

# Reintroduction, range expansion, and population development on a continental scale: the beaver's reconquest of Eurasia



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## Introduction

Formerly widespread throughout much of the Palearctic region, Eurasian beaver *Castor fiber* populations were reduced through overhunting to c. 1200 animals, in eight isolated populations, by around the end of the 19th Century (Figures 1 & 2). Since the 1920s, effective protection of these remnants, the resultant natural spread, and widespread reintroductions have led to a powerful recovery in both range and population (Figures 1 & 2).



## Population status

The minimum population estimate in 2008 is 643 000 individuals. c. 15 000 introduced North American beaver *C. canadensis* are established in Finland, Russian Karelia, and the Russian Far East; other populations introduced to France, Poland and Austria are now extinct.

Populations are now established throughout Europe, with the exception of the Great Britain (reintroduction Scotland scheduled 2009), Portugal, Italy and the southern Balkans. Habitat occupied ranges from wilderness areas to intensively managed landscapes with dense human populations, and from warm temperate to subarctic climates. Reintroductions are continuing. Considerable further expansion of both range and population, especially in western Europe and the lower Danube basin, can be expected. If current trends continue, *C. fiber* will within a few decades be a fairly common mammal throughout much of Europe.

## Patterns of spread and population development

Following initial establishment on a watershed, populations typically show a pattern of rapid range extension, followed only later by rapid population growth (Figure 3). There is strong selection for high-quality habitat at this stage, which appears to explain the rapidity of range extension. Later (on average, 34 years post-colonisation in Sweden), populations go into decline as marginal habitat is occupied and then exhausted (Figure 4). The period of peak and declining populations often coincides with a peak in conflicts with human land use interests, as marginal habitats are more likely to require extensive modification by beavers.

## Barriers to spread

Even in areas with short overland distances between suitable habitats and favourable terrain, watershed divides form a clear barrier to population spread (Figures 3 & 5). Where a significant physical barrier to population spread exists, such as mountains (e.g. Switzerland) or intensive farmland (e.g. Elze River, Brittany), it may be strongly isolating.

Man-made dams and barrages have also been shown to constrain or prevent population spread within a river system, e.g. on the Rhône and Danube (Figure 6). Solutions include the construction of "beaver ladders" around barrages.

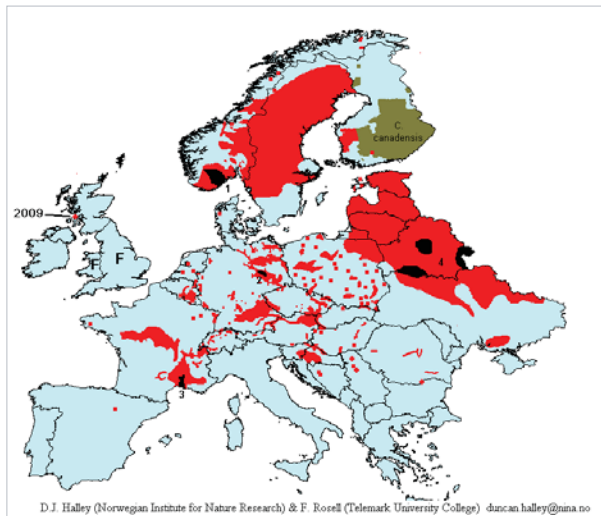


Figure 1. Distribution of beavers in Europe, excluding Russia. Locations of relic populations are marked in black: 1 *Castor fiber fiber*; 2 *C. f. albus*; 3 *C. f. galliae*; 4 *C. f. belarusicus*. Red shading represents the present range of *C. fiber*; green shading represents the range of *C. canadensis* in Finland. Red squares are reintroduction sites where range has not yet spread significantly; red crosses represent planned reintroductions, with date where known. Countries marked 'F' have feasibility studies in progress.



Figure 2. Distribution of beavers in European Russia and Asia. Locations of relic populations are marked in black: 4 *Castor fiber belarusicus*; 5 *C. f. osteuropaeus*; 6 *C. f. pohlei*; 7 *C. f. tuvinicus*; 8 *C. f. biruli*. Red shading represents the present range of *C. fiber*; green shading represents the range of *C. canadensis*.

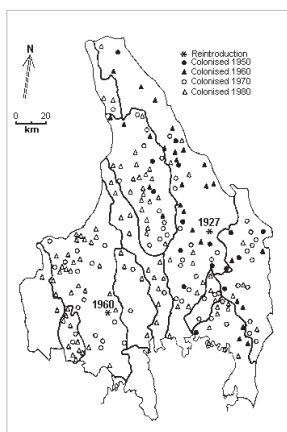


Figure 3. Patterns of spread of beaver recolonising Värmland province, Sweden. Terrain is flat to mildly hilly and heavily wooded. Watershed divides are shown by bold lines. Dates and locations of reintroductions are indicated. Beaver spread very rapidly throughout watersheds after initial recolonisation, with infilling thereafter. Watershed divides, however, significantly slowed range expansion. Figure adapted from Hartman (1994).

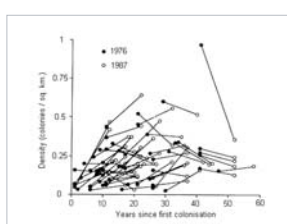


Figure 4. Changes in local beaver population densities in Värmland, Sweden, related to time since colonisation. Figure adapted from Hartman (1994).

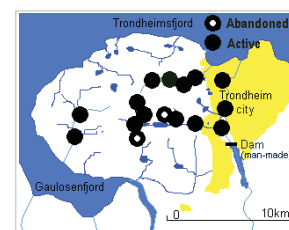


Figure 5. Distribution of beavers in Trondheim Byneset in 2005. Filled black circles represent the centres of active home ranges; hollow circles indicate abandoned home ranges. Beaver were reintroduced in 1975 and by 2005 had colonised three of the six major stream systems. Each of the three largest uncolonised stream systems contain sufficient habitat for several beaver colonies, but as yet remain unoccupied, although clearly marginal sites on the other systems are in use or have been abandoned.

Table 1. The history and present status of Eurasian beavers (*Castor fiber*) by country (updated after Halley & Rosell 2002)

Country	Extinct	Protection	Re-introduction/translocations	Present population
Austria	1869	-	1970-90	2800-3000
Belarus	remnant	1922	-	24,000
Belgium	1848	-	1998-99	400-500
Bulgaria	?	?	-	0
Bosnia & Herzegovina	?	?	2006	>40
Croatia	1857?	-	1996-98	350-400
Czechia	17th cent.	-	1991-92, 1996	c.500
Denmark	c.500 BC1	-	1999	80-90
England	18th century	-	Feasibility study in progress	0
Estonia	1841	-	1957	17,500
Finland	1868	1868	1935-37, 1995	2000
France	remnant	1909	1959-95	7000-10,000
Germany	remnant	1910	1936-40, 1966-89, 1999-2000	8000-10,000
Hungary	1865	-	1980-2006	473
Italy	1541	-	proposed	0
Kazakhstan	?	-	-	1000
Latvia	1830s	-	1927-52, 1975-84	>100,000
Lithuania	1938	-	1947-59	50,000-70,000
Luxembourg	?	?	2000	4
Mongolia & China	remnant	?	1959-85	800
Netherlands	1826	-	1988-2000	177-227
Norway	remnant	1845	1925-32, 1952-65	>70,000
Poland	1844	1923	1943-49, 1975-86	18000-23000
Portugal	c. 1450	-	-	0
Romania	1824?	-	1998-99	271
Russia	remnant	1922	1927-33, 1934-41, 1946-64, 2003-	232,000-300,000
Scotland	16th century	-	Scheduled 2008	0
Serbia	1903?	-	2003-4	110-120
Slovenia	?	?	1999	<6
Spain	17th cent.	1980s	2003	>40
Sweden	1871	1873	1922-39	>100,000
Switzerland	1820	-	1956-77	>350
Ukraine	remnant	1922	-	6000
Wales	16th century	-	Feasibility study in progress	0

## Management implications

Beaver populations and distribution should normally be managed at the watershed scale. A major exception is that sections of watersheds may be manageable in isolation where man-made dams act as barriers to beaver dispersal. Populations can be regulated, and conflicts with human land uses minimised, through the introduction of a controlled harvest (e.g. through sport hunting). This should be introduced during the rapid increase phase of population growth.

Early provision of interpretation and public viewing opportunities has been a feature of many recent reintroductions. This provides benefits in the form of public enjoyment, enhancement of the local economy through wildlife tourism, and the fostering of positive attitudes to beavers.



Figure 6. Dams and barrages across rivers, even relatively small structures, form significant barriers to beaver dispersal within a watershed. In many cases the isolating effect has been shown to be very strong.

## Acknowledgements

This review relies largely on published and unpublished information kindly made available to me by many beaver researchers and managers throughout the region; I regret that space limitations prevent me from naming them individually. I would like to thank G. Hartman for allowing me to adapt figures on range extension and population growth/decline from data published in his doctoral thesis on beaver population development in Sweden.

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