain at low levels[3].

One genetic study of 1,071 wildcats in Germany this year found only 3.5% were notable hybrids[4]. Throughout their range, where they exist in good numbers, wildcats and domestics have been known to segregate between woodland/scrub-pasture habitats and farmsteads respectively[5].

Location, location

Across England and Wales numerous regions could provide viable habitat for wildcat reintroductions. Kielder Forest and mid-Wales have large blocks of coniferous forest with grassy edges and clear-fell full of field voles, *Microtus agrestis*. But many European populations of wildcats prefer mature broadleaved woodland with a complex structure, connected by hedgerows, copses and meadows rich in their dominant prey of rabbits and voles. Feasibility scoping could thus be broadened to areas such as the Mendip Hills, the Forest of Dean, Selwood and the Weald.

Factors affecting site suitability are proximity to major roads and urban centres (the former has shown to be a severe threat to wildcats[6]), prey availability, habitat fragmentation and the density of game shooting interests. This highlights the need for effective communication throughout the course of any project.

To many unfamiliar with wildcats, their name conjures up an image of an animal far bigger and more dangerous than it actually is. While wildcats generally eat a low number of birds, including those reared for shooting, the perceived risk of another predator can still increase the chances of persecution.

Ensuring community support across a range of stakeholders would be crucial. An exemplar case study is the Vincent Wildlife Trust's pine marten recovery programme (www.vwt.org.uk/projects-all/pine-marten-recovery-project/) in mid-Wales, where foresters, farmers and gamekeepers work effectively alongside project staff through careful communication and trust-building.

Keeping Felix at bay

Undeniably one of the largest concerns is the presence of domestic and feral cats. Prior to any release, their numbers should be scoped using trail cameras by scented bait sticks and the neutering of pet cats encouraged among local vet surgeries. A programme of trap-neuter-vaccinate-release for feral cats, as practised in the Scotland wildcat conservation action plan[7], would be a likely outcome in many areas.

While this would be a challenging venture, the continental experience of relatively few hybrids despite the presence of domestics suggests that it is possible to maintain mostly pure-type populations that segregate themselves from the former spatially and behaviourally. The key requirement is suitable habitat and plenty of wildcats. So these source populations need to be sourced very effectively and carefully before any reintroduction work gets going on the ground.

A wildcat ark

Wildcats in Britain are in a unique situation, where the only solution available for any kind of future is through reintroduction with animals sourced from captive breeding programmes. This is very challenging for most animals, and even more so with carnivores. But with very few (if any) pure wildcats left in Scotland, and the need for genetically viable animals crucial, it is all we have left.

Thankfully there are real-world models that show how it could be done. The Iberian lynx, *Lynx pardinus*, project has successfully released captive-bred animals fully trained for life in the wild from an off-display facility for over 15 years. While this receives over £30 million in funding from government, a cheaper and effective template for wildcats can be seen at Marianne Hartmann-Furter's breeding centre in Switzerland. Here, off-show enclosures breed kittens prepared for the wild and un-accustomed to people, thanks in part to automated feeders that reduce the constant presence of keepers.

Scottish wildcat, *Felis sylvestris sylvestris*

> To many unfamiliar with wildcats, their name conjures up an image of an animal far bigger and more dangerous than it actually is.

The last hope

Without significant intervention, this is an animal on the cusp of no-return in Britain. If we do not want the wildcat to join our only other native felid the Eurasian lynx, *Lynx lynx*, in extinction then proposals such as reintroduction on a national scale are all we have in our toolkit.

An operation carried out to the highest possible standard could be a leading example in range recovery for felids and other 'complex' species. While its UK status is perilous, globally the wildcat is considered 'Least Concern' by the IUCN. Therefore, success with this species would be an excellent template for future reintroduction of small carnivores that may be at greater risk of total extinction.

Ultimately, no reintroduction is free from risk. Yet the rewards of restoring another member of Britain's lost carnivore guild would be hugely beneficial in multiple ways: for ecology, as we become far more aware of the beneficial impacts of high-level predators; and for hope in conservation. If we can overcome the challenge of restoring Britain's wood-cat, imagine what else we can do.

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The zoo that cares for trees

Sarah Bird

Over the past 15 years Chester Zoo has partnered on several native tree conservation projects predominantly in Cheshire and North Wales. Species include the locally threatened black poplar (www.chesterzoo.org/conservation-and-science/where-we-work/uk-and-europe/black-poplar-project) and endemic Llangollen whitebeam.

Sarah Bird is the Biodiversity Officer at Chester Zoo with responsibility for wildlife on the zoo site and coordination of UK field conservation projects.

Conservation activities are a requirement of current zoo licensing in the UK, and for many zoos that is covered by the breeding of endangered animals, conservation research or relevant skills training. Several UK zoos are pursuing native plant conservation activities too, which are challenging as more exotic and attention-grabbing conservation programmes garner support more easily. Nevertheless this important work should not be overlooked.

Zoos are ideally placed to play a key role in the conservation of native plants. With extensive experience in conservation breeding, horticulture and biodiversity skills, knowledge and understanding of International Union for Conservation of Nature (IUCN) guidelines on conservation translocations, and large local audiences, they are the perfect facilitators for community plant conservation.

Britain's rarest native timber tree

The black poplar, *Populus nigra* subsp. *betulifolia*, 'Britain's rarest native timber tree[1]', was one of the first native species that Chester Zoo became involved with. Black poplar includes many subspecies, hybrids and cultivars, covering a wide distribution through much of mainland Europe, reaching into central Asia and North Africa. The subspecies found in mainland Europe, *Populus nigra* subsp. *nigra*, is different from the one found in the UK, *Populus nigra* subsp. *betulifolia*, which occurs in Britain, Ireland and on the fringe of Western Europe[2].

An estimated 8,000 mature native black poplar trees have been recorded in Britain, chiefly occurring south of a line from the Mersey to the Humber estuaries, with strongholds in Shropshire, Cheshire, the Vale of Aylesbury and Suffolk. Although not nationally recognised as a UK conservation priority, a number of local action groups are working to protect and conserve this tree.

Approximately 380 native mature black poplars have been identified in Cheshire, most of which are in decline and unmanaged. Old trees are likely to have been planted by people, and probably from cuttings, so genetic diversity in the UK population is considered to be low. Old trees are not naturally regenerating, and any seed produced is likely hybridised with other planted poplar cultivars.

The tree is dioecious (has either male or female reproductive parts), and female trees are less frequent than males in the UK - a result of landowner planting preference. Since the surviving UK 'wild' population is largely over-mature, long term commitment to a planting strategy is essential to produce a more resilient, mixed age population for the future.

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Sarah Bird

Black poplar project

Since 2005, Chester Zoo has worked with partners across Cheshire including the Forestry Commission, (www.forestry.gov.uk/) Cheshire Wildlife Trust, (www.cheshirewildlifetrust.org.uk/) Environment Agency, (www.gov.uk/government/organisations/environment-agency) Mersey Forest, (www.merseyforest.org.uk/) and The Conservation Volunteers (www.tcv.org.uk/). Action has focused on recording existing specimens, raising awareness, and propagating trees. Initially extensive stool beds were established at a number of partners' sites, and several thousand young trees produced. From 2008 Forest Research offered a genetic testing service to identify individual black poplar clones. Between 2008 and 2015 Chester Zoo funded testing of over 100 Cheshire trees, using leaf samples collected in early summer. Just seven individual clones were identified from samples taken from 110 trees.

The propagation process has been refined to reflect this – rather than collecting material regularly from the old declining trees around the county, the current tree nursery at Chester Zoo provides good quality propagation material sustainably from carefully managed stools of the seven identified clones. Zoo staff have refined propagation methods using hardwood cuttings, rooted and grown on in pots in a cold frame, to produce plants that can be transported easily to planting sites, and do not suffer unduly if not planted immediately.

Since 2010 over 1500 trees have been supplied to land owners, landscape architects, community groups and Wildlife Trusts, and survival rates are estimated at over 50%. Young black poplar trees establish well, but are easily over-grown by tall grasses and herbs if not protected with a mulch mat or similar in the first few years. Management of competing vegetation around young trees must be undertaken carefully, but the trees are fast growing in suitable sites, reaching over eight metres tall in 10 years, and they become less vulnerable as they mature.

The project has also increased public awareness of these iconic trees, and delivered advice to land owners and managers of trees. Training sessions have proved very popular, and a factsheet is available from the zoo website.

Close links have been developed with action groups in neighbouring counties of England and Wales. During the lifetime of this project, momentum for black poplar conservation in the UK has peaked and waned – in the early 2000s there were many regional action groups and a national initiative, but few are still operating in 2018. The survival of the Cheshire group is largely due to sustained input from Chester Zoo over more than 15 years.

A rare endemic whitebeam

For over 200 years botanists have known about a strange tree growing at Castell Dinas Bran near Llangollen. It is not known when this plant first appeared but it was described in Hudson's Flora Anglica 1798 as growing out of the castle walls, and also mentioned in Sowerby's English Botany in 1843.

It looked a bit like a whitebeam, but botanists were confused and gave it several different names including the 'bastard whitebeam'!

Taking poplar cuttings in the tree nursery

An elderly black poplar

Black poplar cuttings in pots

Llangollen whitebeam, *Sorbus cuneifolia*, on Eglywyseg escarpment

A descendant of that tree had to be removed from the castle in the 1990s to prevent damage to the historic castle walls. The rescued tree was planted in a private garden and almost forgotten until 2016, when a further rescue was needed to remove the tree from the garden. It was brought to Chester Zoo, and the idea for a conservation project grew from there.

Llangollen whitebeam, *Sorbus cuneifolia*, is an extremely rare British endemic tree that is only found on limestone crags of the Eglywyseg escarpment in Denbighshire, and one quarry in Shropshire about 20 miles away. It was formally described and named *Sorbus cuneifolia* in 2009 by whitebeam expert Tim Rich. Surveys in the 1980s recorded around 240 trees, but a lack of more recent population counts meant a resurvey was needed to better understand the conservation status of this special species. This would then inform whether any action was needed, such as reinforcement of the wild population.

Chester Zoo funded a full survey of the escarpment in 2017 and found 300 trees, including a number of young plants. The population therefore appears to be increasing slightly, though a number of individual trees were being choked, and overgrown by invasive non-native *Cotoneaster* species. The new survey figures will enable IUCN Red List (www.iucnredlist.org/) status to be updated, and measures have already been taken to tackle the *Cotoneaster*.

Planting more trees in the wild has been deemed unnecessary, but some seedlings are being raised at Chester Zoo (using seeds that were collected by Tim Rich a few years before, and stored at the Kew's Millennium Seed Bank) (www.kew.org/science/projects/uk-national-tree-seed-project). A programme of awareness-raising is also underway. Young trees will be planted at public gardens in the Llangollen area, where the fascinating story of this rare tree can be told, and a number of walks have been organised to show people the amazing landscape and the trees in situ. A small group of trees will be restored to a safe spot near castle Dinas Bran when they are large enough to survive.

And the rescued tree that started it all...?

Well, it was thought not to have survived its second rescue, as it lost a lot of roots when it was lifted in 2016. It was gradually cut back as it lost leaves, twigs and then branches, and finally it was left in a corner of the zoo nursery as everyone thought it was dead. But, in spring 2018, the remaining stump sprouted leaves! This special tree will remain at Chester Zoo where visitors can learn all about its history.

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Importance of biosecurity for species translocations

Matt Elliot

Translocation (the human-assisted movement of species for conservation benefits) can be a very valuable conservation tool, which is likely to become increasingly common in the future given the pressures on many species.

Dr Matt Elliot is Woodland Trust's conservation adviser for tree health (www.woodlandtrust.org.uk/publications/2017/07/biosecurity/).

WTML/Laurie Campbell

> Introducing trees to provide a specific ecological function is used in conservation and also carries a biosecurity risk.

Various factors need to be considered before a translocation can take place, as set out in the IUCN guidelines on Conservation Translocations. Biosecurity is an important consideration, which may not be immediately apparent. Yet there is a serious risk of inadvertently translocating a pest, disease or invasive non-native species along with the beneficial, target species, which could be deleterious to the ecosystem's health. Therefore, biosecurity should be an integral part of any translocation project.

Spreading pests and pathogens

Juniper is an important native conifer that has been under pressure from various threats for many years. From this a number of restoration projects began with the aim of bolstering ailing populations. These projects collect seed from juniper trees within, or as close as possible, to the population being restored, which are germinated and grown in a nursery before the juniper saplings are planted out within the restoration area.

Unfortunately, there have been a number of instances of plants becoming infected with *Phytophthora austrocedri* while in the nursery then planted out into the restoration area, which has resulted in this serious disease being introduced into the juniper population. This shows it to be extremely important to ensure plants intended for restoration projects are subjected to strict biosecurity procedures, such as growing them completely separately to other nursery stock and using an uncontaminated water supply for watering.

Dutch elm disease, *Ophiostoma novo-ulmi*

White letter hairstreak, *Satyrium w-album*

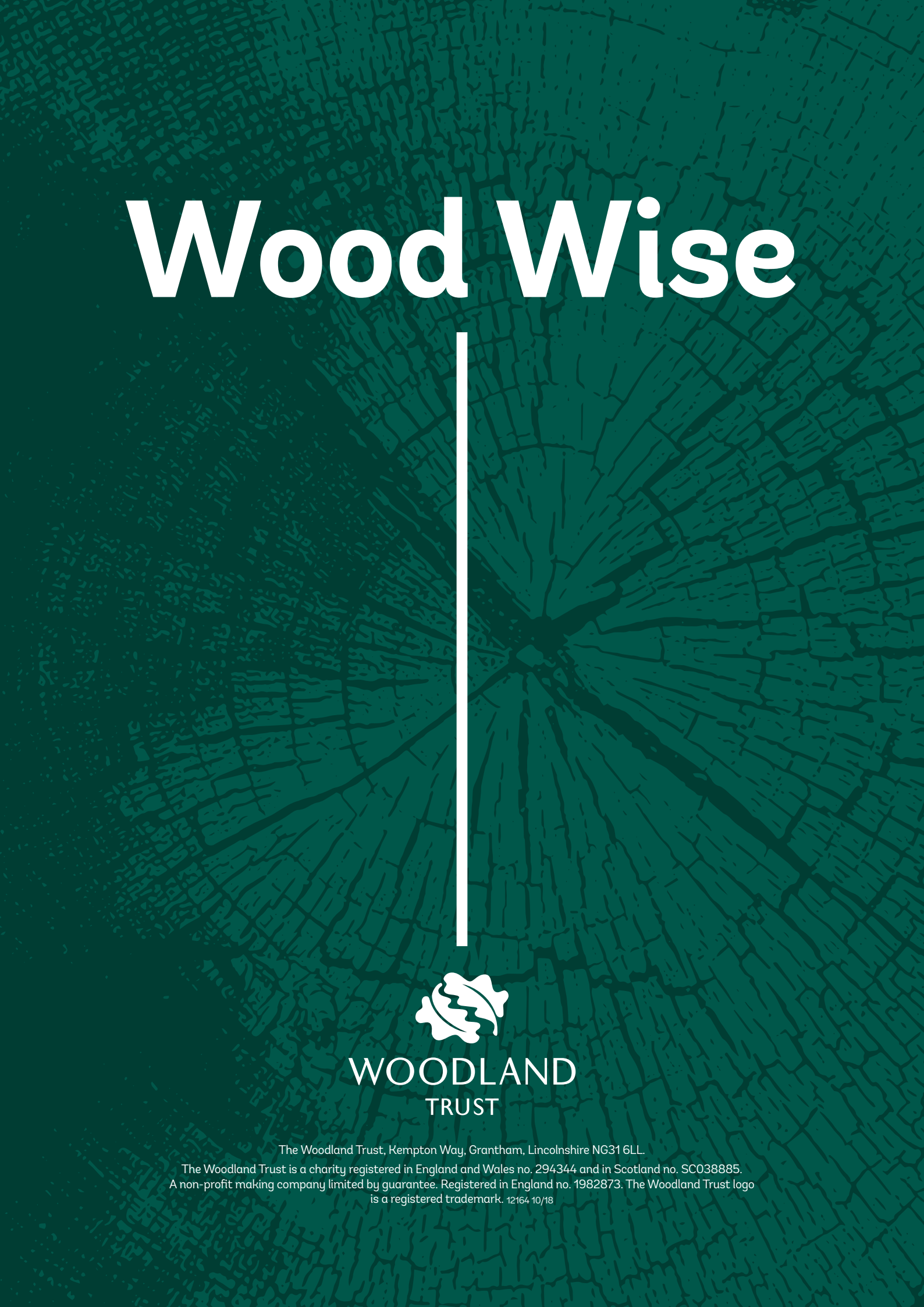
Weighing up the risks

Introducing trees to provide a specific ecological function is used in conservation and also carries a biosecurity risk. For example, Dutch elm disease-resistant elm trees are now openly available from some specialist tree nurseries on the continent. It would be tempting to introduce these trees to replace the elm that have been lost to this terrible disease, to provide a home for elm specialist species such as the white letter hairstreak butterfly, *Satyrium w-album*.

However, caution should be exercised because these trees have to be imported. This means another disease or pest could be inadvertently introduced with the plants such as elm yellows disease or zig zag elm sawfly. The cultivated disease-resistant trees may also prove to be invasive. The Woodland Trust takes the view that where there is high risk, or uncertainty of risk, conservation translocations should not proceed. Similarly, movement of species to areas outside their indigenous range should be treated with caution, as species interactions are highly complex and unpredictable.

These examples illustrate how well-intentioned translocation projects could have unintended consequences. So it is extremely important to consider biosecurity carefully when carrying out translocations, to ensure that unwanted pests, diseases and invasive non-native species are not accidentally introduced into new areas along with the species of conservation interest.

Wood Wise



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