CONSERVATION GRAZING

KONIK HORSE, EUROPEAN BEAVER AND WILD BOAR

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ON BEHALF OF WILDWOOD TRUST
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wildwood

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Introduction

The use of large herbivores in conservation grazing projects is becoming increasingly popular throughout much of Europe. There are numerous conservation and biodiversity issues associated with these projects which will be discussed here in detail in relation to three species: the European beaver *Castor fiber*, Konik horse *Equus ferus* and wild boar *Sus scrofa*.

Beavers, wild boar and Konik horses are all native British herbivores which became extinct in the wild in Britain due to deforestation, fragmentation of their habitats and hunting by humans. The Konik horse, or rather its ancestor, the Tarpan, has been absent from Britain for thousands of years. The beaver and the wild boar have both been absent for several hundred years. Due to their long absence from this country, their ecological effects on woodland, marshland, fens, riparian ecosystems and agricultural land are yet to be determined, although likely effects can be studied based on reintroductions abroad. All three species are classified as 'keystone species'. Keystone species have the ability to modify their environment to suit themselves and in doing so can benefit numerous plants and animals associated with the surrounding landscape, leading to a significant impact on the ecosystem.

Konik horse

Species reintroduction is increasingly being seen as a valuable tool for conservation, not only to save species from extinction, but also to reinstate species that have become locally extinct[1]. Article 11(2) of the Convention of European Wildlife and Natural Habitats states that European governments should encourage the reintroduction of native species[1]. However, there have been several alien introductions to Britain where species have proved to be detrimental to established native species. Consequently, reintroductions are viewed with some caution. Both the benefits and possible detrimental effects of reintroducing beavers, wild boar and Konik horses need to be understood in terms of their impact on ecosystems.

Wild boar

Before any species is reintroduced, IUCN (The World Conservation Union) guidelines need to be fulfilled. In Britain, the main legislative acts pertinent to the protection of the environment from invasive species are the Wildlife and Countryside Act (1981), the Dangerous Wild Animals Act (1976) and the Zoo Licensing Act (1981).

European beaver

History since the last Ice Age

Konik horse

Wild horses known as Tarpan were present in Britain during the Anglian glaciation, the Wolstonian glaciation and the late glacial periods. They may have remained into the post glacial on higher, less wooded ground, for example the Peak District. Tarpan characteristic of the late glacial had almost gone by the post glacial, due to not only an increased human population but also an increase in unsuitable woodland habitat.

Ice Age cave art depicting a Tarpan

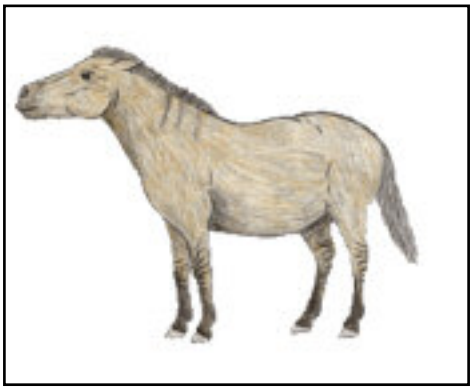
It is thought that Tarpan were reintroduced to Britain in Neolithic times, assuming that they had not survived through from the early Mesolithic. The earliest records from Britain date back to 3,740 b.p. They died out within 1,000 years after the start of the post glacial period.

Fossilised Ice Age horse jaw

During modern times, Tarpan numbers remained highest in Central and Eastern Europe, although the Tarpan ranged from southern France and Spain eastward to central Russia. By the 18th century very few Tarpan remained in Europe. Extinction of the Tarpan was caused by destruction of their natural habitat to provide room for the increasing human population. They were also hunted extensively for their flesh. The pure Tarpan was finally removed through hybridisation with domestic horses. The last Tarpan died in Russia in 1876.

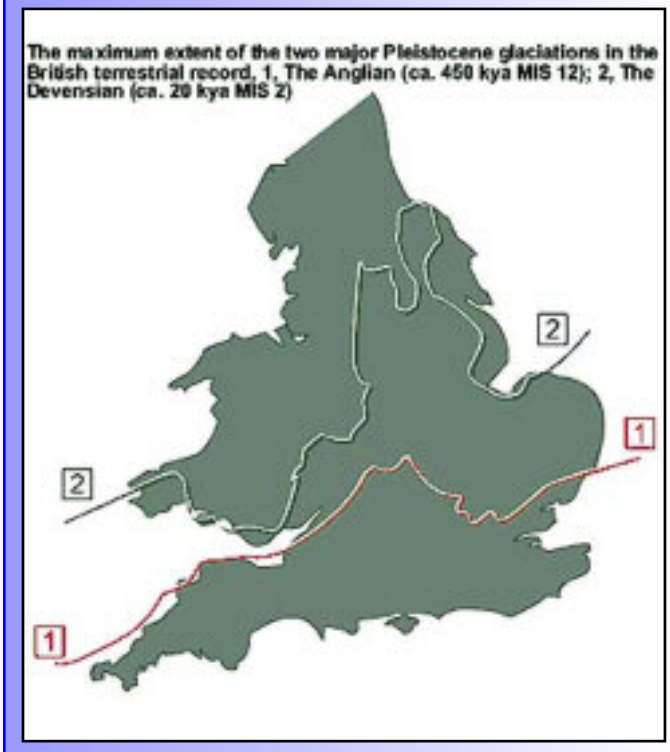
The Konik horse is a descendant of the Tarpan.

The word 'konik' is a Polish word, simply meaning 'small horse'. Tarpan were crossed with domestic horses to produce a hybrid. Selective breeding, during the early part of the twentieth century, of the horses with the most prominent Tarpan features produced the Konik horse. Konik horses are now found primarily in Belgium and Holland. They have recently been reintroduced to England, where they are being used as conservation management tools. Konik horses are currently being used to manage four nature reserves in Kent: Stodmarsh, Pegwell Bay, Whitehall Meadows and Ham Fen.



Drawing of a typical Tarpan

Extent of ice covering Britain during Devensian and Anglian glaciations



Ice distribution map during the Devensian (the last glaciation) and the Anglian glaciations.

European beaver

Beavers first appeared in the late Oligocene period in Europe, spreading to Asia by the early Miocene. The European beavers seen today date from the late Pliocene or early Pleistocene, less than two million years ago. Neolithic Ice Age remains have produced numerous records of beavers in Eastern Europe. When the ice of the last glaciation retreated, the beaver spread back to Britain, reaching it by 11,500 years ago. There are two species of beaver nowadays, the European beaver *Castor fiber*, formerly found in Britain and the North American beaver *Castor canadensis*.

Fossilsed beaver teeth

Beavers survived in Britain until the medieval period but were extinct over most of the country by the 12th century. The last isolated populations disappeared from Scotland by the 16th century. Beavers do not appear in the fossil record for Ireland, which is surprising. They are very capable swimmers, were present in the early post-glacial and are capable of negotiating a narrow land bridge.

Beaver pelt

Beavers were removed from much of their former range in Europe due to hunting for their pelts, meat and scent glands, although habitat loss was also a contributing factor. Pelts were particularly valued, due to the incredibly dense nature of the fur, which made it ideal for felting. By the 19th century, the European beaver faced extinction in Europe. It was restricted to several small strongholds, including parts of southern Norway, the Rhone Basin in France and the Elbe basin in Germany. It was brought back from the brink during the 20th century and it has now been reintroduced successfully to 13 countries.

European beavers are now protected under the Berne Convention and the European Union's Habitat Directive. The IUCN still classifies the beaver as vulnerable, meaning that it could face the danger of extinction in the future.

Beavers were often hunted for their scent glands (the beaver in the centre is shown offering his to the hunter in exchange for his life)

Timeline of the Cenozoic Era

(65mya to today)

Dates shown are relevant to beavers, wild boar and Konik horses. ***I*** = ***archaeological time***

Quarterary Period (1.8mya to today)

Holocene (10,000ya to today)
-*Neolithic period* (6000ya to 4000ya)
- *Mesolithic period* (10,000ya to 6000ya)
I Pleistocene (1.8mya to 10,000ya)
-Devensian Glaciation (73,000ya to 10,000ya)
-Wolstonian Glaciation (200,000ya to 125,000ya)
-Anglian Glaciation (450,000ya to 300,000ya)

Tertiary Period (65mya to 1.8mya)

I Pliocene (5.3mya to 1.8mya)
I Miocene (23.8mya to 5.3mya)
I Oligocene (33.7mya to 23.8mya)
I Eocene (54.8mya to 33.7mya)
I Paleocene (65mya to 54.8 mya)

Wild boar

Wild boar fossilised jaw

The ancestors of the wild boar date back to the last Ice Age, some 150,000-10,000 years ago, in the late Pleistocene. Having been absent during the last glaciation, they reappeared in Britain early in the post glacial, about 10,000 years ago. Mesolithic hunters preyed on wild boar. It is believed that they were domesticated, giving rise to the domestic pig, somewhere between 5,000-9,000 years ago, when humans settled down to farm.

Wild boar first became extinct in Britain approximately 600 years ago. The main causes of their extinction were overhunting by humans, combined with the destruction of their woodland habitat. Due to numerous subsequent attempts at reintroducing wild boar, the exact date at which they finally became extinct in Britain is unknown. It is believed that they became extinct in the wild in the 13th century and that reintroduced individuals from elsewhere in Europe, along with managed stock in hunting parks, became extinct in the 17th century. King James I reintroduced them to Windsor Great Park in 1608 but this attempt failed, primarily due to poaching. Attempts were made in the 18th and 19th centuries again to reintroduce wild boar from abroad, predominantly to private estates for hunting purposes. These attempts failed as the boar were seen mainly as pests.

Current distribution of wild boar in Britain (according to DEFRA)

After an absence of 300 years, wild boar are now once again present in the wild in Britain. Wild boar have been escaping from wildlife parks in Britain since the 1970s, either through their own devices or with assistance from humans. They have also been kept on farms in Britain since the late 1970s, where they are bred for their meat, which is considered a delicacy in many parts of Europe. Boar have escaped or been released by animal rights activists from farms on several occasions. The first accidental reintroduction to involve more than just a few animals took place in Kent after the Great Storm of 1987. It is thought that between 100 and 200 individuals escaped to establish a breeding population on the Kent-Sussex border. A smaller population of approximately 100 boar originated in Dorset in the mid-1990s and there are believed to be upwards of 50 wild boar in the Forest of Dean in Gloucestershire. The latest accidental reintroduction involved an unknown number of boar who escaped from a farm in Devon when the fences were deliberately cut. Official figures suggest there are approximately 400 established individuals in the wild in Britain and four main breeding populations. However, these are believed to be gross underestimates.

Collapsed fence during an escape

Wild boar would once have been seen as an integral part of British woodland habitat. However, after being extinct in this country for centuries, their impact upon reintroduction is unknown. They are known to cause rooting damage to agricultural land and in Europe there are compensation schemes set up for farmers whose land is damaged in this way. There are also concerns about the boar's impact on other species. Since wild boar were last here, there have been many changes to the British landscape, including loss of woodland, fragmentation of their habitat, changes in agricultural practices and a decrease in biodiversity. It may be that there is insufficient suitable woodland habitat nowadays to support significant numbers of wild boar in Britain.

Konik Horse Ecology

Konik horses show numerous primitive features, associated with their ancestor, the Tarpan. They are resistant to harsh climates and severe weather conditions, hence their extensive range. They are very fertile and can produce numerous offspring in their lifetime. As they are adapted to foraging in the wild, they can live on a limited amount of food and have an extremely resilient immune system. They are very intelligent, allowing them to adapt their diet according to season and food availability. They also have the ability to delay their growth in times of food shortage.

Konik horse grazing

Wild horses such as Koniks digest grasses better than domestic horses, enabling them to survive on a diet of much coarser foods than would be suitable for a domestic horse. Horses are not ruminants, but have a simple stomach arrangement much like a human. With its small, simple stomach and large fibre-digesting hindgut, the horse is designed to eat small amounts in a continuous fashion.

A Konik horse's teeth are specially adapted to its herbivorous diet. The incisors consist mainly of dentine, which is covered by enamel and an outer layer of cement, which eventually wears off. The incisors are not folded to the same degree as the molars, but there is a fold at the top. These teeth are designed for cutting and tearing as opposed to grinding. The molars are folded teeth, covered in cement and enamel, with rings and ridges of enamel surrounded by cement and dentin. The molars are grinding surfaces which are continually worn down, so grow throughout the horse's life.

Konik dorsal stripe

Koniks have a dun colouration, characterized by smoky grey or mouse-coloured hairs on the body. They have a black dorsal stripe and their face, tail and lower legs are darker than their body. Their manes are two-toned and their front legs have zebra stripes. Their heads are large, with large jaws and a thick neck. They also have relatively long manes. The whorl of hair on their forehead is found between the eyes, a lower position than their domestic relatives.

Distinctive long mane with white running throughout

Horses have binocular vision, allowing them to look at objects with both eyes at once. Each eye on a horse has a large range of vision. Horses have lengthened foot bones ending in a single toe covered by a hoof. This is an adaptation to running at speed. Hooves are strong and slow growing. In the case of Koniks, horseshoes are never required, as the hooves are naturally self-trimming, breaking off as they become too long.

Self trimming Konik hooves

Horses live in social groups or herds, usually consisting of one male stallion, numerous females and foals and sub-adults. The male does not always lead the group; it can sometimes be a dominant mare who takes charge. To reduce the risk of interbreeding, young stallions and mares are often rejected from the group on reaching sexual maturity.

European Beaver Ecology

Beavers are highly adapted to their amphibious lifestyle. They possess valves that close across both the ears and nostrils when underwater. They have an extra clear membrane that covers the eyes, allowing them to see without hindrance underwater, as well as providing protection. The tail is useful not only for swimming but also fat storage, thermoregulation, diving and as an alarm signal when slapped on the water. It is flat and scaly and often used for balance when cutting trees. Beavers' front feet are highly dexterous with an opposable digit, allowing them to dig and manipulate food. The hind feet are webbed (unlike the forefeet), allowing the beaver to propel itself through the water.

Tail used for propulsion

A beaver's dentition is adapted to its woody diet. Like all rodents, beavers have four incisors with open roots, which grow continuously throughout their lifetime. The incisors consist of a layer of enamel, backed by softer dentine. As they rub against one another, the softer dentine wears away faster than the enamel, maintaining a sharp cutting edge. The flat enamel ridges on the molars are used for shredding woody food. Unlike the incisors, the molars do not have open roots and gradually wear down throughout the beaver's life. A gap called the diastema takes the place of the canines, allowing the mouth to close behind the incisors, preventing swallowing of waste vegetation when gnawing. The diastema also allows beavers to gnaw on vegetation when underwater. The beaver's skull is very strong, allowing it to withstand the forces of its powerful chewing muscles.

Like many herbivorous mammals, beavers face the problem of digesting cellulose. Beavers ingest their food for a second time after it has passed through the body (caecotrophy), allowing further digestion and maximum nutrient intake. Due to the inability of the beaver to produce enzymes that digest cellulose, the caecum contains micro-organisms that aid in this process. Beavers learn the dietary preferences of their parents very early on by watching their parents eating. This highly adaptive behaviour, an example of social learning, is necessary as beavers inhabit areas with a range of vegetation types. For example, if their instinct was to feed on aspen in an area where this food source was rare, they would be unlikely to survive.

Female beavers normally reach reproductive age by three years old, and pairs can produce a litter of 2-3 kits on a yearly basis. Beavers live in small family groups, consisting of on average 3-5 individuals, usually an adult pair, kits, the previous year's kits and perhaps one or more sub-adults. Beavers are usually weaned by about a month old, and at just four days old can gnaw on the bark of trees. By the first autumn, young beavers have developed their full set of digging actions.

The building of lodges seems to be an innate behaviour, with beavers as young as 14 days old starting to push around building materials and carry sticks. European beavers have a preference for burrows in river banks, but will build lodges if necessary. When building dams, they have the ability to stand bipedally and carry materials between their chin and arms.

Beaver lodge

On colonising a new area, beavers will create a tunnel and lodge system for protection from predators. Dams may be created to provide a large area of deep water to escape easily when foraging. On finding a natural depression they will dig into it using their forearms and use their paws to move the soil away. Beavers may also create canals from the main body of water to aid in the transport of food and materials to their lodge.

Building a dam

Wild Boar Ecology

Wild boar have a large range and can be found living in a variety of climates. Their preferred habitats are broadleaved woodland and wild grass areas. The European wild boar *Sus scrofa scrofa* is found in Switzerland, France, Germany, Austria, the Netherlands and parts of Poland, Denmark, the Czech Republic and Slovakia. Wild boar have extremely thick skin and a coarse layer of long bristly hair with a softer, woollier underlayer to aid in retaining heat. In the summer they wallow in mud to aid in heat reduction as they lack sweat glands. Adult wild boar will also moult out their fur in summer, regrowing it by autumn.

Wild boar wallowing

Wild boar may live 15 to 20 years in captivity but due to hunting pressure they rarely live beyond six years in the wild. They search for food mainly at dawn and dusk, making them difficult to observe and their population numbers hard to keep track of. A diurnal pattern of activity can be seen when food is scarce or when there is increased hunting pressure. Females and their young live together in large groups called sounders. Young males form bachelor groups, whereas adult males are solitary, only coming together during the mating season, when males challenge each other for access to the females.

Although sexually mature at eighteen months old, male wild boar do not usually mate until they are four years old. Males have no part in the rearing of young and they leave the herd after mating. The sow builds a ground-level nest in a secure area of woodland, where between 3 and 12 young are born after a gestation period of 112-115 days. As the population size increases, the food supply dwindles and therefore dispersal of some subdominant individuals is necessary. On dispersing, wild boar have a preference for natural land rather than cultivated areas.

Wild boar piglets

Wild boar are of the order Artiodactyla, hoofed animals with an even number of toes (in this case four), which are symmetrical in shape. This means they have four weight bearing toes to support them. Their large size (adults can weigh up to 200kg) means that a lot of the damage they can cause to woodlands and agricultural crops is via trampling. Their hooves are also used to hold their food in place whilst they are eating.

Wild boar have relatively poor eyesight, which is balanced by an exceptional sense of smell. A wild boar's long narrow snout is toughened for rooting amongst leaf litter and damp soil of open woodlands. These rooted areas can reach depths of 5-15cm allowing the boar to feed on the tree roots, soil invertebrates and bulbs[2]. Rooting behaviour develops in the piglets very early, during the first few days of life[2].

Wild boar snout

Wild boar have a simple stomach arrangement and do not ruminate. This means that plant matter, unlike in cows, is difficult to digest as the cellulose is not broken down into digestible pieces. The wild boar's diet consists of fruit, reptiles, small mammals, nuts, roots, fungi, eggs, nestlings, invertebrates, bulbs, agricultural crops, acorns and beech mast[1].

Wild boar have a dental formation that is specifically adapted to their diet. The males grow tusks when they are approximately one year of age, consisting of a sharp cutting edge, continually sharpened by the upper tusks rubbing against the lower.

Reintroduction of Konik horses

Grassland in Britain is dependent upon numerous processes that prevent its succession to scrub and eventually woodland. In the process of succession, numerous plant and animal species that depend on open land disappear.

Large, wild, grazing animals have been absent from our landscape for a substantial length of time, meaning there is little knowledge of how natural grazing systems worked when they were present. Konik horses are used mainly in wetland ecosystems, where they have been shown to improve the vegetation structure and enhance biodiversity. At present Konik horses are being used to fill a niche that was left vacant by the extinction of the Tarpan.

Positive impacts

Introducing Koniks to wetland ecosystems in Britain provides a large scale, cost effective method of conservation management. Encouraging a wide diversity of plant and invertebrate species provides a mosaic of habitats. During the spring and summer months, Koniks prefer grazing on grasses. By autumn they will take a more varied diet including sedges, rushes and reeds. This helps stimulate wildlife in fens and marshes. When food is scarce in winter, they dig up and eat roots and rhizomes of some plants. They effectively control the succession of scrub into woodland by browsing on a range of tree species including willow, oak, elm, brambles and hawthorn. Botanically diverse pasture promotes high densities of insects and the open land gives plants, birds and insects a chance to settle in an area. The grazing and roaming of such species will aid in maintaining open countryside, essential for the survival of numerous other species.

Mechanical reed cutting

Worming drugs are not used on the Konik horses at either Stodmarsh or Ham Fen. These can pose a risk to the biodiversity of manure fauna. Dung beetles lay their eggs in fresh manure, where the drug residues kill the newly hatched larvae. Manure contributes greatly to biodiversity, providing habitats and a food source for numerous invertebrates, mammals, birds and fungi. Dung arthropods aid in the breakdown of the organic matter of the manure and plant nutrients it contains[3].

Konik horses graze intensively and systematically in small areas so their effects are long lasting and resounding. It seems to be the case that they keep to a different diet each season, allowing each species of plant to be grazed at some point, but the terrain is not constantly grazed. They prevent wet grassland from becoming overcome with reeds, through intensive grazing.

Negative impacts

Due to their selective grazing Konik horses can completely eliminate a single plant species from an area.

Ham Fen and Stodmarsh

In 2002, Wildwood, together with English Nature and Kent Wildlife Trust, imported two herds of Konik horses from Holland to manage the wetlands of Stodmarsh and Ham Fen. This was a move to restore a native species to Kent, where big grazers originally shaped the British countryside. They have been introduced to fenland to manage the area by grazing and trampling.

At Stodmarsh, the herd is mainly confined to areas of grazing marsh and reed bed where beneficial changes to surrounding wildlife have been observed. An increase in the biodiversity of invertebrates has been seen where they have been attracted to the horses' communal dung heaps[4].

Konik at Stodmarsh

If there are plants of high botanical interest at a site, this should be considered when introducing Koniks. Konik horses produce a patchy mosaic structure of vegetation, which creates a diversity of flora and fauna for numerous species. Although the horses are wild they are confined to certain areas of the reserve, where they are rotated in fields, reducing the risk of overgrazing[3].

Reed beds at Stodmarsh

Oostvaardersplassen

The Oostvaardersplassen, found in the Netherlands, is a famous wetland of international importance with numerous breeding marshbirds, migrating waders and waterfowl. Many natural habitats have become fragmented causing various species to abandon this area. Here conservation management is entirely natural, involving in particular Konik horses, roe deer, red deer and Heck cattle. In 1984, twenty Konik horses were introduced to transform the reed beds into more open and diverse vegetation.

Konik horses on the Oostvaardersplassen

Konik horses are increasingly being seen as a natural part of large nature reserves, fulfilling an essential role in the development and management of the landscape. The Konik horses put to graze by farmers increased the conversion of the remaining farmland in the marginal zone into grassland. Big grazers seemed to prefer dry grassland; wet grassland was used to a limited extent but had the highest ecological value. Konik horses aid in keeping the grass short in the marginal zone, for the benefit of numerous species including ducks, geeseand meadow birds.

The horses can survive well even in hard winters, compensating for the poor food quality by eating more of it. Konik horses alone cannot manage the landscape without the integration of big grazers, in particular roe deer, red deer and Heck cattle. Deer consume large quantities of buds, bark and twigs from trees which horses do not feed on. When the earth is trampled and opened it provides conditions for other plants to germinate. The problem with this is that trampled earth provides good germinating conditions for elder. Konik horses do not consume elder due to toxic substances in the leaves. There are some species that become more abundant in swards that are heavily trampled, for example rye-grass. Most species are most abundant in areas of medium density trampling.

Implications of their return

Konik horses have already been introduced successfully to Britain. They have increased biodiversity when used as a conservation management tool in marshlands and fens. An ideal conservation management tool would involve the use of a single large herbivore, providing different grazing systems. This should provide a varied vegetation structure and an increased number of habitats for both plants and animals to inhabit.

Species such as the reed warbler can benefit from grazing by Koniks

Reintroduction of European Beaver

Beavers play a central role in the functioning of riparian ecosystems, due to their ability to modify the landscape to suit their needs. They have the ability to create wetlands, which are considered one of the most invaluable land-based ecosystems. However, they can compromise the integrity of levies, roadways, bridges and dykes and can plug culverts and drainage ditches.

As generalist herbivores, the beavers' diet varies seasonally. Aspen is their preferred tree species, but they will also take alder, birch, willow and oak. In the spring and summer months they feed mainly on non- woody plants, including leaves, roots, aquatic plants, herbs and grasses. In northern latitudes, where the water freezes in winter, beavers store food underwater, allowing them to retrieve it without leaving the safety of the pond.

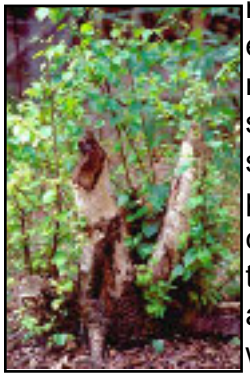
Beavers have the ability to fell trees up to one meter in diameter but prefer trees less than 10cm in diameter. In Europe at present, beavers are increasingly moving onto agricultural land, where they are becoming a pest. Beaver dams can flood agricultural land, fields and meadows. Orchards and plantations are also used as a food source by beavers.

Positive Impacts

Modification of the landscape by beavers has many important ecological benefits. The bodies of water they create by building dams provide valuable wildlife habitats for fish, waterfowl, amphibians and invertebrates. Fish benefit from an increase in numbers of bottom dwelling invertebrates which have a preference for slow moving water. A study in Lithuania showed that beavers have a positive influence on amphibian diversity and breeding by providing raised water levels, calm waters, habitat heterogeneity and areas free from vegetation[5]. Fish-eating birds benefit from the fish attracted to the slow moving waters of the pond. Waterfowl use the beaver's ponds to nest on and various herbivores benefit from the re-growth of woody plants and grasses in the surrounding area, caused by tree-felling.

Beaver ponds provide suitable habitat for otters, water voles and water shrews in abandoned lodges and burrows. Water voles also benefit from the aquatic grasses found on the margins of beaver ponds. Beavers slow the current of the rivers they occupy so that instead of organic matter being washed away, it is retained as sediment. This build up of nutrients makes the beaver habitat more fertile and favours the growth of aquatic vegetation.

Beavers have a natural coppicing effect on many deciduous trees, encouraging the production of new shoots, as well as stimulating vegetation succession. Coppiced wood provides another potential crop for beavers to harvest in the future. Coppicing trees allows more light to reach the woodland floor, providing a more diverse ground flora. Beavers also create a variety of deadwood habitats for many invertebrate species by felling trees and through the flooding of woodland.



Beaver coppicing

Damming has a significant impact on water quality. Sediments are slowed down and pollutants are oxidised when water seeping through the dam is aerated. Slowing the flow of water reduces erosion and stabilises riverbanks. The exposed mudflats provide fertile soils for future agricultural processes, or provide vegetation for diverse wildlife habitats. Once the beavers move on and the dam is no longer being constantly maintained, it will eventually fail and the pond will drain away. A transition to a riparian wood-land habitat will eventually occur when the area becomes dry enough to support tree growth. European beavers have been used as stream ecosystem engineers in Sweden and also used with great

Burst beaver dam

success in wetland restoration projects in Russia[6].

Negative impacts

Dam building activity can result in widespread flooding of surrounding agricultural land and woodlands, as well as flooding roads, railroad tracks and causing property damage. Flooding caused by dams can result in tree drowning, especially in aspen, alder and willow. However, none of these are seen as particularly commercially valuable. A study on juvenile salmon and trout in Norway supported the fact that beaver dams may prove impossible for anadromous fish populations to cross upstream[7].

Beavers' preference for aspen puts additional pressure on a species already under pressure from both domestic and wild grazing herbivores. Beavers do not fell trees that are larger than 1m in diameter but a larger tree can be girdled by removing the bark completely from around a section of the trunk, either killing it or, depending on the extent of damage, seriously harming it. In the Netherlands, beavers were reintroduced in part to increase species diversity within willow-dominated woodland. Instead they had the opposite effect by removing some of the less common tree species[8]. Felling of trees does have an effect on the surrounding woodland, but this rarely results in deforestation of the riparian zone.

Beavers can occasionally cause damage to agricultural crops as well as orchards, vineyards and nurseries. Occasionally, bank dens can cause damage when they undermine the integrity of the water holding structure.

Beaver Project at Ham Fen Nature Reserve, Kent

The Ham Fen beavers are part of a closed nature reserve, where their impact on the landscape is being closely studied. They are being used as a conservation management tool to restore the habitat to a more favourable condition. The presence of the beaver should re-establish and maintain a more diverse mosaic of wetland habitats[9].

The main objective of the project is to restore and maintain Kent's last remaining ancient semi-natural fenland. Konik horses are also being used in this restoration of wet grassland, fen and freshwater marsh habitat. Browsing on aquatic vegetation, waterside coppicing and re-profiling of channels and ditches by the beavers should aid in the restoration of degraded and fragmented ecosystems, whilst preventing the area from becoming overgrown by woodland vegetation.

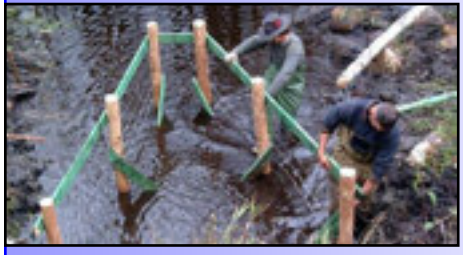
Beaver on Ham Fen nature reserve

The beaver's return to Britain

Scottish Natural Heritage has carried out extensive evaluations on proposed beaver reintroductions to Scotland. These showed that Scotland's existing riparian habitats could support up to 1,000 beavers. Since the 1920s, the European beaver has been reintroduced to 13 countries in Europe, with no serious ecological problems. It appears that beavers can be reintroduced successfully as long as the population density is low enough to allow dispersing young to colonise new habitats without interfering with humans.

Beaver Control and Management

Beaver management on reintroduction is essential, not only to protect the beavers, but also to prevent conflict between beavers and people, particularly landowners. Beaver deceivers and beaver stoppers can be used to prevent beavers from plugging culverts in roads. Levellers run through beavers' dams, draining off some of the water from the pond and thus preventing the water from reaching a dangerous level.



Beaver control methods

Reintroduction of Wild Boar

Wild boar are woodland animals. However, since they were last present in Britain, our native woodlands have been reduced in extent by a very large amount, raising the question of whether there is sufficient habitat available for wild boar to ever be present in large numbers in modern Britain. Also, the growth in the amount of land devoted to agriculture makes it more likely that wild boar will venture onto farmland in search of food.

Wild boar in woodland

Wild boar can have both positive and negative effects on eocsystems, particularly in regard to agricultural land and ancient woodland. As far as agriculture is concerned, the rooting behaviour of wild boar at their natural carrying capacity can cause considerable agricultural damage. It is unknown as yet whether this will lead to economic loss in the UK, as their numbers have not yet reached this point. With current wild boar numbers being so low, their impact on agriculture is insignificant compared to damage caused by other species of wildlife. Wild boar preferably consume acorns and beech mast, where available, and therefore consumption of agricultural crops is only likely to occur in years of poor natural food supply[10]. However, in consuming crops, wild boar also trample them and this may be a more important cause of crop damage.

Acorns are one of the wild boar's preferred foods

Being a former native British species, woodland ecosystems would have evolved with wild boar as an integral part. However, it is possible that woodlands could have stabilised and evolved separately in their absence. In this case they could significantly alter the ecology on returning to their natural habitats.

Positive Impacts

Rooting by wild boar is often seen as a beneficial process. Their rooting activities incorporate leaf litter into the soil, accelerating decomposition by organic matter, mixing soil nutrients and bringing seeds close to the surface[1]. This activity, along with their dung which acts as natural fertiliser, leads to an increase in the diversity of plant species, which benefits the food chain as a whole. Species diversity in British woodlands is declining due to monocultures of grasses and commercial operations. Wild boar may eliminate a single species but in the process produce opportunities for several new species to be established. A woodland ride that has been rooted by wild boar, such as the one illustrated, may look bleak in winter but in summer many different species of wildflower will appear, whereas previously there would only have been grass.

Wild boar rooting increases diversity

In Sweden, it has been shown that the plant species richness in reed beds, alder marshes and pine forests was increased by the rooting activity of wild boar. Welanders' study showed that disturbance seemed beneficial for species with minute seeds such as orchids. His study further suggested that wild boar aided in seed dispersal as seeds got caught in the boar's bristles and were transferred when wallowing or rubbing against trees[11].

In Germany, the introduction of wild boar into young conifer plantations has enhanced the regeneration and growth of the Norway spruce, by removing competitive weeds[12]. Another positive aspect of wild boar rooting is that they consume the larva of invertebrates considered to be pests of timber products.

Negative impacts

There is some evidence that rooting activity by wild boar may not always lead to an increase in biodiversity. According to a study in the Great Smokey Mountains National Park, USA, the presence of wild boar significantly decreased the plant biodiversity, although it must be bourne in mind that, unlike in Britain, wild boar are not native to the USA[13]. Another study in the Netherlands showed that regeneration of beech, oak and red oak was reduced the more rooting activity was present[14].

Bluebells are an important part of our ancient woodlands and their numbers are already in decline. Wild boar would be likely to root up and eat their bulbs, further decreasing their numbers. The wood anemone is a classic indicator of ancient woodland and has shown contradictory results in studies looking at the effect of wild boar. One study showed that the wood anemone benefited from rooting, due to regeneration of the rhizomes fragmented by the wild boar. However, a later study showed that the growth of the wood anemone was greatly reduced when wild boar fed on the plants rhizomes[2].

Wild boar do not solely have an effect on the flora, but also have a substantial effect on the surrounding fauna. This may be beneficial, as when an increase in diversity of plant species leads to an increase in diversity of invertebrates and so on up the food chain but this is not always the case. Wild boar living in stands of Norway spruce in Austria caused additional mortality of a species of sawfly[12]. In intensively rooted areas, two small mammals living in the leaf litter, the Short-Tailed Shrew and the Red-Backed Vole, were almost eliminated. There are numerous species that rely on acorns in their diet, for example introduced grey squirrels and small rodents, and in this case wild boar act as a competitor. It has been suggested that wild boar can also predate eggs of ground nesting birds or destroy them through trampling[15].

Compensation

Farmers abroad are compensated for any damage that wild boar cause to agricultural land. At present, due to the low population levels of wild boar in Britain, this compensation scheme has not been adopted. If the wild boar population were to increase, a concurrent increase in the level of agricultural damage could be expected and compensation schemes could be introduced[2].

Rooting in fields

The level of impact on woodland ecosystems will depend upon the available food supply for the wild boar, especially acorns and beech mast. These food items vary on a yearly basis and the wild boar numbers will fluctuate accordingly. Fluctuating population numbers mean that the ecological effects of rooting disturbance on the woodland floor will not be consistent from year to year[2]. According to Mackin the increased damage to fields in summer is due to increased food requirements, as the adults begin fattening up for the winter and the young boars' growth is accelerating. Supplementary feeding during the spring and summer period should prevent damage[16]. A study in Germany showed that the division of populations into small groups causes an increase in the damage done to fields[17].

Wild boar in Britain

As wild boar are a native species, made extinct in this country by human activity, many people feel the boar have a right to be here and that their return should be encouraged. Others are concerned at the effect this large, rooting animal could have on the British landscape.

To some extent, the accidental reintroductions which have already taken place have taken the decision out of our hands. Wild boar are already back in the British countryside and the question now becomes, how do we manage them? It is crucial that the knowledge gained from studies of wild boar in Europe should be considered when deciding how to manage such a large mammal in a densely farmed landscape.

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