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# Reintroducing species to the UK: Beavers

Reintroduction of species to Britain is proving controversial. Some conservationists argue that wolves and bears have a right to once again roam England's forests. But this Factsheet will consider the case for reintroducing the somewhat less terrifying Beaver.

Beavers were hunted almost to extinction in England 400 years ago. A few survived into the 1900s and there are about 40 in captivity in five locations. However, they have been successfully re-introduced into many countries (Table 1) and many believe that beavers should be reintroduced to Britain's rivers because they are natural "ecosystem engineers".

**Table.1 Reintroduction or translocation of beavers – selected European countries**

| Country | Extirpation | Protection | Reintroduction or translocation | Present population size |
|---|---|---|---|---|
| Austria | 1869 | - | 1970-1990 | > 1300 |
| Czech Republic | 17th century | - | 1991-2, 1996 | 300 |
| Estonia | 1841 | - | 1957 | 10,000 |
| France | Remnant | 1909 | 1959-1995 | 7,000 – 10,000 |
| Germany | Remnant | 1910 | 1936-1940, 1966-1989 | 8,000 – 10,000 |
| Norway | Remnant | 1845 | 1925-1932, 1952-1965 | >70,000 |
| Poland | 1844 | 1923 | 1943-1949, 1975-1986 | 17,000 |

## Why reintroduce beavers to Britain?

The arguments **for** are as follows:

- Beavers are part of Britain's **native** fauna and would still be present if it were not for human activity
- As a member of the EU, Britain has a responsibility to carry out studies on the desirability of reintroducing species that have become extinct (Beavers are listed on Annexes II and IV of the 1992 EC 'Habitats and Species' Directive
- Beavers are a keystone species, acting as "ecosystem engineers" in and around riparian, wetland and forest ecosystems
- Beavers are inherently interesting to humans and could become a flagship species for raising awareness about nature conservation
- Their dams create upstream ponds which capture sediment and organic matter, possibly reducing water treatment costs
- By cleaning river water, they will increase the survival of fish fry, increasing biodiversity
- Dams and canals create new habitats, increasing the complexity and resilience of food webs
- By slowing water flow and creating new channels, they help reduce downstream flooding and help maintain water levels through summer

## Ecology

Beavers are large (15 – 38 kg), semi-aquatic rodents that live in rivers, streams, ditches, lakes and wetland areas. They live in small family groups consisting of an adult male and female, and one to three young in a territory comprising a 1 to 13 km length of river or lake bank. Beavers are herbivores. In spring and summer they eat aquatic plants and those growing along the riverbanks. In autumn and winter they fell and feed on woody species such as willow.

In autumn, they transport felled wood to stores close to their riverbank lodges made of cut wood, to provide winter food. They build dams using tree trunks, branches, twigs, earth, mud and stones in order to raise and stabilise the local water level, providing deeper water to cover lodge entrances, support the transport of food and extend the position of the water's edge. They may also dig canals a metre or so wide to extend their waterside foraging zone.

Ideal beaver habitat will have:

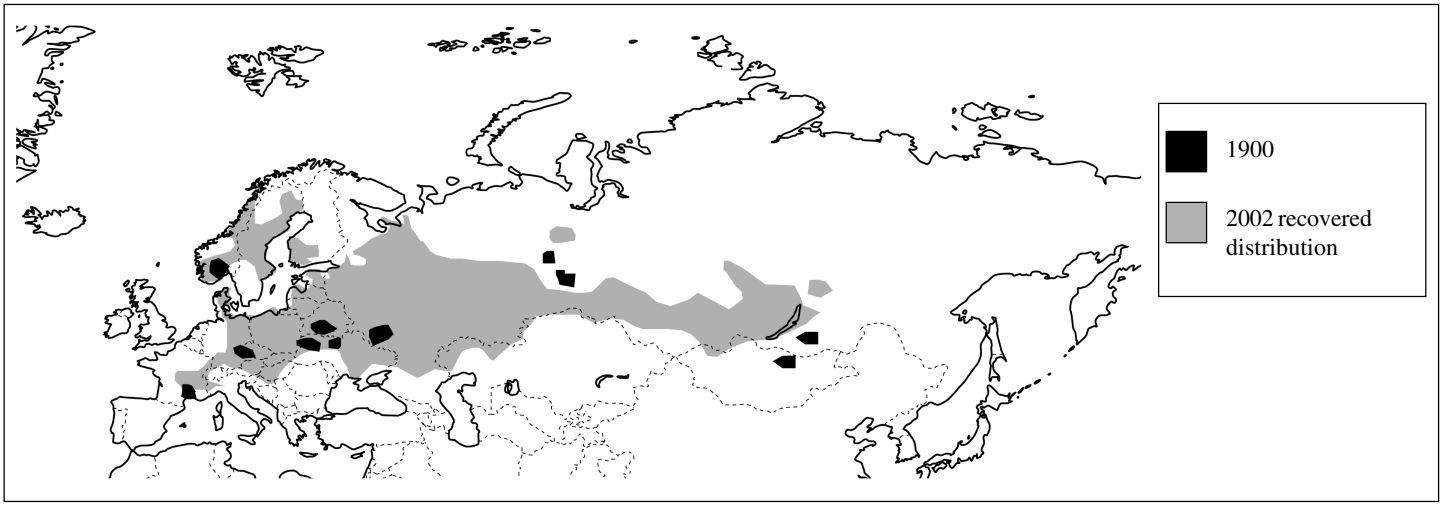
- easy access to grasses, herbs and riparian tree species, especially aspens, birch and willows within 20m of the water's edge
- lowest flow water depths, at least near their lodge and burrow sites, of >0.6m
- a stable water surface and relatively deep water to ensure safe underwater access to their burrows, lodges and food sources (rapidly fluctuating levels e.g. as found downstream of HEP plants are unsuitable,
- shallow river channel gradients
- areas of relatively high banks (>1.5 m above baseflow water level) built of relatively fine materials (earth / loam / peat)

Aerial and map-based surveys suggest that these requirements would be met on many of Britain's lowland, low-gradient rivers.

## Lessons from previous attempts

Many attempts have been made to re-introduce beavers across Europe. The research published in Scientific Journals suggests that, of 87 reintroductions into Europe where population estimates were available 5 years after introduction, 46 (53%) were considered successful. The most common causes of failed reintroductions were release into unsuitable habitats or the release of too few individuals. Some scientists were worried that, in many areas across Europe the **niche** of the beaver would have been pre-empted by other species, such as the successfully re- introduced semi-aquatic coypu (*Myocastor coypus)* and muskrat (*Ondatra zibethicus,* but this has failed to be the case (Fig.1).

**Fig 1. Distribution of European beaver**




## Is more research needed?

Whilst many of the effects of beavers appear positive, there are some obvious disadvantages and several areas where we simply can't be sure what will happen!

By creating dams and canals, gaps in riverbank vegetation and a variety of tree heights, beavers increase habitat diversity. The result is an increase in the number of species of herbaceous plants in the riparian zone and the rejuvenation of bankside woodland (essentially, beaver coppicing), both of which help to maintain or increase bank stability. However, those species of insect or bird that rely directly on riverbank trees for habitat may well suffer – their trees will be felled and submerged! This is one of several areas that require greater research.

By increasing the diversity of habitat, the reintroduction of beavers is expected to increase invertebrate abundance, species richness and diversity thus providing essential food for many other animals such as birds, fish, mammals, reptiles and amphibians. However, the greatest increase is in lentic species – those that prefer stagnant water and some studies have shown that whilst, overall, invertebrate abundance, biomass and secondary productivity were greatly increased in beaver ponds, species richness and diversity were significantly decreased – sometimes by as much as 50%.

It should also be noted that beaver impoundments could actually threaten rare and endangered lotic (clean,free-flowing water) species such as the freshwater pearl mussel *Margaritifera margaritifera*). This species is listed as Endangered on the IUCN Invertebrate Red List, is protected under Schedule 5 of the UK Wildlife and Countryside Act (1981), and is also listed on annexes II and V of the EU Habitats Directive and Appendix III of the Bern Convention. The habitat of this and other rare or endangered species will need to be protected.

The dams and canals act as steps along the river's long profile, where some of the energy of the water is dissipated. This helps to regulate river flow and reduces flood peak levels downstream. Water flow is slowed, allowing organic matter to settle into the sediments.This may mean that less water treatment will be required downstream, reducing costs. Larger dams can extend marginal wetlands and wherever beaver construction occurs, a more complex local channel network develops, which can better accommodate high flows.

Most research also suggests that beaver reintroductions into England are likely to have a positive impact on fish populations. The beavers will create new foraging habitat and refuges for a wide variety of species, including those that are commercially important. Increased growth rates experienced by some fish in beaver pools, along with a tendency for larger species to replace smaller ones in warm water streams, could provide excellent opportunities for anglers. However, the species mix within rivers will almost certainly be altered and the knock-on effects of this have not been studied. Some scientists are also concerned that beaver dams may restrict fish movement and migration - this will need to be monitored closely if beavers are reintroduced.

Some researchers are also concerned that large beaver dams might actually become a threat. In Canada, the collapse of beaver dams has occasionally resulted in catastrophic downstream flooding. For this reason, it may be sensible to re-introduce beavers to those rivers where they are less likely to construct dams - low gradient river types with wide flood plains.

Reintroduction is likely to have a positive impact on native British amphibians by increasing suitable breeding habitat, although in certain parts of the country this could also benefit non-native species such as the American Bullfrog.

Beaver ponds provide suitable nesting, foraging, breeding and roosting habitat for many species of birds, particularly waterfowl (Table 2). Bird abundance, production, diversity and species richness is generally much greater at beaver-created wetlands than at non-impounded (non-dammed) sites and very few species decrease in abundance with the presence of beaver. If, as predicted, beavers lead to an increase in the abundance of invertebrates, amphibians and fish, this should increase food supplies for insectivorous, omnivorous and piscivorous birds. Beaver reintroduction in England may also provide additional foraging habitat for conservation priority species, such as the osprey.

**Table 2. Effects of beaver activity on waterfowl**

| Species | Abundance | Nesting | Brood rearing | Foraging |
|---|---|---|---|---|
| Mallard | - | + | - | - |
| Teal | + | + | - | - |
| Goldeneye | - | + | - | - |
| Widgeon | 0 | - | - | - |
| Duck sp | + | + | + | + |

+ = positive effect - = negative effect 0 = no effect

Beaver impoundments attract a large number of mammals, and could provide food and shelter for many native British species, including semi-aquatic mammals such as water voles, otters, and water shrews. Any negative impacts on mammalian fauna are most likely to be an indirect result of beaver activity, via creation of ideal habitat for introduced pest species, such as American mink.

In summary, whilst there are many possible beneficial consequences of re-introducing beavers, there are some disadvantages and several areas where we simply cannot be sure what will happen (see Box)

## Ecological effects of beaver dams and ponds

- increased storage of precipitation with reduced flow velocities
- reduced variability in the river's discharge regime (until a dam breaks)
- huge increase in water surface area, particularly in low relief environments
- increased water depth
- increased level of the local water table
- increased amount and availability of organic carbon, nitrogen and other nutrients in the channel
- increased nitrogen fixation by sediment microbes
- increased trapping of sediment and a decrease in turbidity downstream
- increased aerobic respiration as a result of increased water-surface area
- anaerobic biogeochemical cycles in sediments beneath ponds
- increased anaerobic breakdown in sediment beneath ponds, resulting in increased release of methane
- reduced oxygen levels in the water in spring and early summer due to decomposition of increased levels of organic matter
- increased extent of open canopy in wooded areas
- loss of species dependent on riparian trees as habitat
- more favourable conditions for riparian tree and wetland plant growth
- increased habitat for species dependent upon ponds, pond edges and/or dead wood
- both enhancement and degradation of conditions for fish, depending on the species
- replacement of running-water invertebrate taxa by pond taxa
- altered populations of fish species - an increase in the absolute importance of collectors and predators and a decrease in the relative importance of shredders and scrapers in impounded sites
- a several-fold increase in the mass of insects emerging from the water surface per unit stream length
- increased plankton productivity

## Does it make economic sense?

Environmental economists use tools such as **cost-benefit analysis** to work out whether environmental initiatives are economically worthwhile. For example, if beavers reduce downstream flooding then they may save hundreds of thousands of pounds. On the other hand, if the dams collapse and flood surrounding cropland, they may cost hundreds of thousands of pounds!

The results of a CBA of the beaver reintroduction in Germany are shown in Table 4.

**Table 4. CBA reintroduction of beavers in Germany**

| | | Euros |
|---|---|---|
| COSTS | Purchase of land & beavers | 1,244,500 |
| | Compensation payments | 1,200 |
| | Admin and management | 634,000 |
| TOTAL COSTS | | 1,879,700 |
| BENEFITS | Cultural services, recreation and tourism | 17,251,700 |
| | Regulation of nitrogen | 250,300 |
| TOTAL BENEFITS | | 17,502,000 |
| NET EFFECT | | 15,622,300 (BENEFIT) |

Recreation and tourism were seen as the greatest sources of income but retention of nitrogen (in sediments, for example) was also significant.

## Summary

Most of the studies into the impacts of beaver translocations and reintroductions have been based in Canada or the United States. The European beaver is a different species and Britain's rivers are significantly different from those in Canada and the US. For these reasons, some scientists have expressed caution that the benefits of reintroduction elsewhere may not transpire here. There are also many interactions that have not yet been fully investigated. However, so far, the main opponents have been landowners who claim that the beavers will damage trees and culverts, spread disease and encourage beaver-seeking trespassers!

Overall, it seems that, as for some other species, there is a growing tide of enthusiasm for the reintroduction of beavers. Both Natural England and the People's Trust for Endangered Species appear enthusiastic about the campaign so it may well be a case of "Re-introduce – and see what happens!"

**Source: This Factsheet is based upon:**

The feasibility and acceptability of reintroducing the European beaver to England. Natural England Commissioned Report NECR002 (March 2009) which can be downloaded from

http://www.naturalengland.org.uk/
and doing a search

or specifically from
http://naturalengland.etraderstores.com/naturalenglandshop/Product.aspx?ProductID=0228d212-15d7-41bf-8152-047585ec0941

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