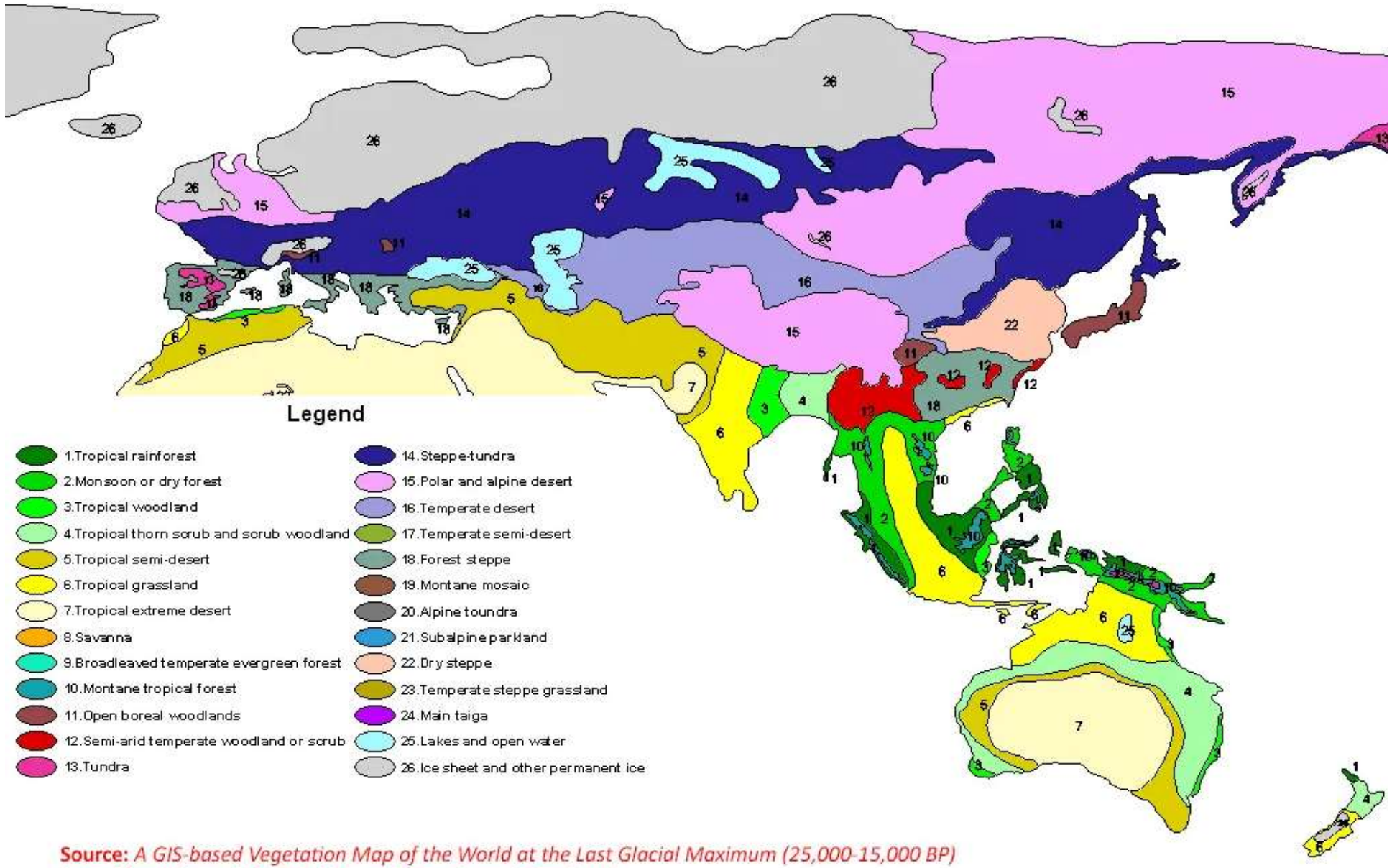
Cite as: Halley, D. & Schwab, G. 2020. Eurasian population and distribution: the past, present and future. Presentation, BeaverCON 2020, Baltimore, March 3-5 2020

Eurasian beaver population and distribution: The past, present and future

Duncan Halley, Norwegian Institute for Nature Research

Gerhard Schwab, BUND Naturschutz in Bayern e.V.



Source: *A GIS-based Vegetation Map of the World at the Last Glacial Maximum (25,000-15,000 BP)*
http://intarch.ac.uk/journal/issue11/rayadams_index.html

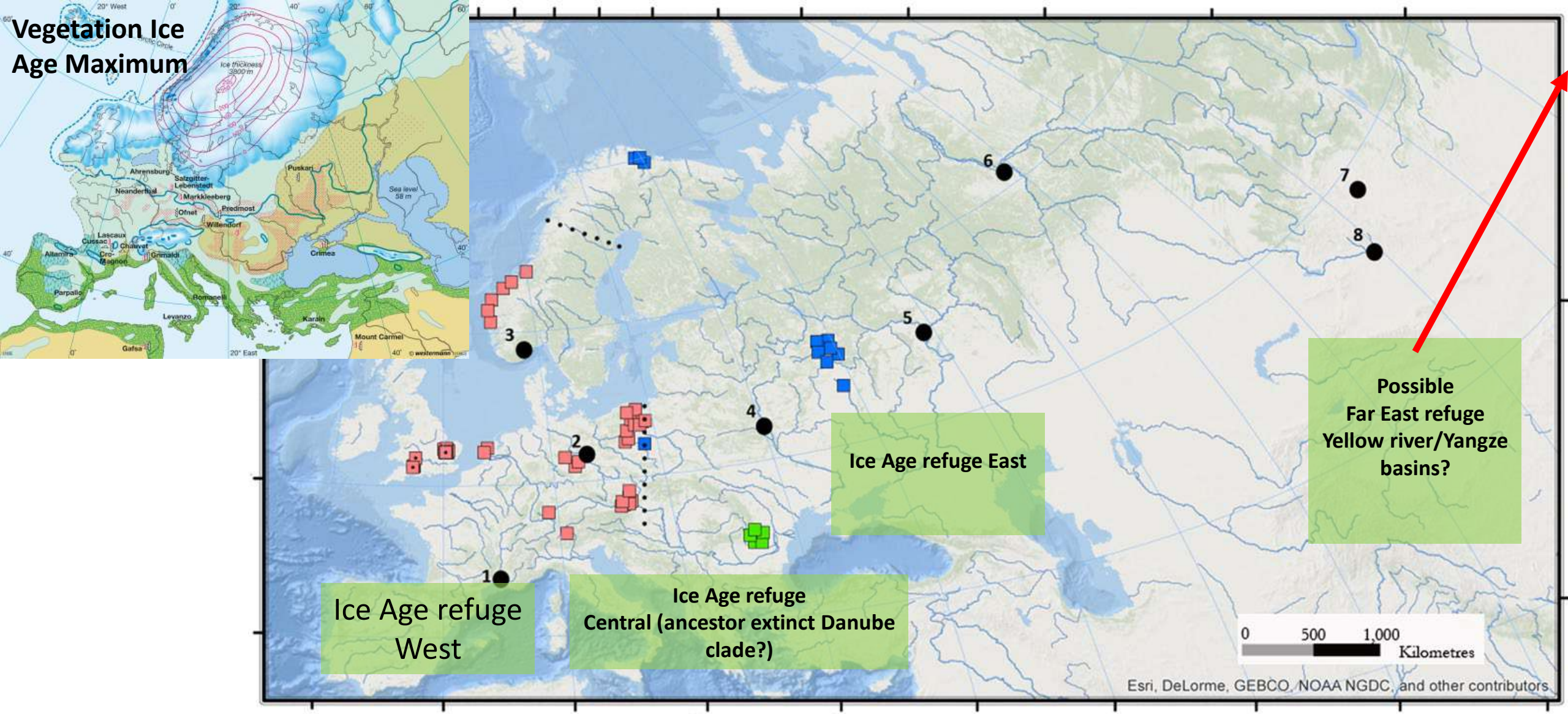
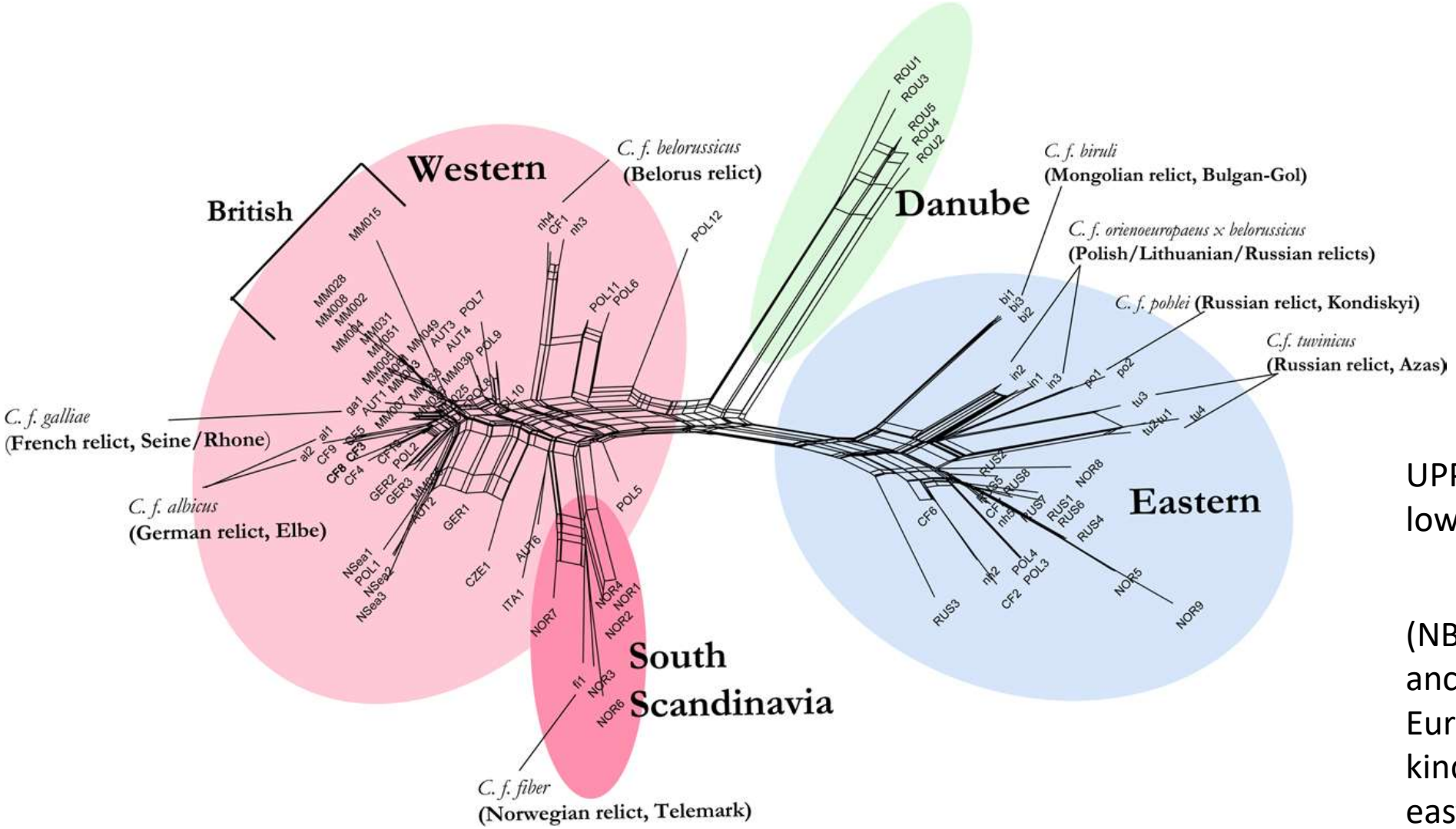


Fig. 1 in Marr et al 2018. Map of sampling localities for ancient *Castor fiber* individuals. The Western clade (pink) and Eastern clade (blue) had two post Ice-Age contact zones. A now extinct clade existed in the Danube Basin (green). Approximate locations of extant relict populations (1 to 8) from where modern *C. fiber* haplotypes derive are shown in black. *Data was sourced from Natural Earth Data*, www.naturalearthdata.com.

(NB that no data for ancient DNA east of European Russia is as yet available; the furthest east relict populations, 7&8, headwaters of the Yenesei and in western Mongolia/north Xinjiang, are of 'Ice Age refuge East' origin)

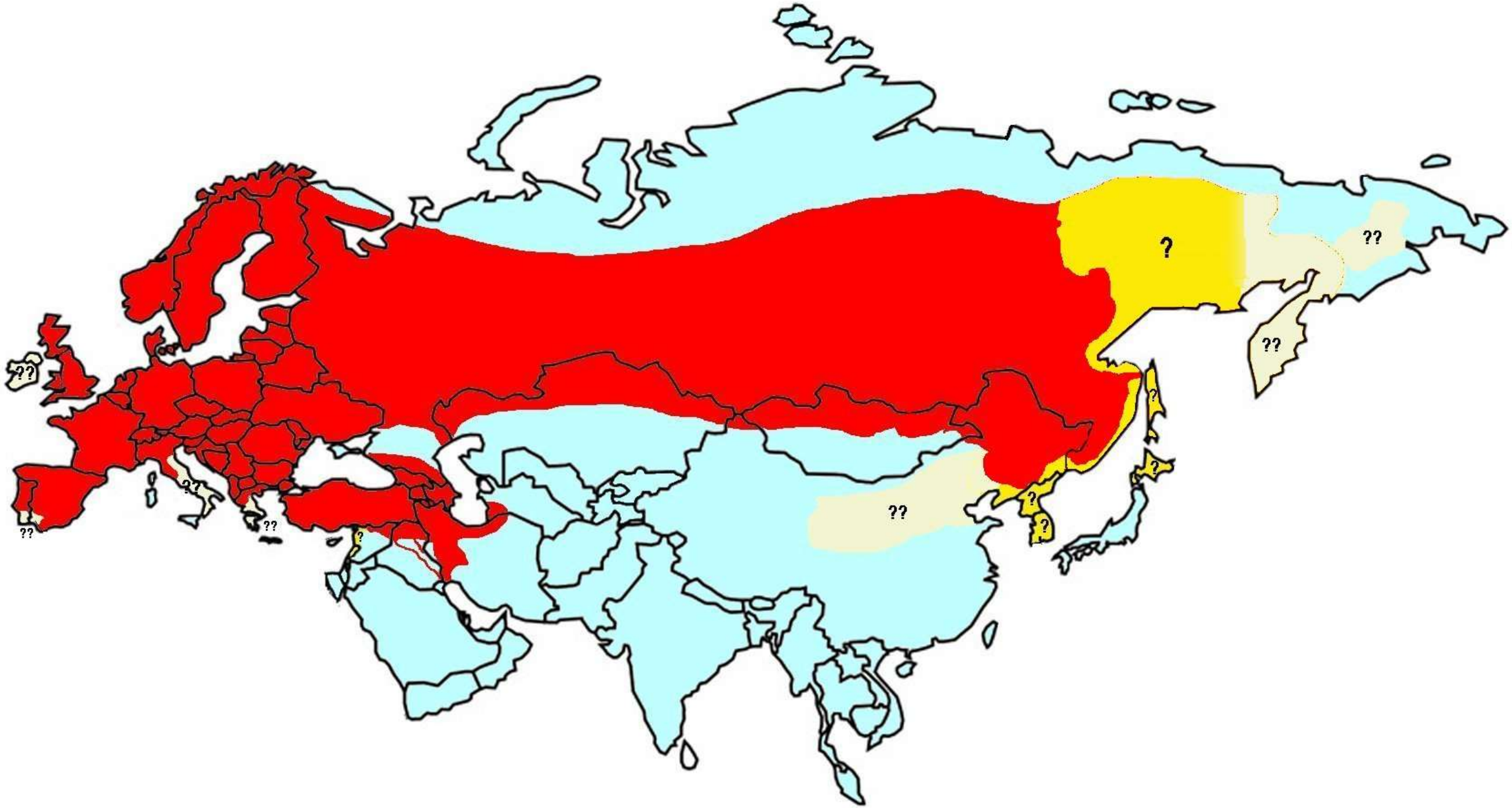


UPPER CASE: ancient DNA
lower case: modern refugia

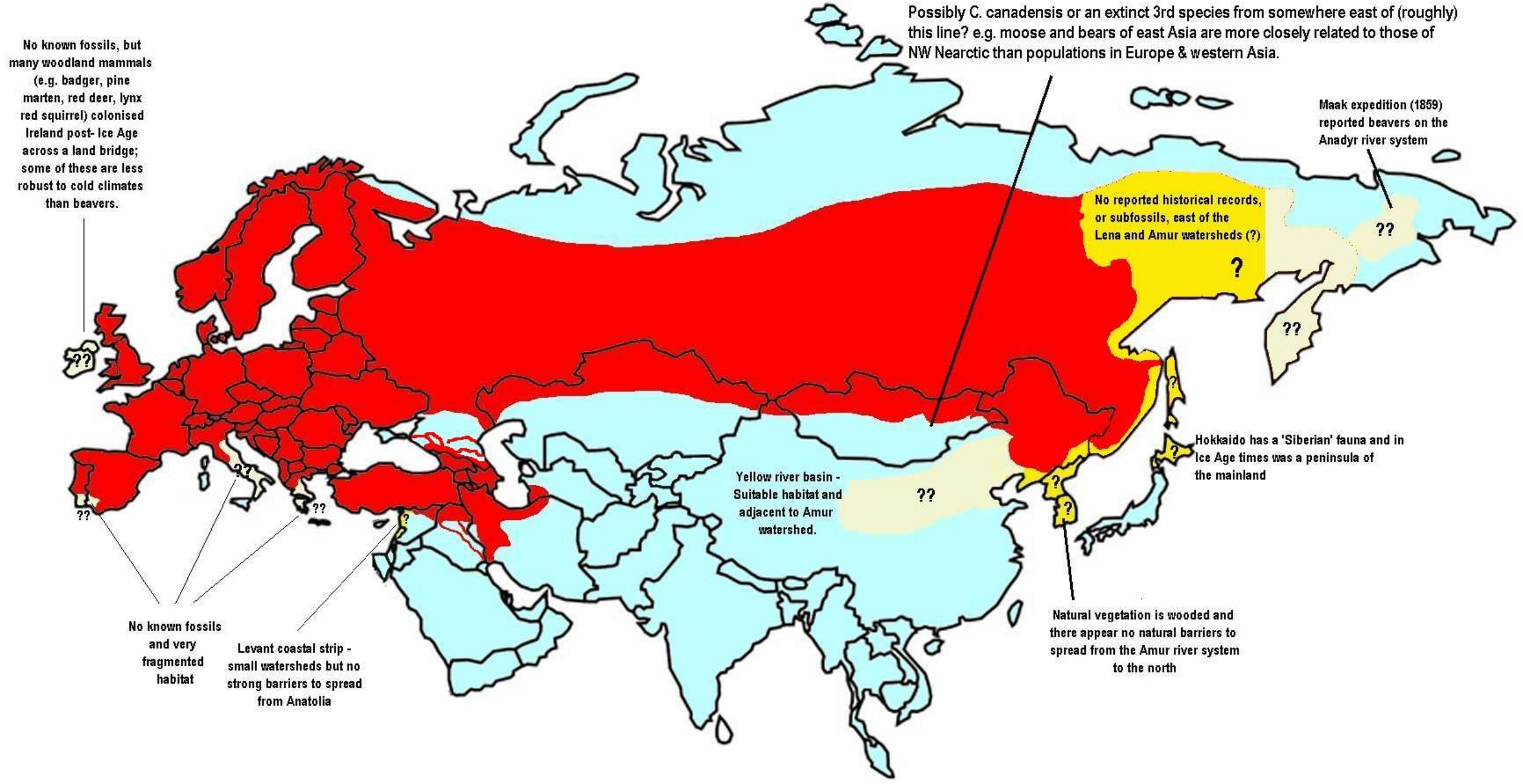
(NB that no data for ancient DNA east of European Russia, or of any kind from the Baikal region eastwards, has been published)

Neighbour-net network showing relationships among ancient and modern beavers. Source: Marr et al 2018

Probable post Ice-Age distribution of beavers in Eurasia



Probable post Ice-Age distribution of beavers in Eurasia



Cuenca-Besos et al 2017

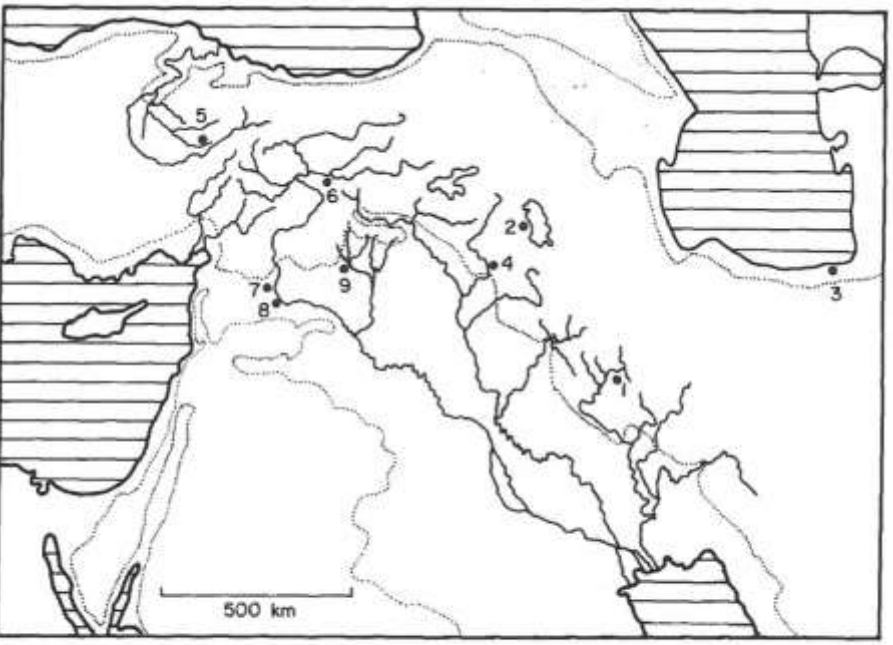
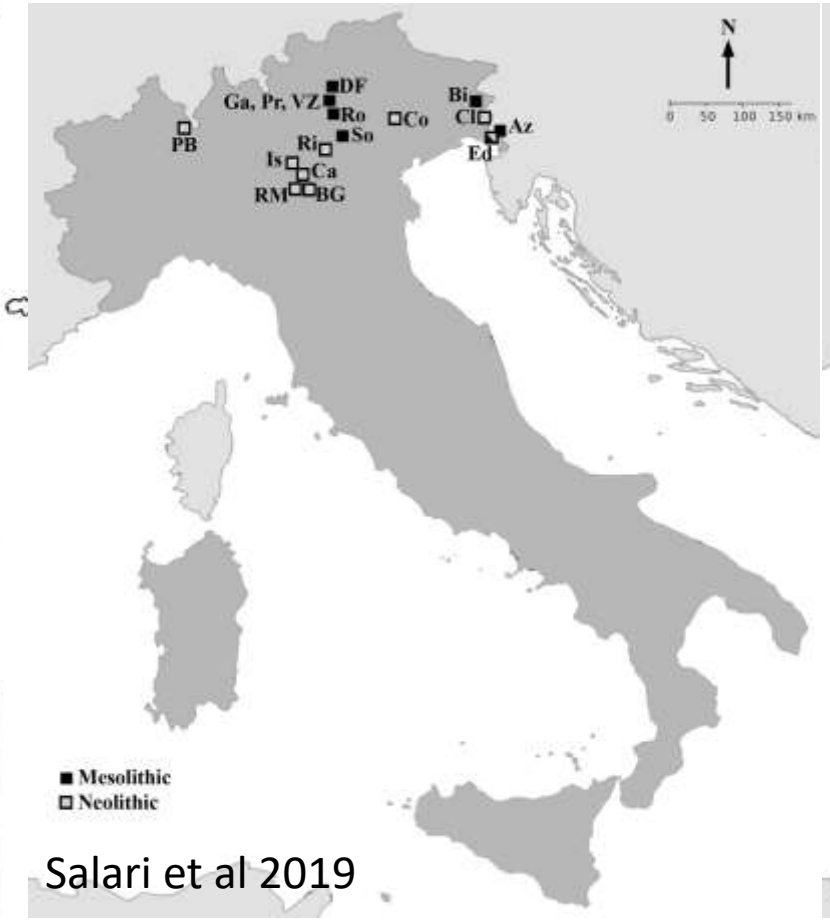


Figure 1. Archaeological sites in the Near East with evidence of beaver. 1, Bisitun Cave and Tepe Sarab. 2, Tamtama Cave. 3, Belt Cave. 4, Shanidar Cave. 5, Alisar Hüyük. 6, Korucutepe and Norsuntepe. 7, Tell Hadidi. 8, Tell Abu Hureyra. 9, Tell Halaf, 500 m contour



Salari et al 2019

Salari et al 2019

Beaver remains in human archaeological contexts in southern Europe & the Middle East

Legge & Rowley-Conwy 1986

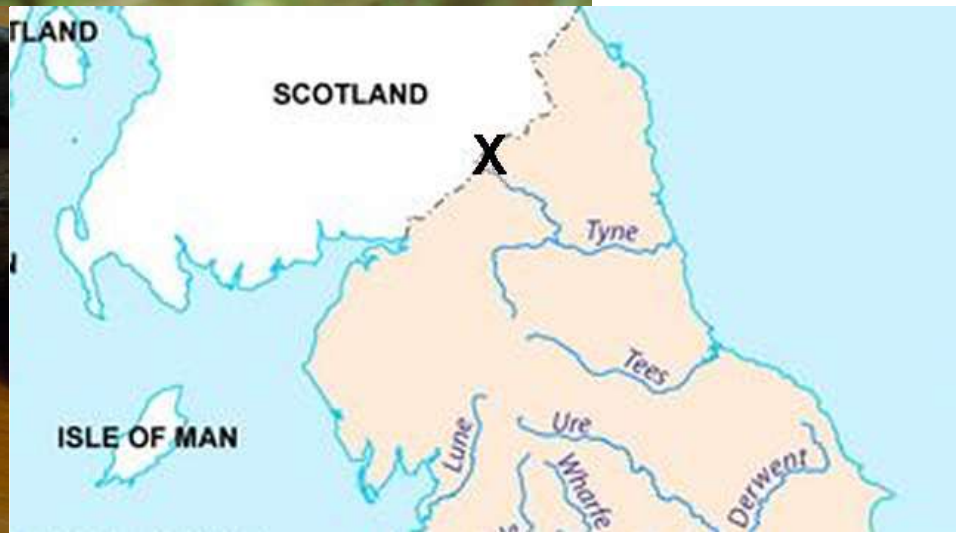
Chapter on beavers, Bestiary, Iran, Maragheh, 1297-1298 or 1299-1300. The Morgan Library & Museum.

Woodcut from Hortus Sanitatis, (Garden of Health), printed by Johann Pruss in Strasbourg in 1497.

Beaver chewed stick, Scaup Burn (Anglo-Scottish border)

- Carbon dated to early 1300s-early 1400s
- Cut by a beaver, probably a subadult
- Previous latest date for physical remains in Great Britain 800-1000
- Documentary evidence indicates survival to at least 1566 (bounty in the 'Act for Preservation of Grain'), possibly 1790 (bounty paid in north England).

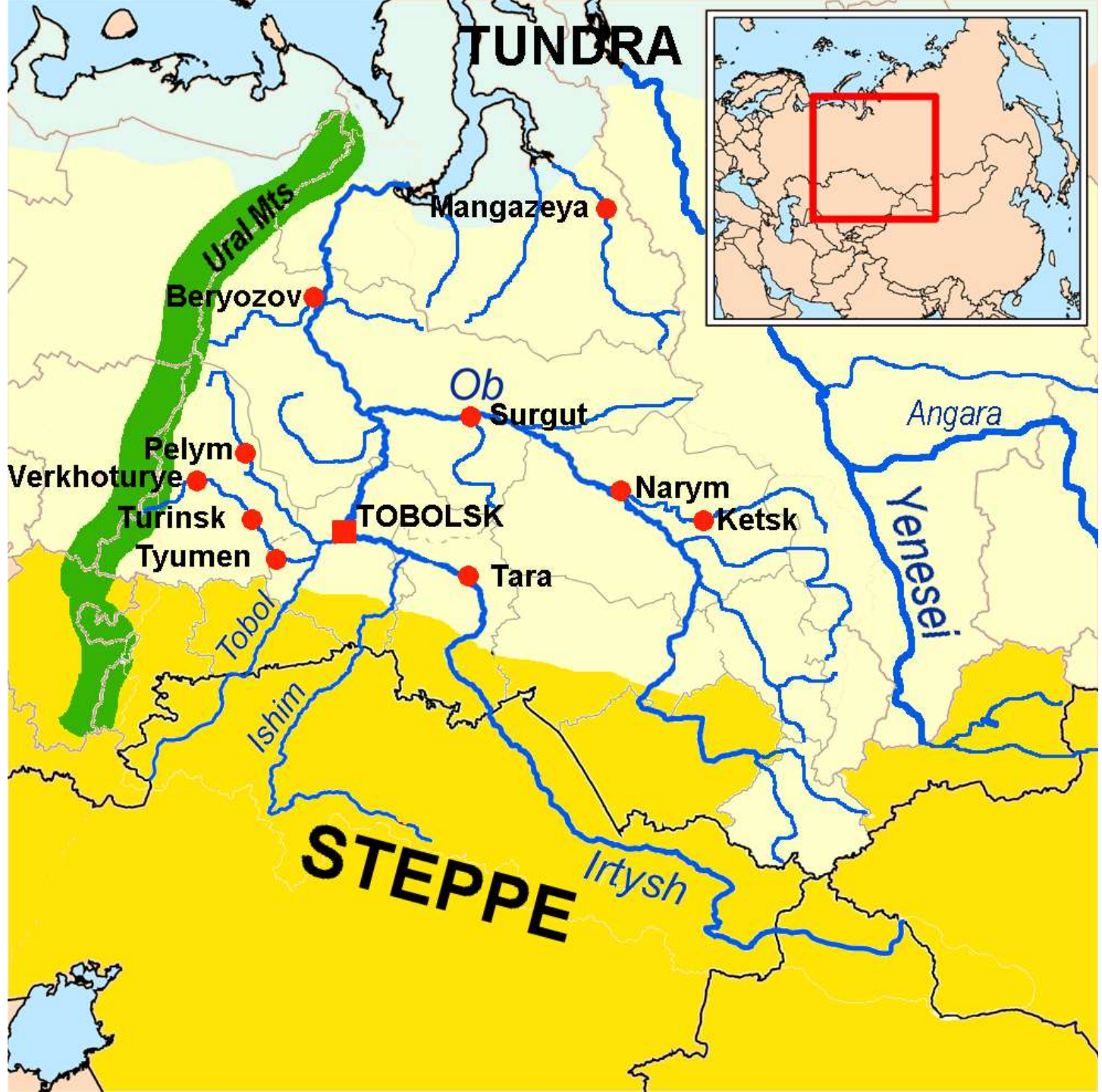
(Manning et al 2014)

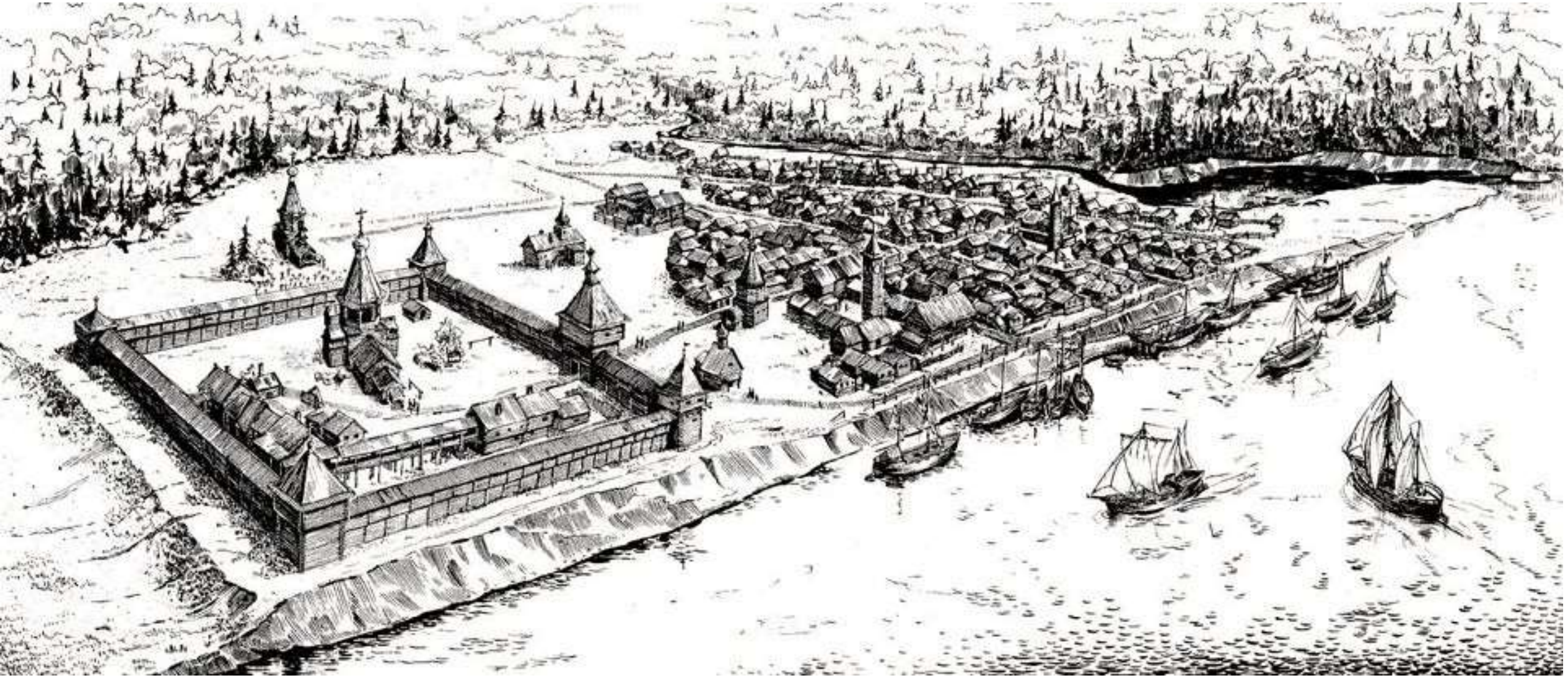


- Similar data from other parts of western and central Europe indicate beavers remained widespread, though probably in most places scarce, through to the early modern period.
- The last beaver records for Italy are for 1540, Spain the 1600s; and for the counties of west and central Europe (apart from the Rhone, Elbe, Telemark refuges) the later 18th-19th centuries.

Modernity, globalization, and extinction

“Yermak's Conquest of Siberia” (1582) by Vasily Surikov, 1895.


TUNDRA
Ural Mts
Mangazeya
Beryozov
Ob
Surgut
Angara
Pelym
Verkhoturye
Turinsk
TOBOLSK
Narym
Ketsk
Tyumen
Tara
Yenesei
Tobol
Ishim
STEPPE
Irtysh



Mangazeya (on Taz) in c. 1600

Annual Iasak Collections[33]

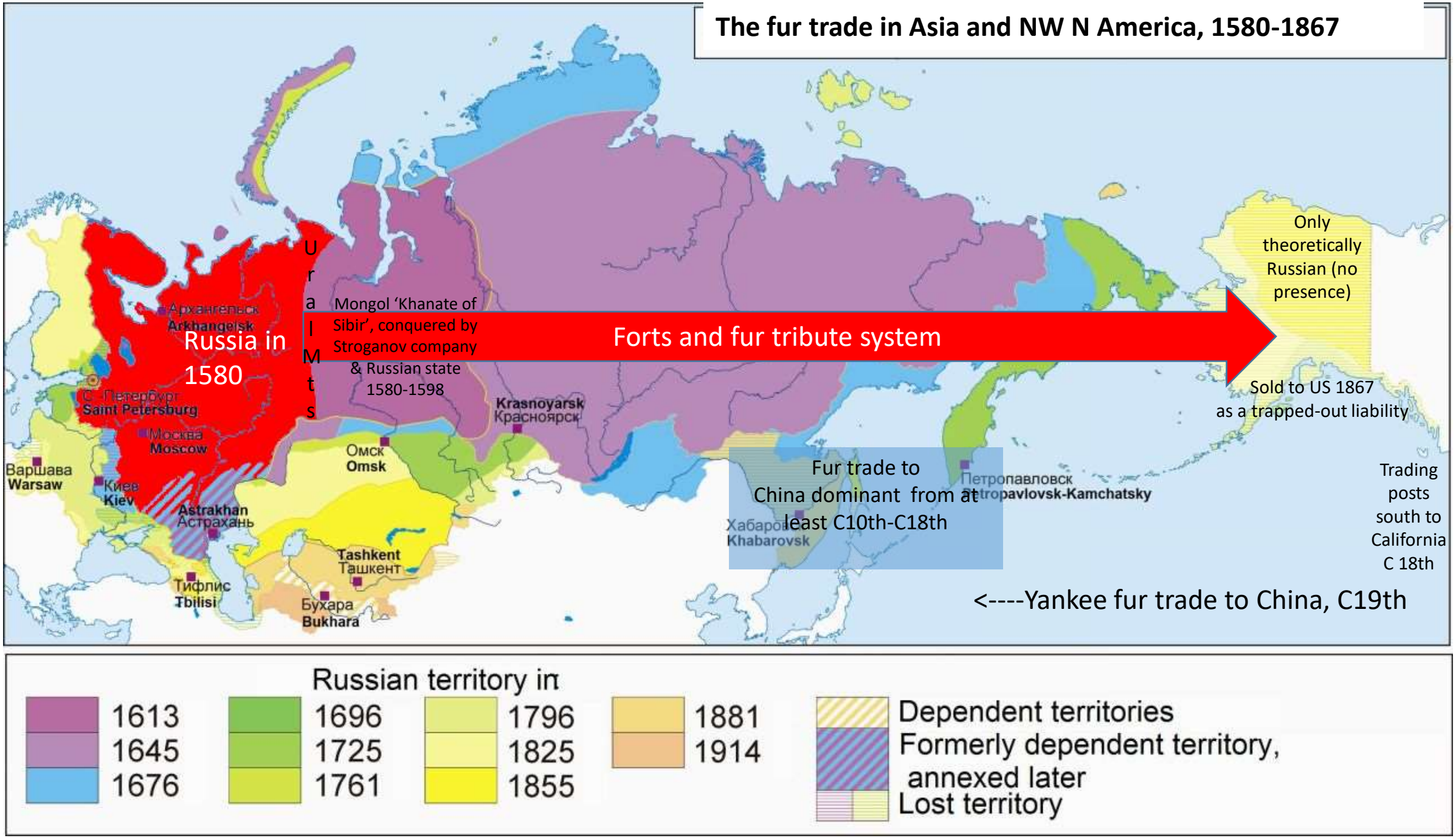
(Values in rubles at Siberian prices)

(*Iasak* = fur tribute from native peoples)

Year	Tiumen	Tobolsk	Pelym	Berezov	Tara	Surgut	Turinsk	Narym	Verkhoturie	Mangazeia	Ketsk
1624	...	.....	...	.....	1,631	.....		.....	...	.....	.....
1625	...	.....	...	.....	.....	3,000		1,600	711	.....	1,200
1626	...	.....	...	.....	.....	.....		.....	713	.....	.....
1627	...	915	...	.....	1,408	.....		.....	682	.....	.....
1628	500	663	645	3,887	1,014	.....		.....	709	.....	.....
1629	535	786	.....	3,654	.....	.....		1,600	684	5,000	1,012
1630	...	.....	...	.....	.....	.....		.....	670	.....	.....
1631	...	.....	...	.....	.....	.....		.....	591	.....	.....
1632	...	.....	...	.....	.....	.....	between	.....	445	.....	.....
1633	356	.....	...	.....	.....	.....	500 and	.....	546	.....	.....
1635	...	.....	872	.....	1,231	.....	300	.....	671	.....	.....
1636	...	.....	...	.....	.....	.....		.....	...	7,143	.....
1638	...	.....	...	.....	.....	.....		.....	...	9,376	.....
1640	...	1,997	...	.....	.....	.....		.....	...	.....	.....
1642	...	.....	...	.....	.....	.....		.....	...	6,458	.....
1643	...	.....	850	.....	.....	.....		.....	...	4,100	.....
1644	...	2,233	...	.....	.....	.....		.....	814	.....	.....
1646	...	.....	...	.....	.....	.....		.....	...	7,234	.....
1647	...	.....	...	.....	.....	.....		.....	...	.....	.....
1671	...	.....	...	.....	.....	.....	...	....	632	.....	.....
1698	101	3,600	566	1,500	1,280	1,938	170	690	700	2,700	40
1699	106	2,700	534	1,320	1,300	1,687	154	660	530	1,600	35

c. ¼ of the annual fur take was iasak; ¾ trapped by Russians or traded (and taxed by the Tsar)

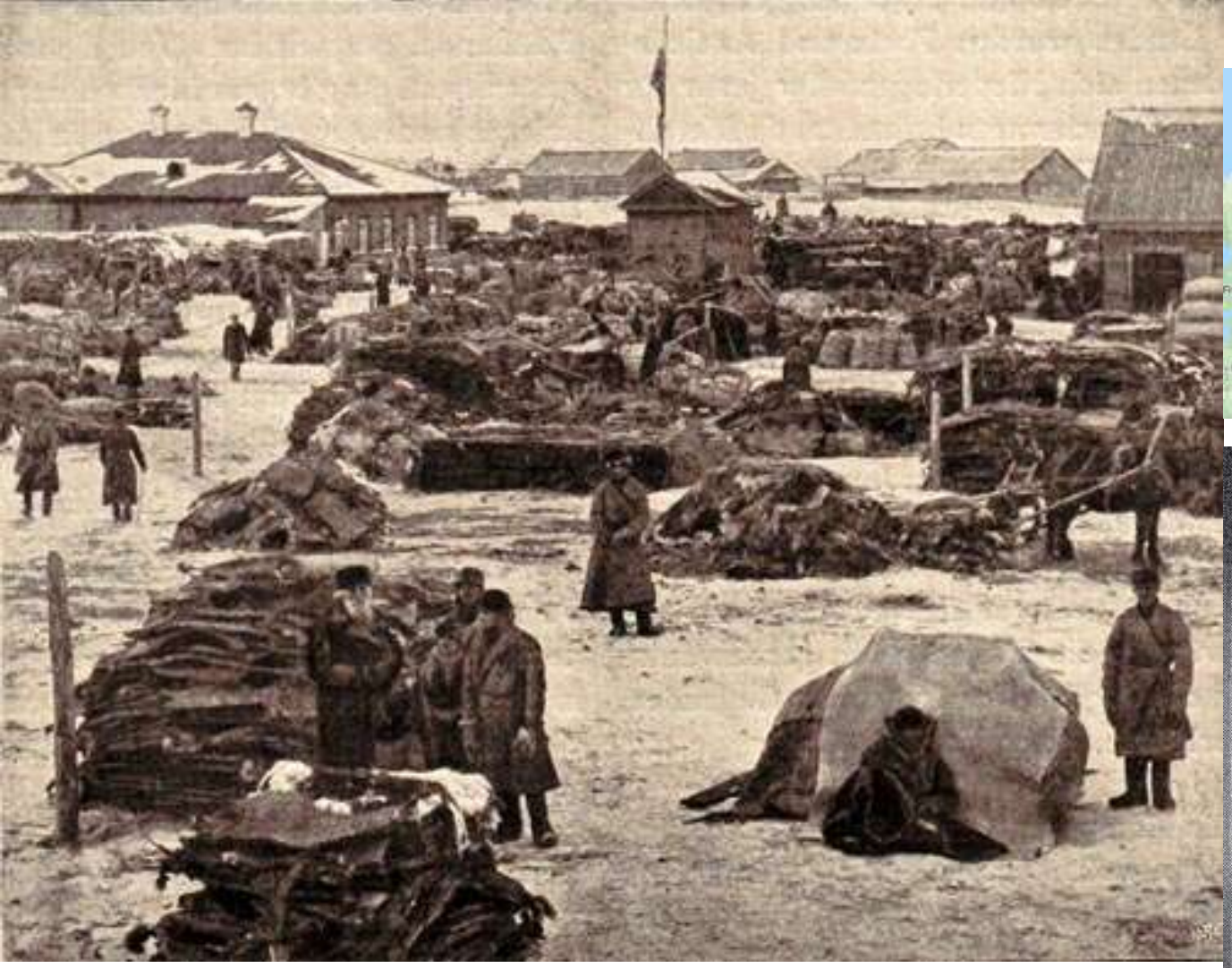
Source

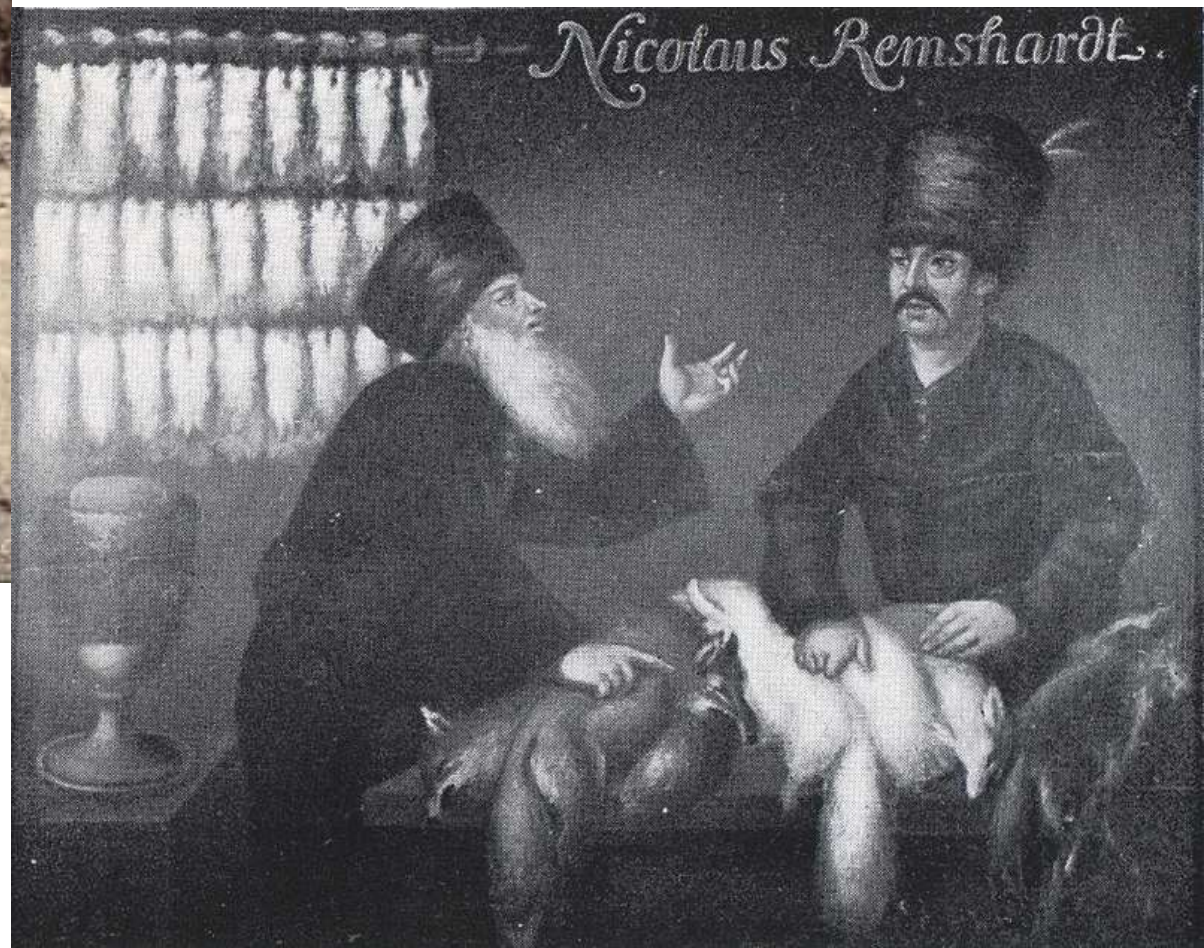

The fur trade in Asia and NW N America, 1580-1867
Russia in 1580
Urals
Mongol 'Khanate of Sibir', conquered by Stroganov company & Russian state 1580-1598
Forts and fur tribute system
Only theoretically Russian (no presence)
Sold to US 1867 as a trapped-out liability
Fur trade to China dominant from at least C10th-C18th
Trading posts south to California C 18th
<----Yankee fur trade to China, C19th
Архангельск
Arkhangelsk
С.-Петербург
Saint Petersburg
Москва
Moscow
Варшава
Warsaw
Киев
Kiev
Astrakhan
Астрахань
Тифлис
Tbilisi
Бухара
Bukhara
Tashkent
Ташкент
Омск
Omsk
Krasnoyarsk
Красноярск
Хабаровск
Khabarovsk
Петропавловск
Petropavlovsk-Kamchatsky
Russian territory in
1613
1645
1676
1696
1725
1761
1796
1825
1855
1881
1914
Dependent territories
Formerly dependent territory, annexed later
Lost territory

Siberian river routes [Source]

Area of Russia east of Urals: 13.2 million km^2 Contiguous USA: 8 million km^2 Europe excluding Russia: 6.2 million km^2

Fur market in Irbit, 1913





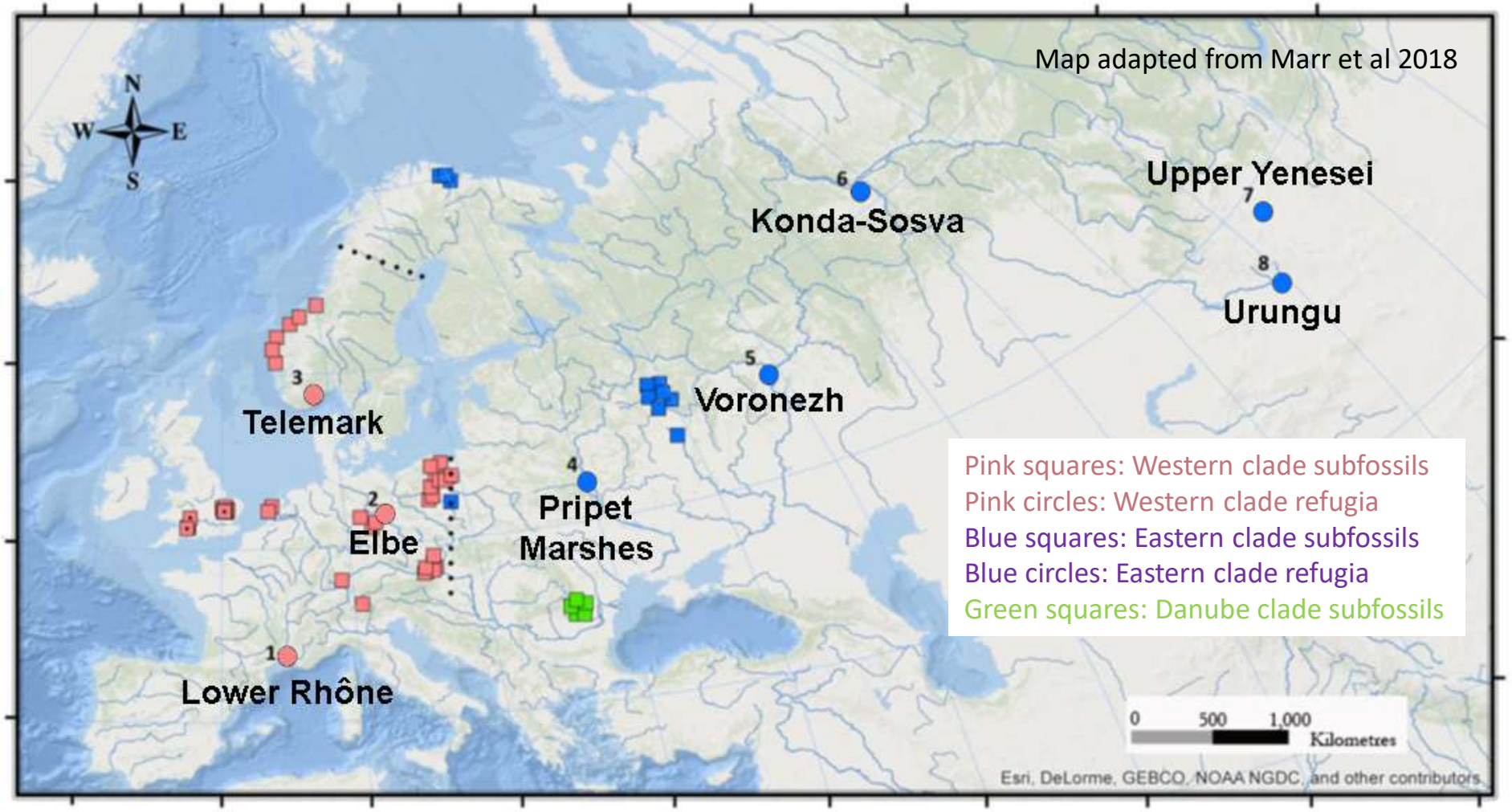
Russian trader in Siberian furs at the market in Leipzig, Germany c. 1800

Source: Internet

Painting by Zehler

Shanghai, 1934

September 1927 edition



Known refugia where beaver were never extinct (early 20th century)

DNA evidence from Poland is most easily explained by the survival of one or more additional, unrecorded populations in modern Poland/eastern Germany (Biedrzycka et al 2014)

	Population	Minimum	Source
1.	Lower Rhône, France	30	Richard 1985
2.	Elbe, Germany	200	Heidecke & Hurig 1985
3.	Telemark, Norway	60-120	Collet 1897
4.	Pripet, Belarus/Ukraine/Russia	<300	Zharkov & Solokov 1967
5.	Voronezh, Russia	70	Lavrov & Lavrov 1986
6.	Konda-Sosva, Russia	300	Lavrov & Lavrov 1986
7.	Upper Yenesei, Russia	30-40	Lavrov & Lavrov 1986
8.	Urungu, Mongolia/China	<100-150	Lavrov & Hao-Tsuan 1961

Eurasian beavers reached their lowest point in range and population in the early 20th century, eight known populations totalling c. 1200 individuals.

- The first known reintroduction of beavers anywhere was in the modern Czech republic (then province of Bohemia, Austrian Empire), 1800-1810, at Třeboňsko (Vorel & Korbelova 2016). The population established survived until 1876.
- No further reintroductions for over a century.
- In the early 1900s the surviving populations of beavers were protected, followed by:

- **The first wave of beaver releases, 1920s to 1950s:**

- bring back a commercially very valuable species: fur, castoreum, meat.
- beavers are too costly to breed in captivity (for harvest): they are territorial, need a lot of water, and take 2-3 years to reach a useful size.
- the idea: release a founder population, let them reproduce and spread, and harvest the surplus.
- There were also small releases in Germany and Norway for rich man`s prestige reasons

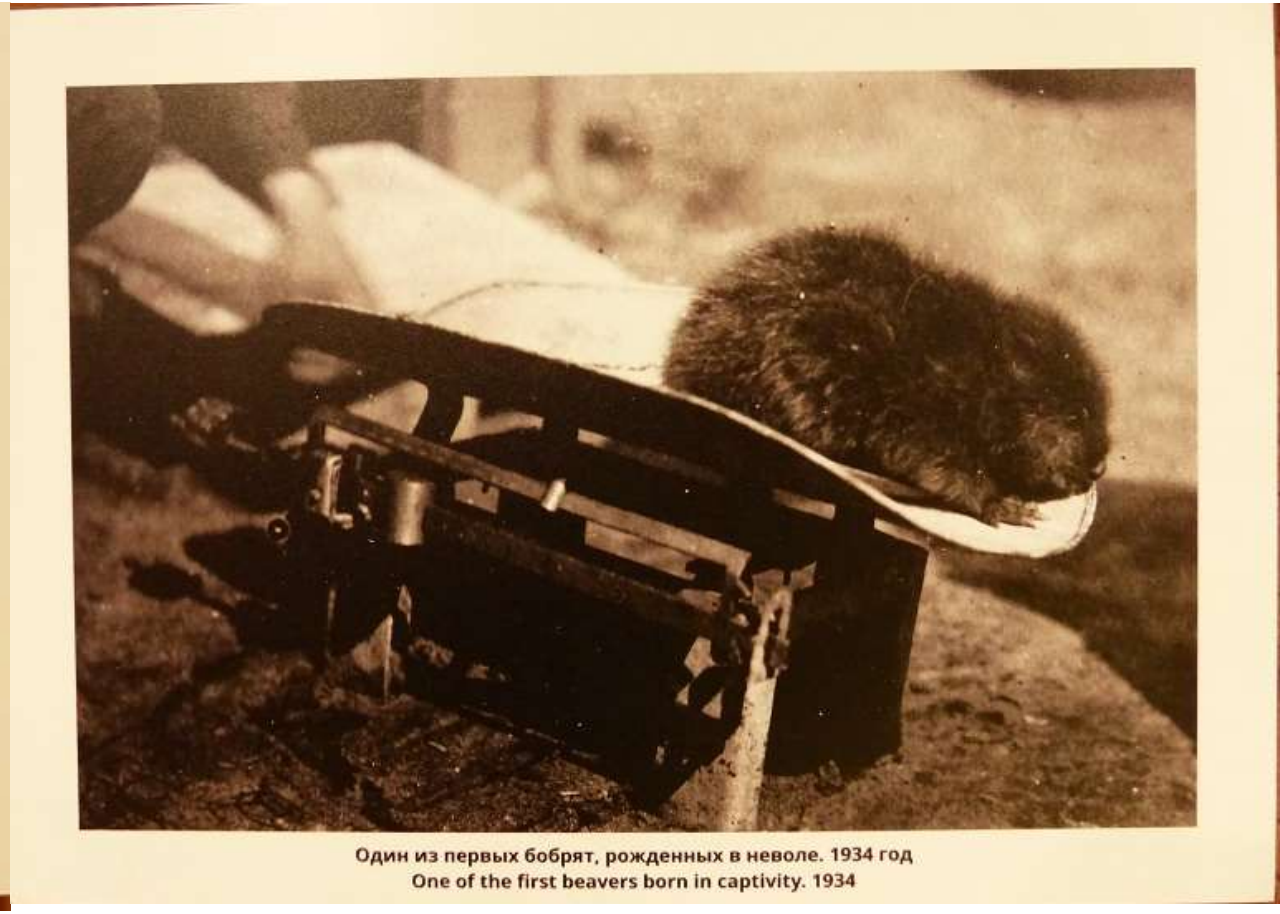
How do you get beavers, if you have none?

Breed them!

Beaver Breeding Center in Voronezh, Russia

Lots of them!

На площадке группового содержания бобров, 50-е годы
Site of beaver group keeping, 50s

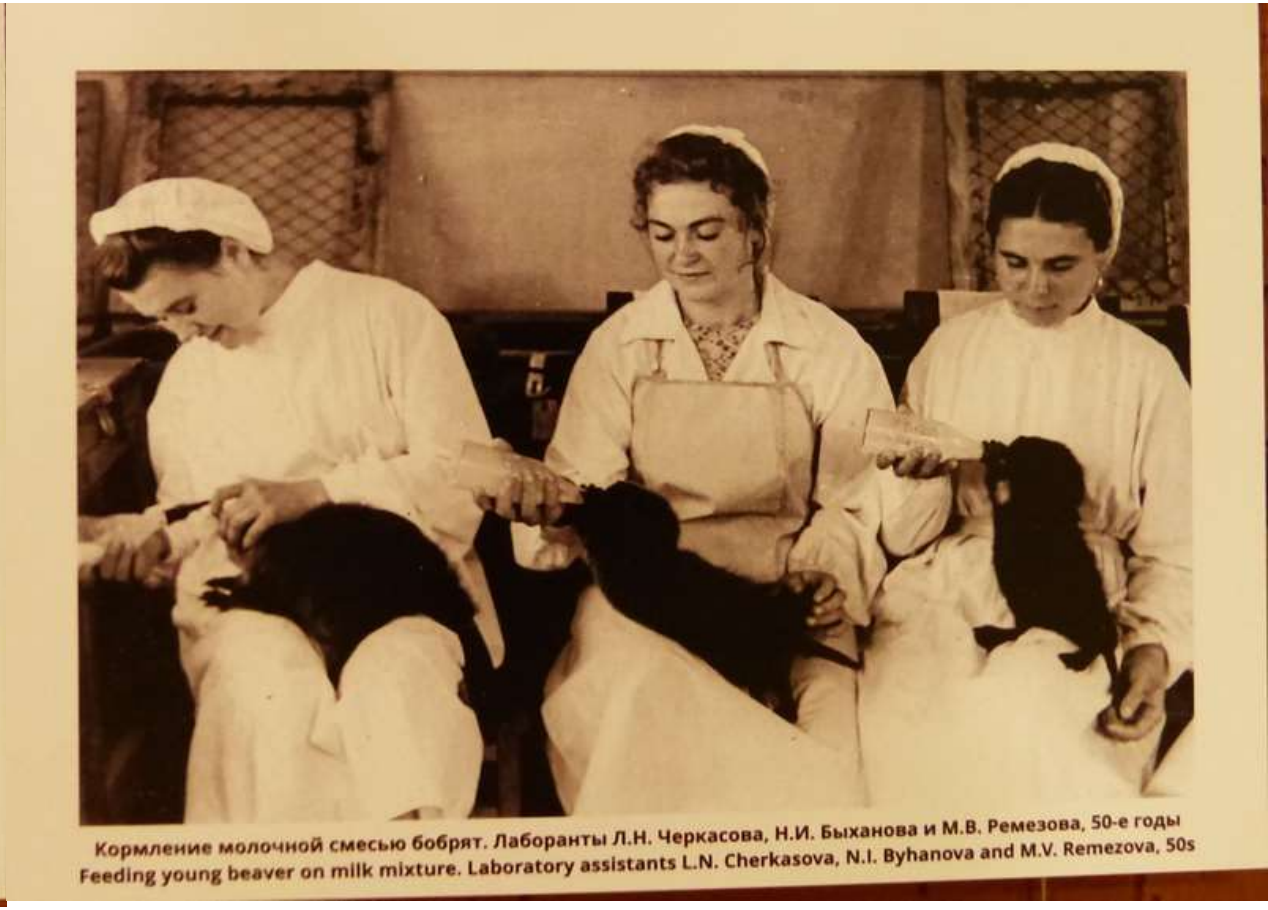


Один из первых бобрят, рожденных в неволе. 1934 год
One of the first beavers born in captivity. 1934

… taken care of…

… in close contact with `mum`…

Группа ручных бобрят с воспитательницей Л.Н. Черкасовой, 50-е годы
Group of tame young beavers with the nurse L.N. Cherkasova, 50s



Кормление молочной смесью бобрят. Лаборанты Л.Н. Черкасова, Н.И. Быханова и М.В. Ремезова, 50-е годы
Feeding young beaver on milk mixture. Laboratory assistants L.N. Cherkasova, N.I. Byhanova and M.V. Remezova, 50s

… and well fed …

…because not all survive

The second wave, 1950s to 1990s

Bring back an extinct species: not for hunting, but simply to restore the species

- **Switzerland**: released 141 animals between 1956 and 1977
- **France**: relocated about 300 animals from the Rhone river to other River systems
- **Austria**: released about 40 animals between 1976 and 1982 (among them some *C. canadensis*)

The second wave 1950s to 1990s

- **East Germany**: relocation of beavers from the Elbe river to other river systems
- **Netherlands**: release of 42 animals in the Biesbosch, another 54 released 1994 in the Gelderseeport
- **West Germany**: releases in several regions from 1996 to 1990‘s
- **Czech Republic**: release of 27 beavers in the Odra in the east

They are back, and they have shown us…

- they do not simply live in a landscape, they change and develop it into booming biodiversity

The third wave 1990s to 2010s

Bring back the beaver to restore ecosystem services

- **Croatia**: release of 86 beavers in 1996 to 1998 into two watersheds
- **Romania**: release of about 250 beavers from 1998 to 2003 into 3 river systems
- **Hungary**: release of about 200 beavers from 1998 to 2008 in several National Parks

The third wave 1990s to 2010s

- **Belgium**: release of about 140 beavers in several parts of the country
- **Spain**: release of 18 beaver in the Aragon-Ebro river
- **Serbia**: release of 70 beavers into two sites in 2004 and 2005

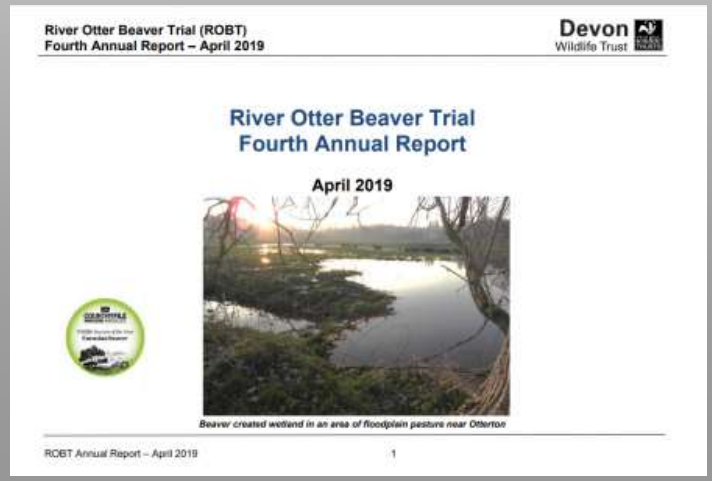
The third wave 1990s to 2010s

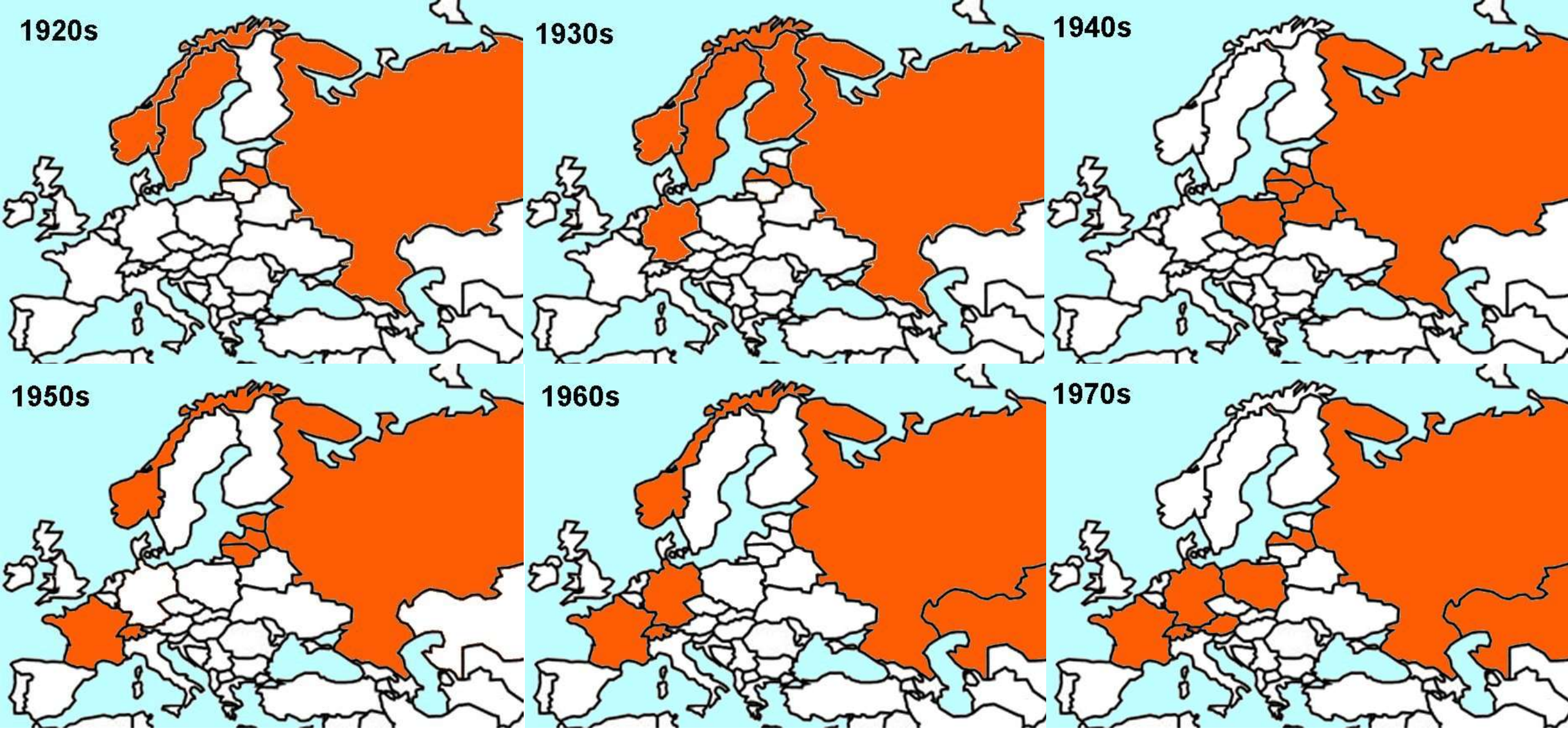
- **Bosnia-Herzegovina**: release of 40 beavers into two sites in 2005 and 2006
- **Scotland**: release of 16 beavers 2008-2009 in Knapdale. A population apparently descended from escapes was found to be living on the Tay watershed at about the same time.

The fourth wave 2010 -

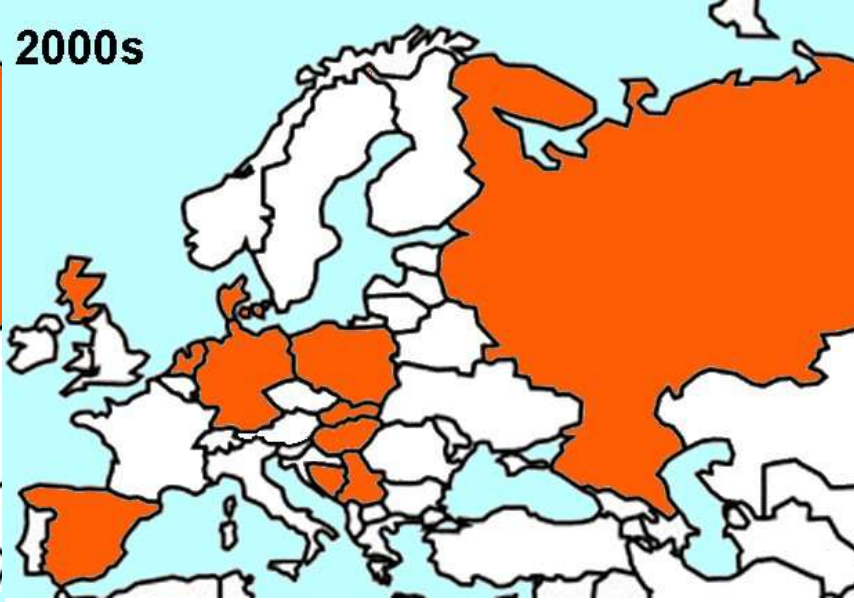
Bring back the beaver to benefit people (and save money)

- Mongolia 2012: first beavers released to restore ground water tables and to clean water from surplus fertilizer from arable lands.
- England – a population of beavers ‘of unknown origin’ has been present on the River Otter since around 2008
- The government initially planned to remove them from the river.
- But changed its mind in 2015 following local pressure, for a ‘trial period’ ending this month (March 2020). Effects on flood risk were a part of the trial and ‘a sequence of beaver dams constructed upstream of…properties at risk of flooding has seen areduction in peak flows as a result’.
- Two new beavers were released on the river Otter in 2016.
- Beavers are also known to be established in the wild on at least two other rivers in England, and one on the English/Welsh border.

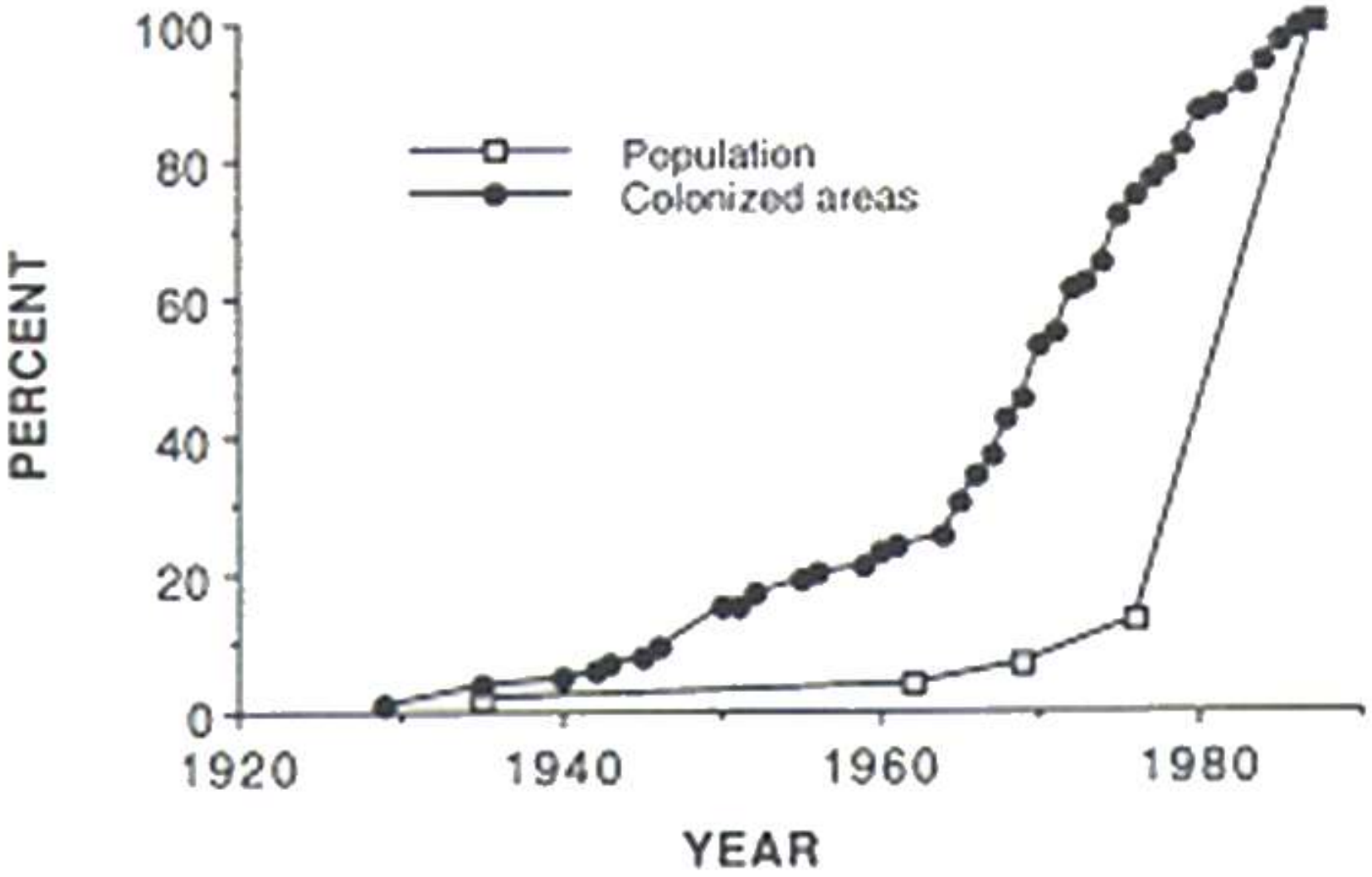




Beaver reintroductions in Europe by decade, 1920s-1980s



Beaver reintroductions in Europe by decade, 1990s-2010s



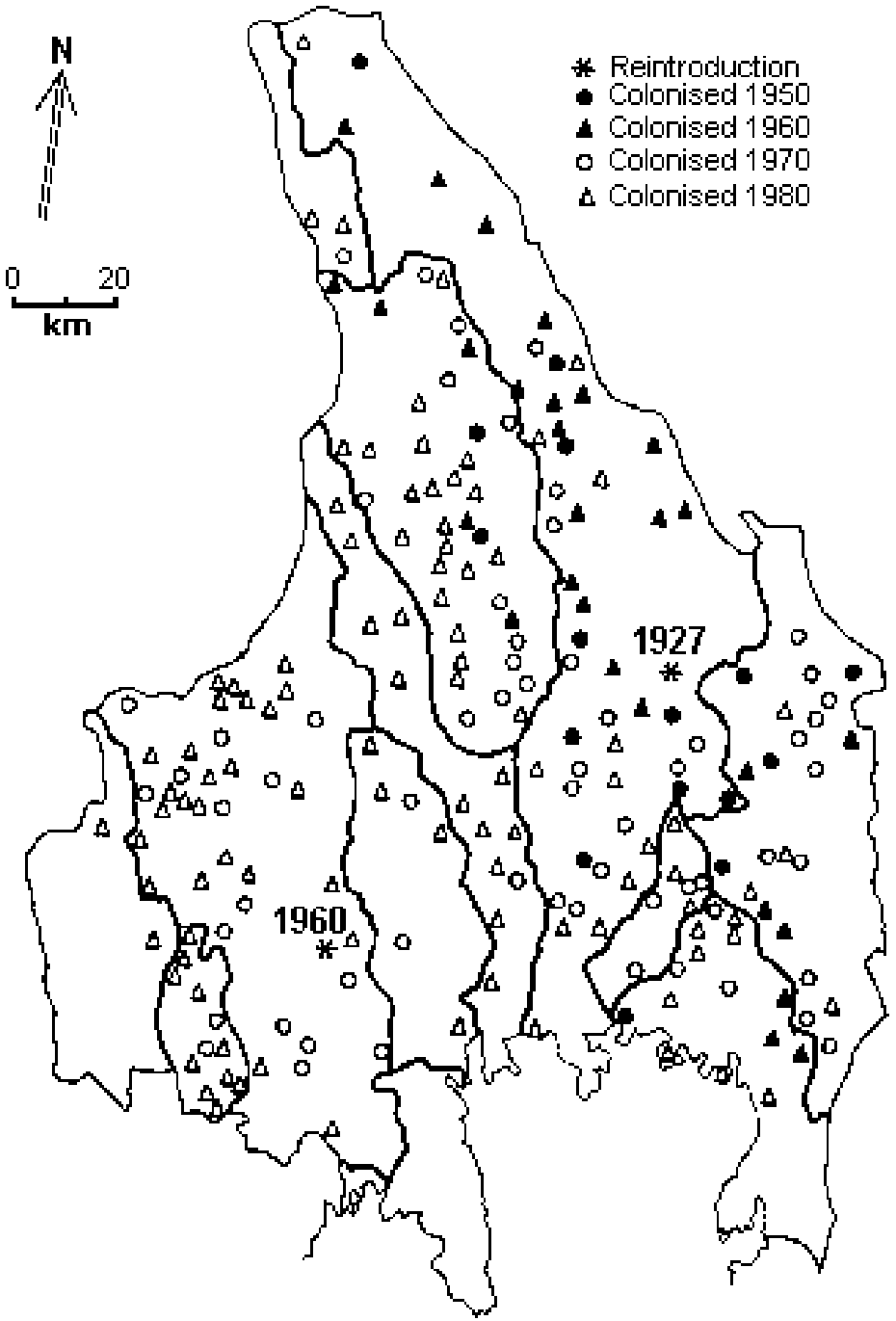
IUCN Red Data status:

1920: Endangered C2a (i) (using modern classification)
2002: Near Threatened
2006: Lower risk/near threatened
2008: Least Concern

Pattern of range extension and population growth within a watershed post-colonisation, Sweden.
Data: Göran Hartman, SLU, Uppsala

Värmland, Sweden

Heavy black lines mark watershed divides

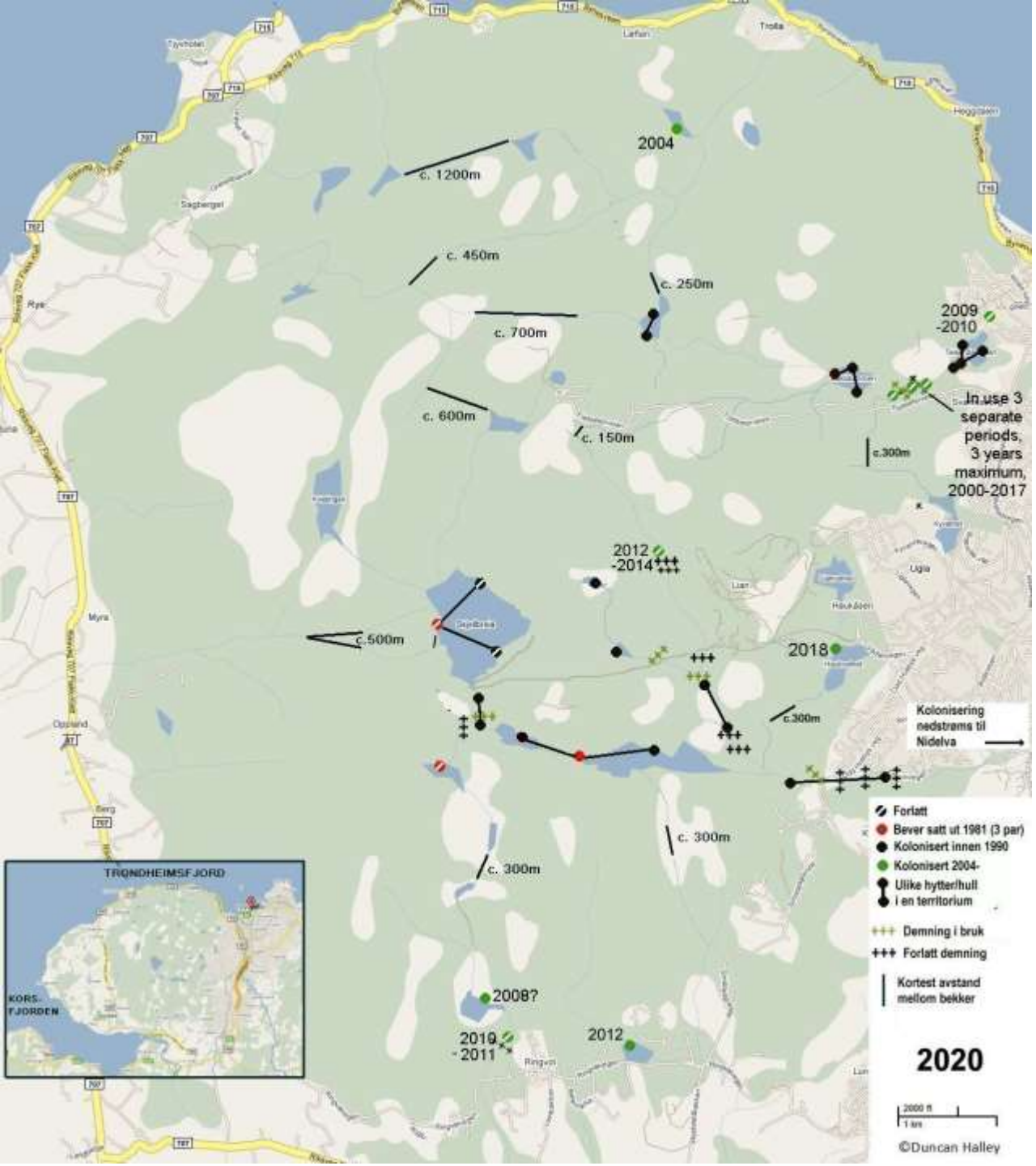


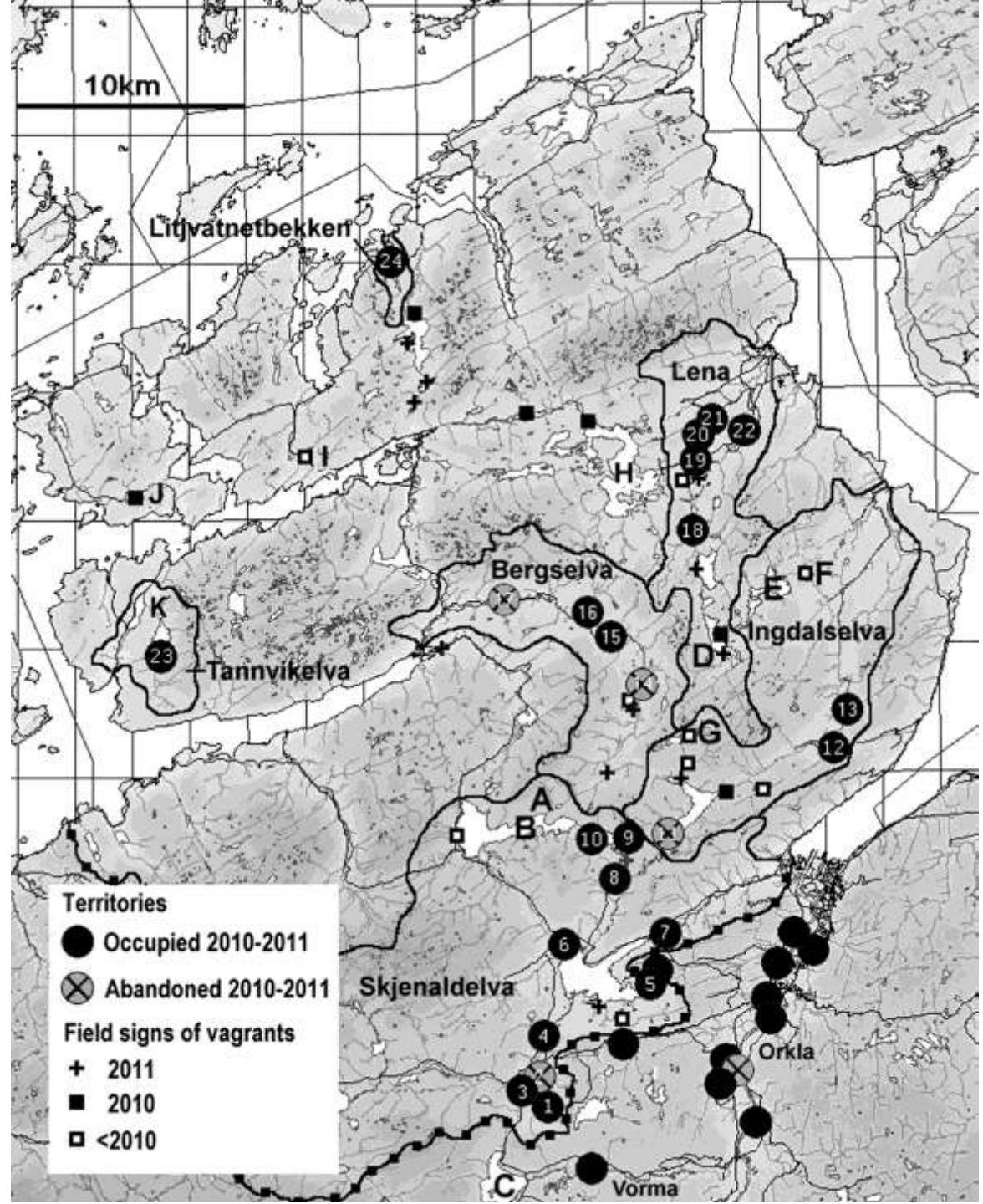
Data: Göran Hartman, SLU Uppsala

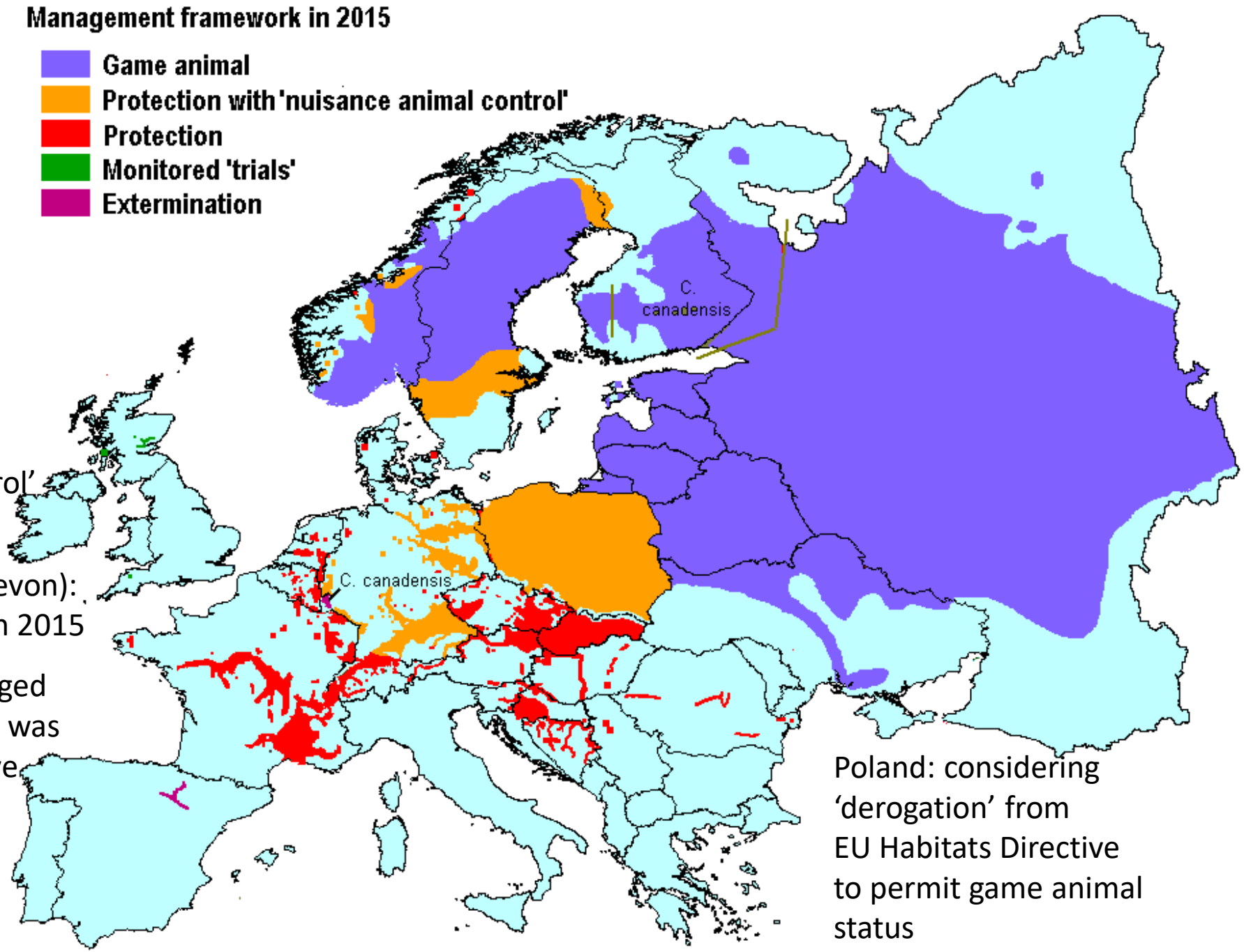
Sites occupied early strongly associated with:

- Riparian deciduous forest
- Low stream gradient/high tortuosity
- Rich grass and forb layer
- Soft soils
- Relatively deep water
- Water depths in which damming not necessary

i.e. low gradient, depositional landforms


2004
c. 1200m
c. 450m
c. 250m
c. 700m
2009
-2010
c. 600m
c. 150m
c.300m
In use 3 separate periods, 3 years maximum, 2000-2017
2012
-2014
c.500m
2018
c.300m
Kolonisering nedstrøms til Nidelva
c. 300m
c. 300m
2008?
2019
-2011
2012
TRONDHEIMSFJORD
KORS-FJORDEN
Forlatt
Bever satt ut 1981 (3 par)
Kolonisert innen 1990
Kolonisert 2004-
Ulike hytter/hull i en territorium
Demning i bruk
Forlatt demning
Kortest avstand mellom bekker
2020
©Duncan Halley


10km
Litjvatnetbekken
Lena
Bergselva
Ingdalselva
Tannvikelva
Skjenaldelva
Orkla
Vorma
A
B
C
D
E
F
G
H
I
J
K
Territories
Occupied 2010-2011
Abandoned 2010-2011
Field signs of vagrants
2011
2010
<2010



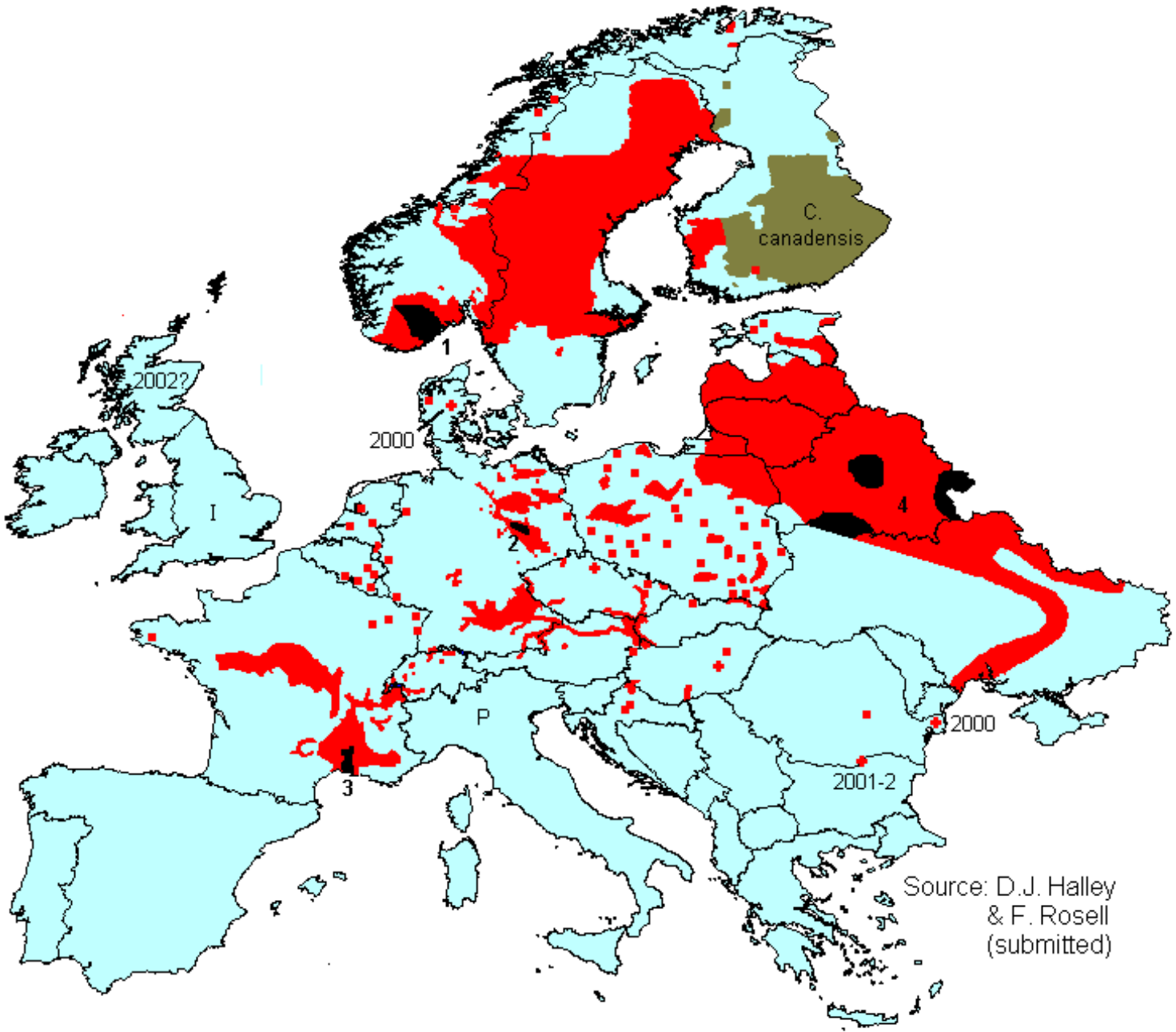
Scotland: Protected status with 'nuisance animal control' from 2019

England (River Otter, Devon): 'Trial' period agreed Jan 2015

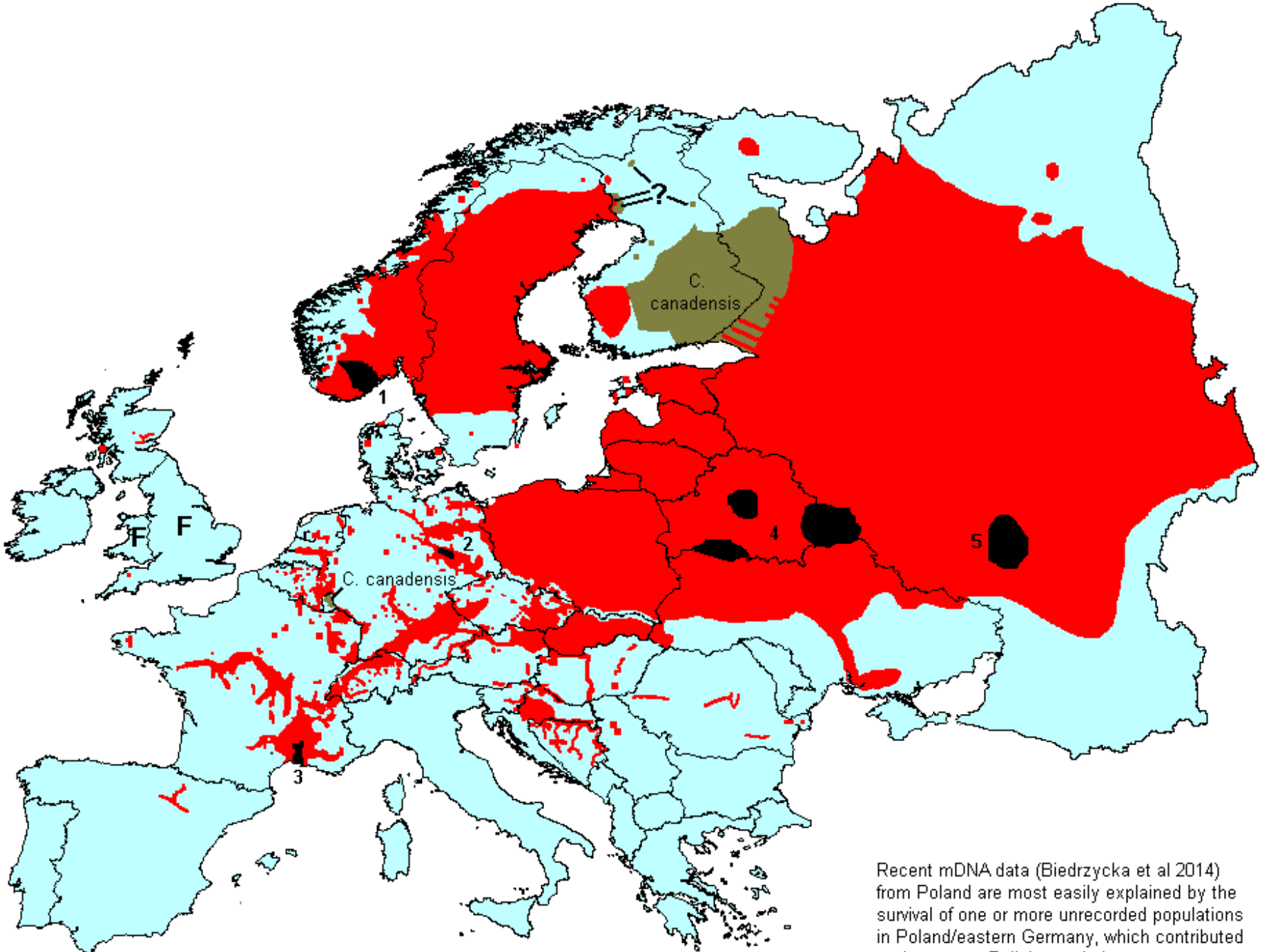
Spain (Ebro): In 2018 EU changed position and ruled population was protected by Habitats Directive

Poland: considering 'derogation' from EU Habitats Directive to permit game animal status

2000

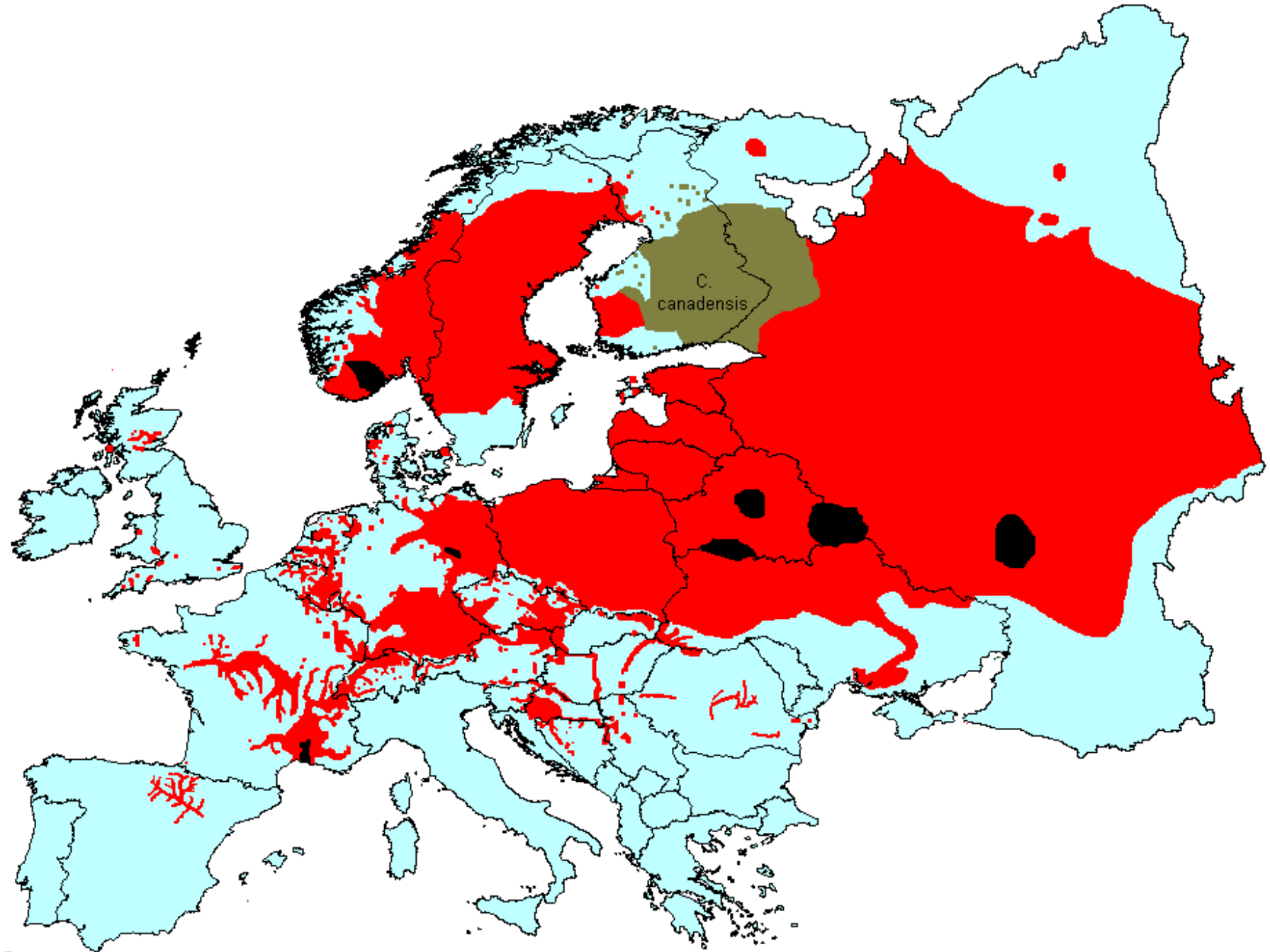

C. canadensis
1
2002?
2000
I
4
P
2000
1
3
2001-2
Source: D.J. Halley
& F. Rosell
(submitted)

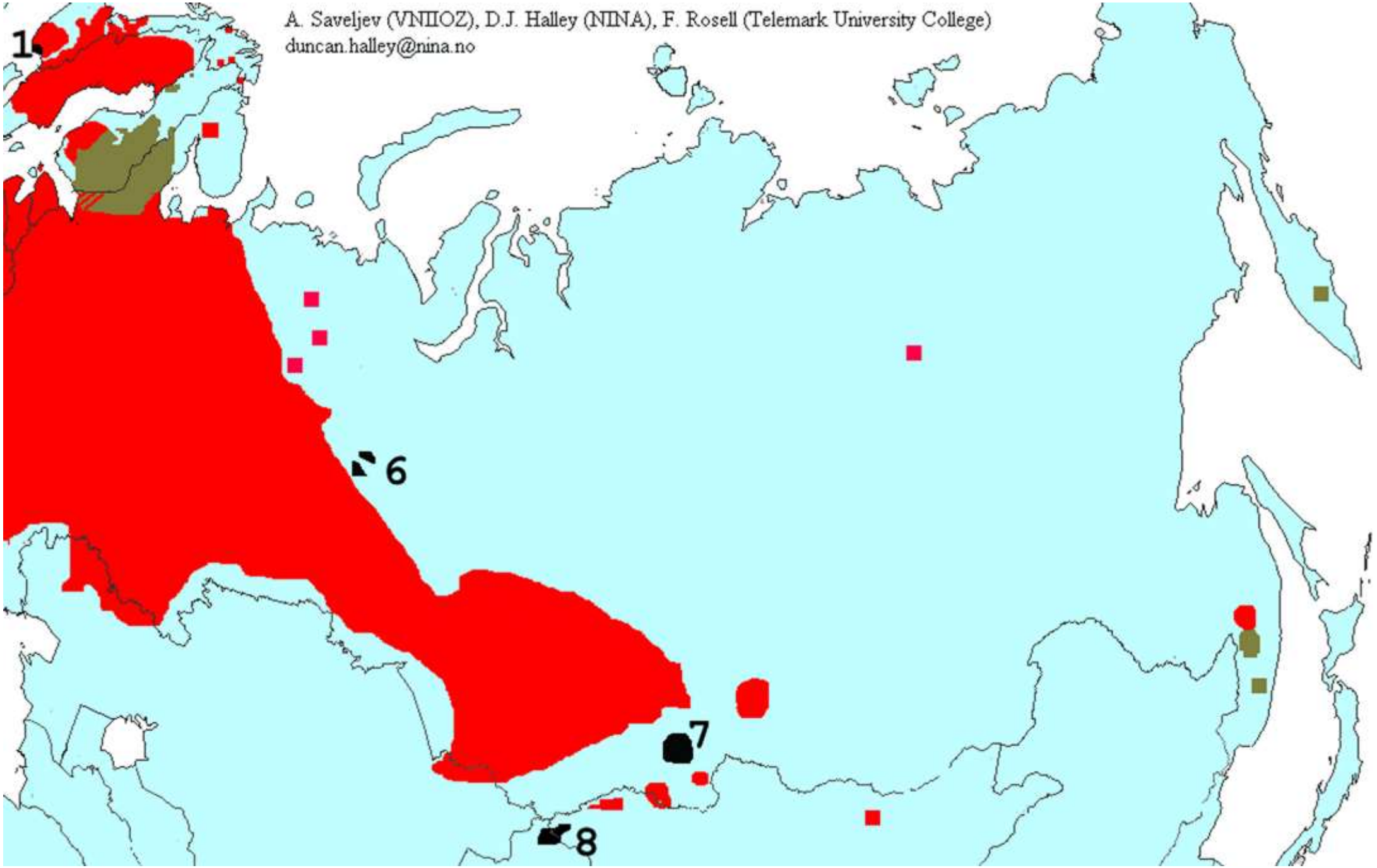
2016



Recent mDNA data (Biedrzycka et al 2014) from Poland are most easily explained by the survival of one or more unrecorded populations in Poland/eastern Germany, which contributed to the current Polish population.

2020




A. Saveljev (VNIIOZ), D.J. Halley (NINA), F. Rosell (Telemark University College)
duncan.halley@nina.no
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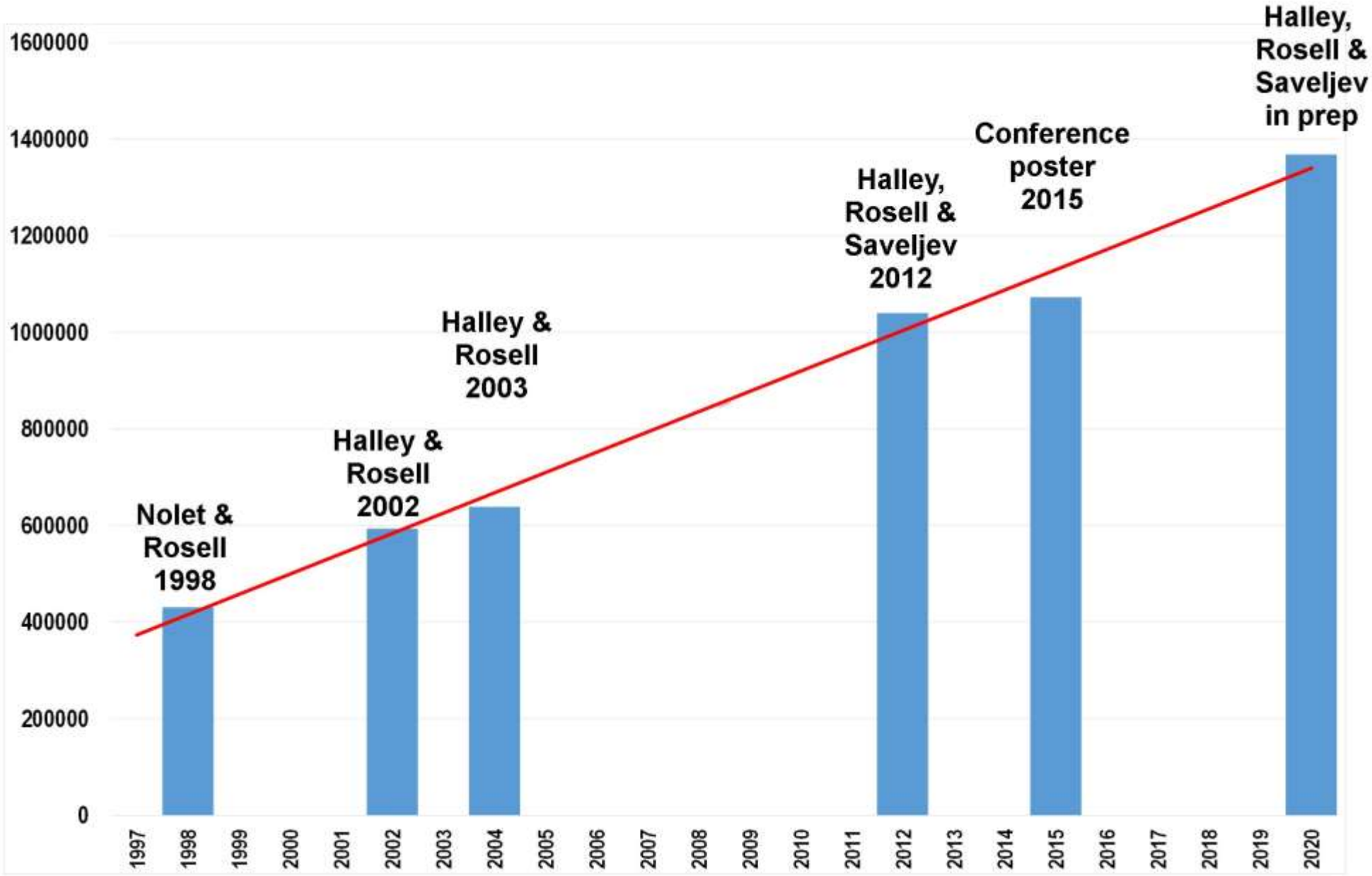
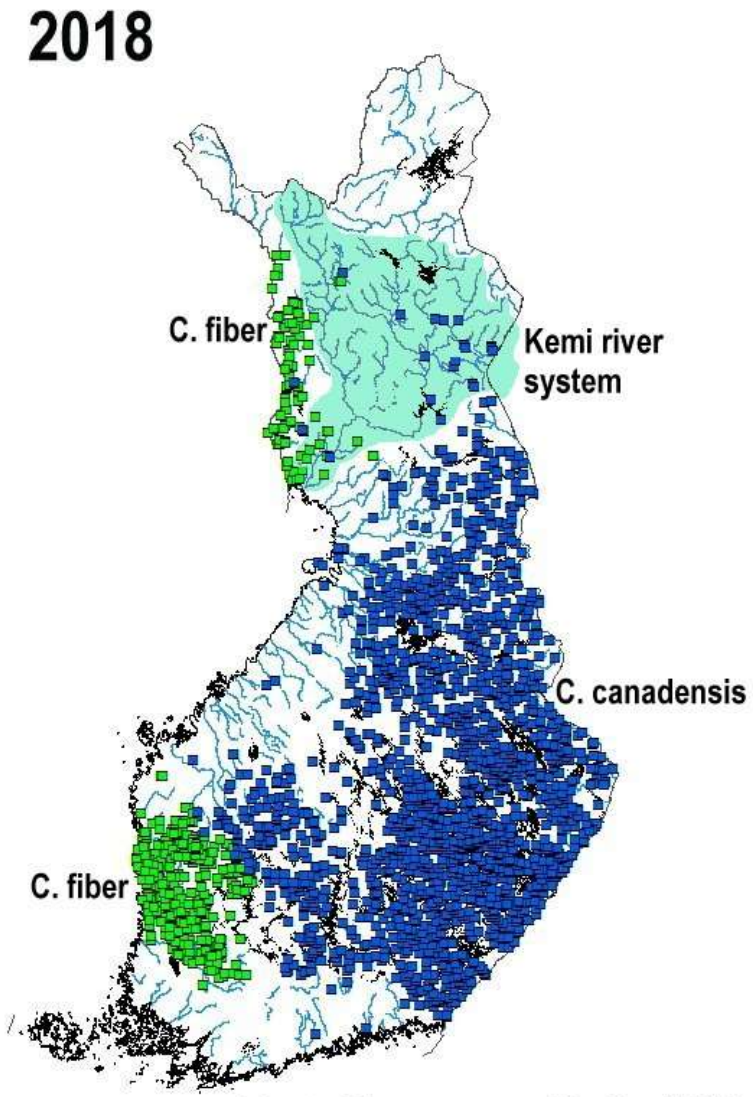
Estimated minimum world population of Eurasian beaver, 1998-2020



Some current management issues



Adapted from map provided by LUKE

Finland

- *C. fiber* slowly losing ground to *C. canadensis* in SW Finland.
- Large scale *C. fiber* invasion of NW Finland from Sweden through the Torne river system (the main course of which forms the border with Sweden).
- Both species now invading the Kemi river system, which drains most of Finnish Lapland.
- The Finnish authorities should consider removing, or at least strongly reducing, *C. canadensis* from the Kemi (currently feasible and inexpensive; soon impractical), and encouraging *C. fiber* spread, possibly through translocations.
- The alternative is a huge natural experiment in interspecific competition, as the two populations meet somewhere on the middle course of the river system. It is quite plausible that the ‘balance of forces’ at that time might tip the issue.

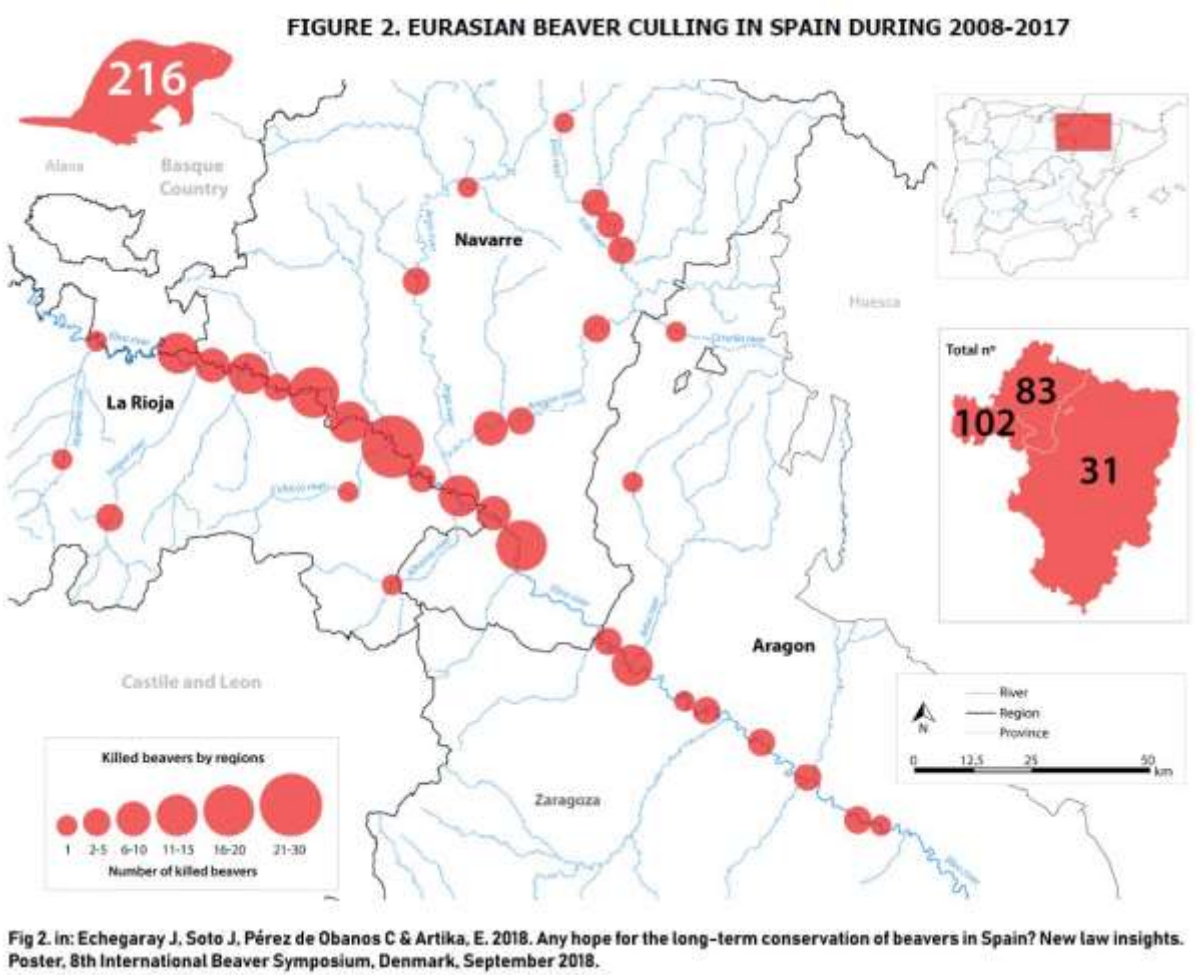
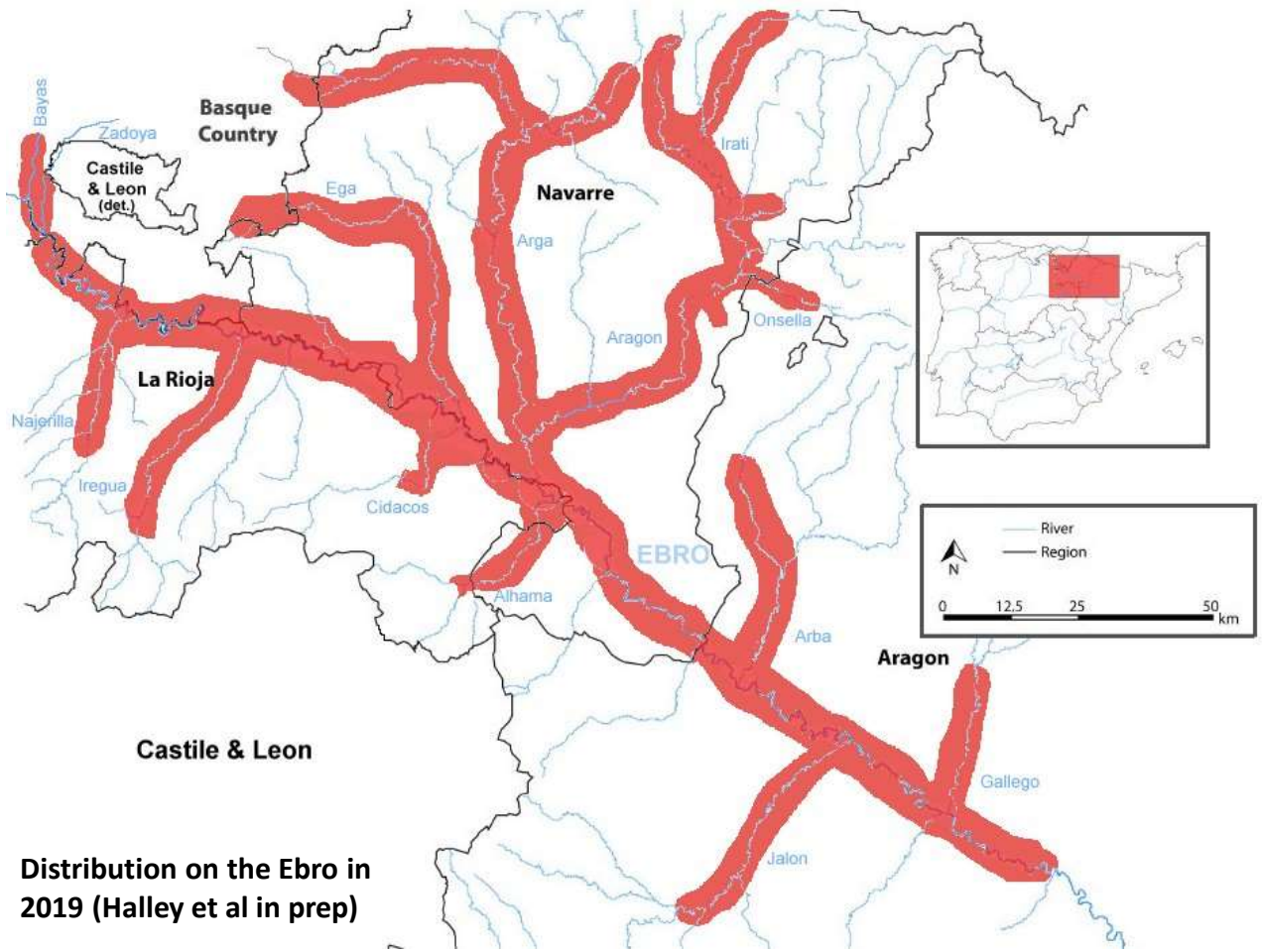
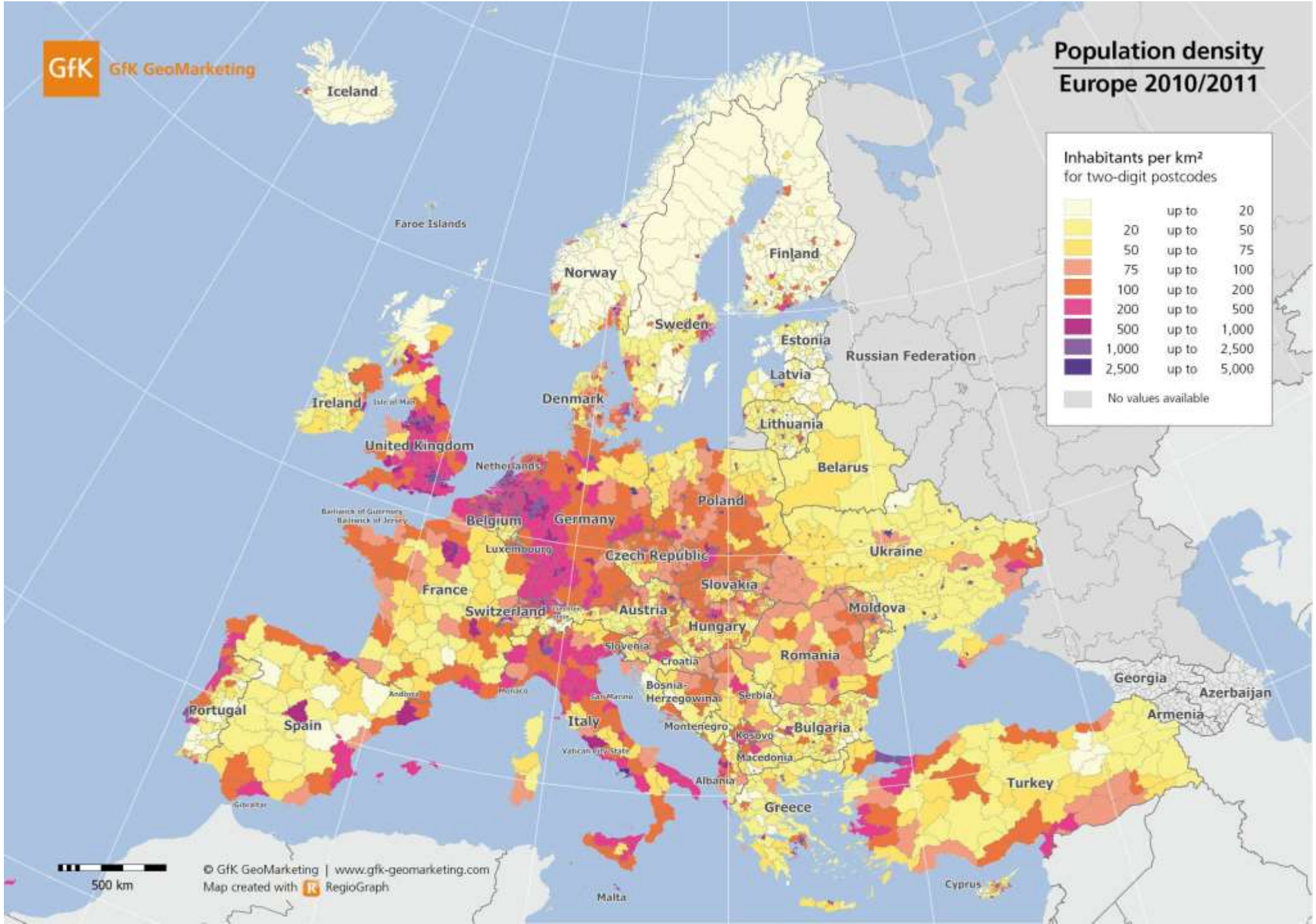


Fig 2. in: Echegaray J, Soto J, Pérez de Obanos C & Artika, E. 2018. Any hope for the long-term conservation of beavers in Spain? New law insights. Poster, 8th International Beaver Symposium, Denmark, September 2018.



Distribution on the Ebro in 2019 (Halley et al in prep)

- 'Informal' reintroduction of 18 individuals near Ebro/Aragon confluence in 2003
- Spanish authorities obtained a derogation from the EU Habitats Directive which allowed them to attempt extermination
- 2008-2017 216 beavers were trapped on the Ebro watershed (mostly early in the period)
- But the population in Navarra alone was estimated in 2014 as 450-650 (Government of Navarra 2015, unpublished report)
- If this is correct, the population on the entire Ebro system must presumably now be in excess of 1000 individuals.
- In 2018 the EC Environment Directorate reversed position and stated that beavers were 'historically autocthonous' on the Ebro and protected by the Habitats Directive. Trapping has ceased but the status of beavers in regional law remains unclear.


GfK GeoMarketing
Population density
Europe 2010/2011
Inhabitants per km²
for two-digit postcodes
up to 20
20 up to 50
50 up to 75
75 up to 100
100 up to 200
200 up to 500
500 up to 1,000
1,000 up to 2,500
2,500 up to 5,000
No values available
Iceland
Faroe Islands
Norway
Finland
Sweden
Estonia
Russian Federation
Latvia
Lithuania
Ireland
Isle of Man
Denmark
United Kingdom
Netherlands
Belarus
Poland
Bailiwick of Guernsey
Bailiwick of Jersey
Belgium
Germany
Luxembourg
Czech Republic
Ukraine
France
Slovakia
Switzerland
Austria
Moldova
Hungary
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Croatia
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Azerbaijan
Armenia
Andorra
Monaco
San Marino
Bosnia-Herzegowina
Serbia
Portugal
Spain
Italy
Montenegro
Kosovo
Bulgaria
Vatican City State
Macedonia
Albania
Turkey
Greece
Gibraltar
Malta
Cyprus
500 km
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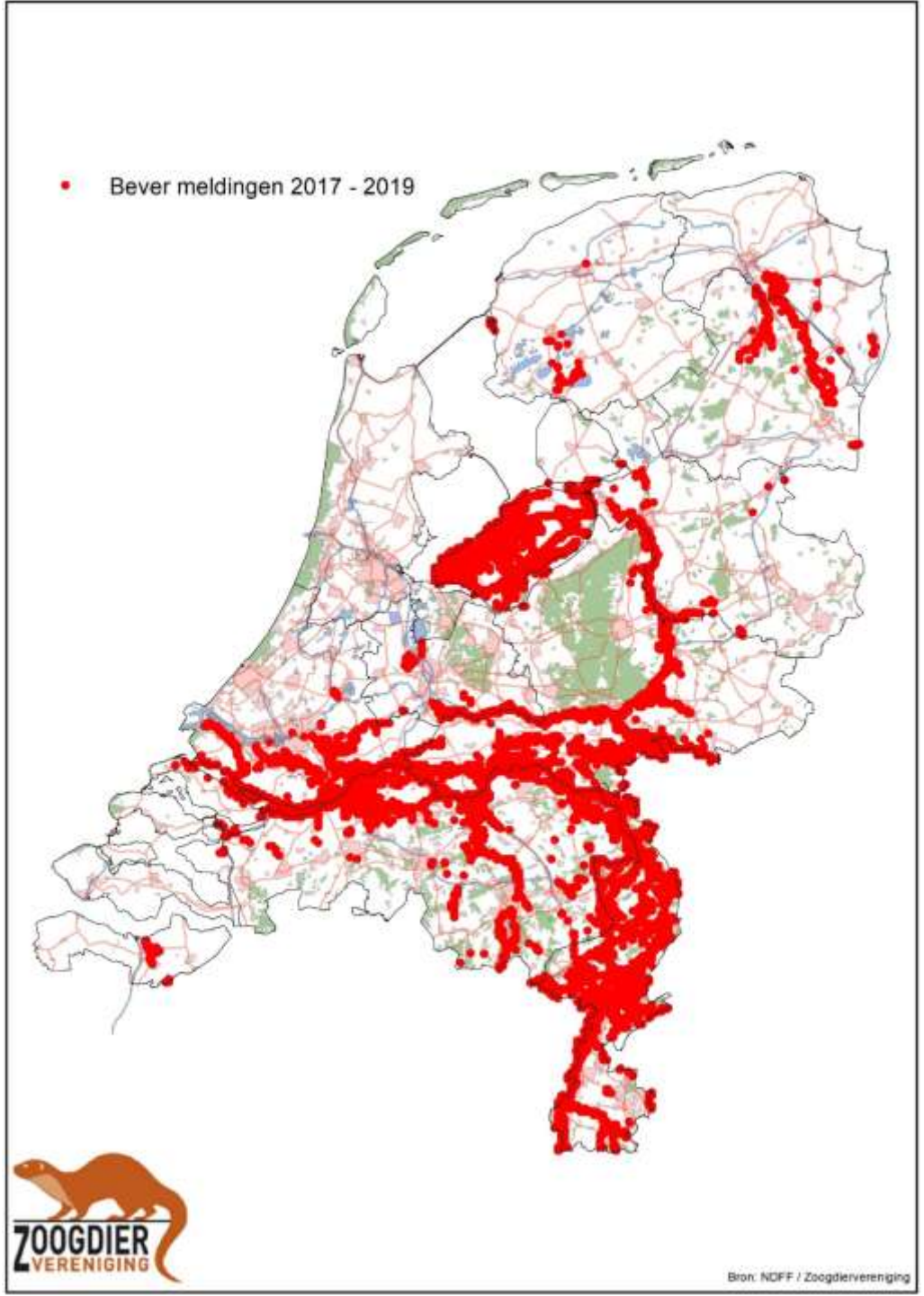
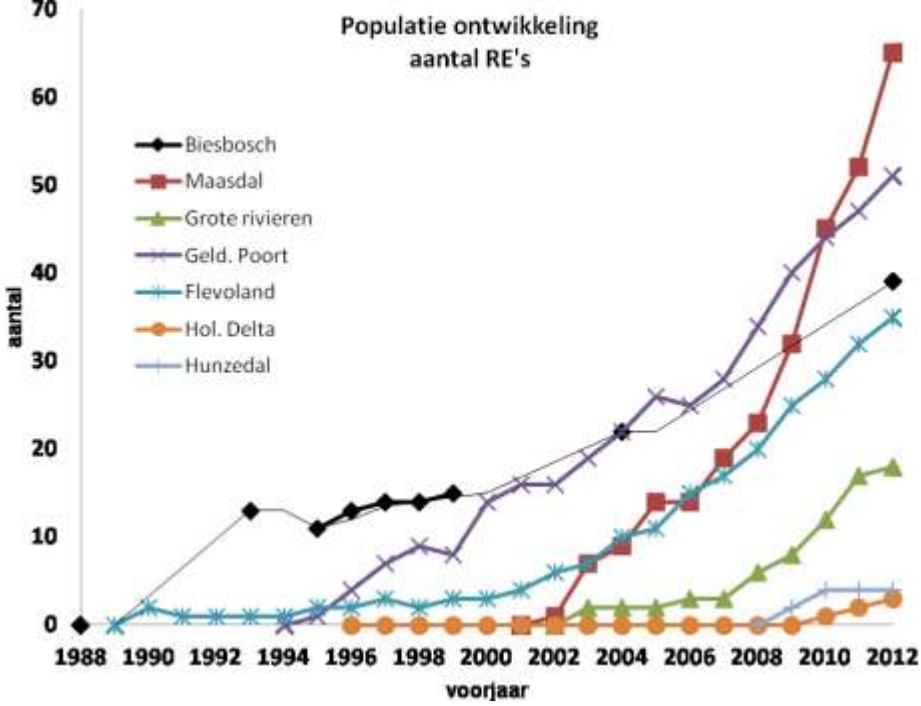
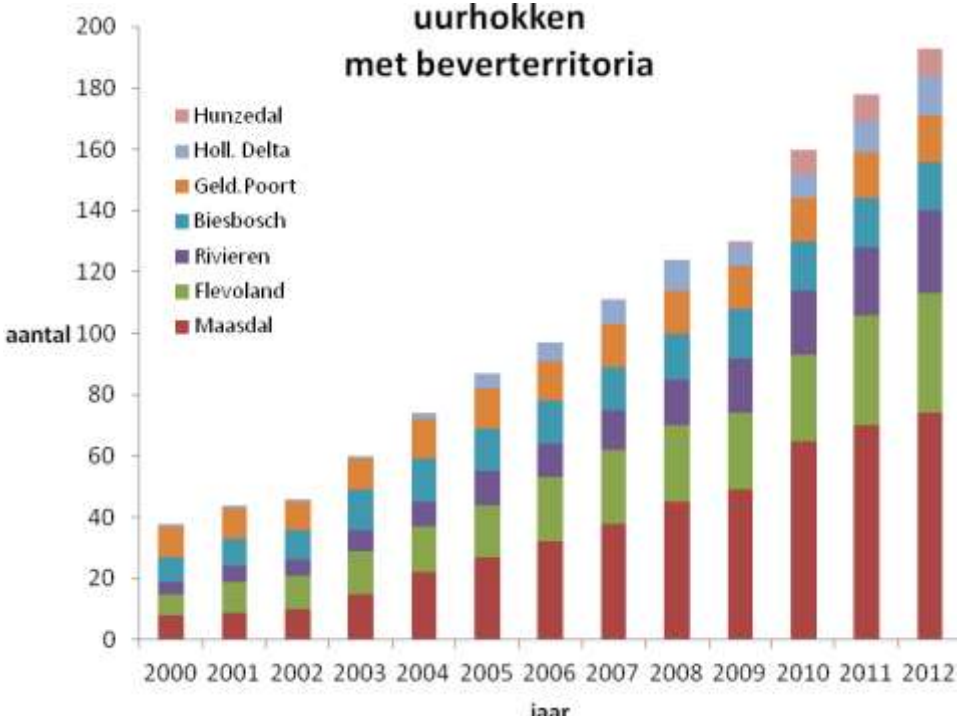
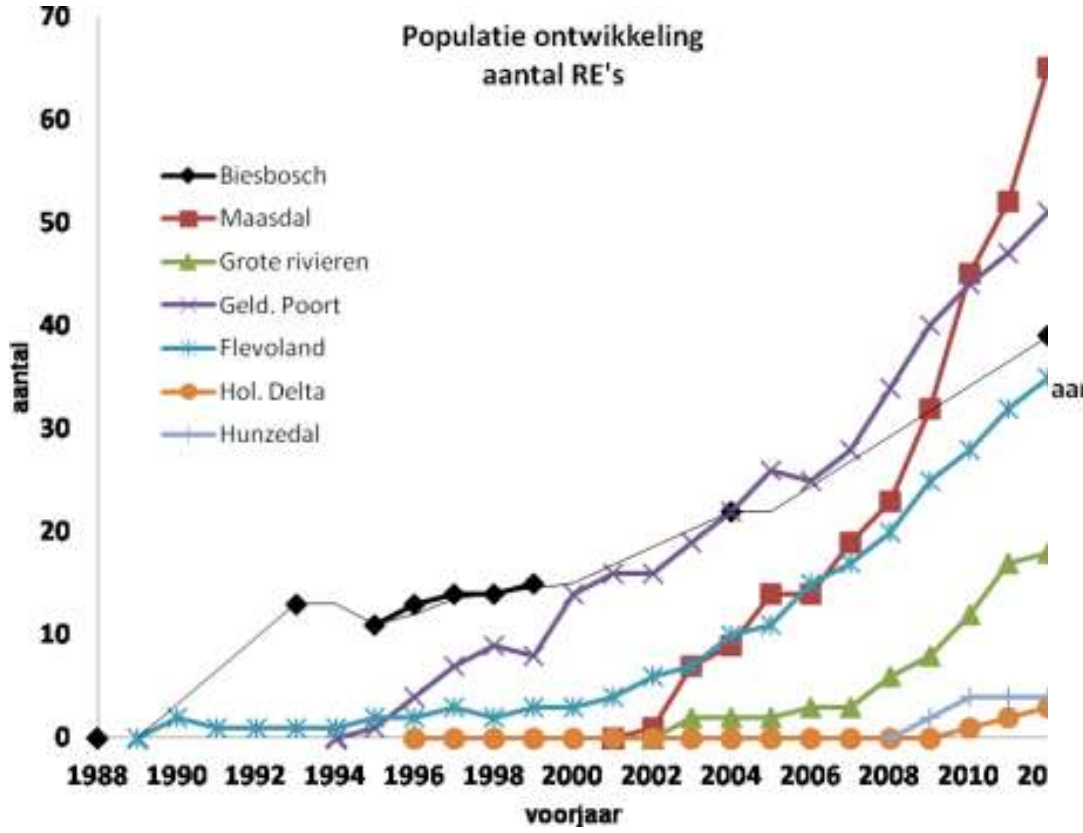
Map created with RegioGraph

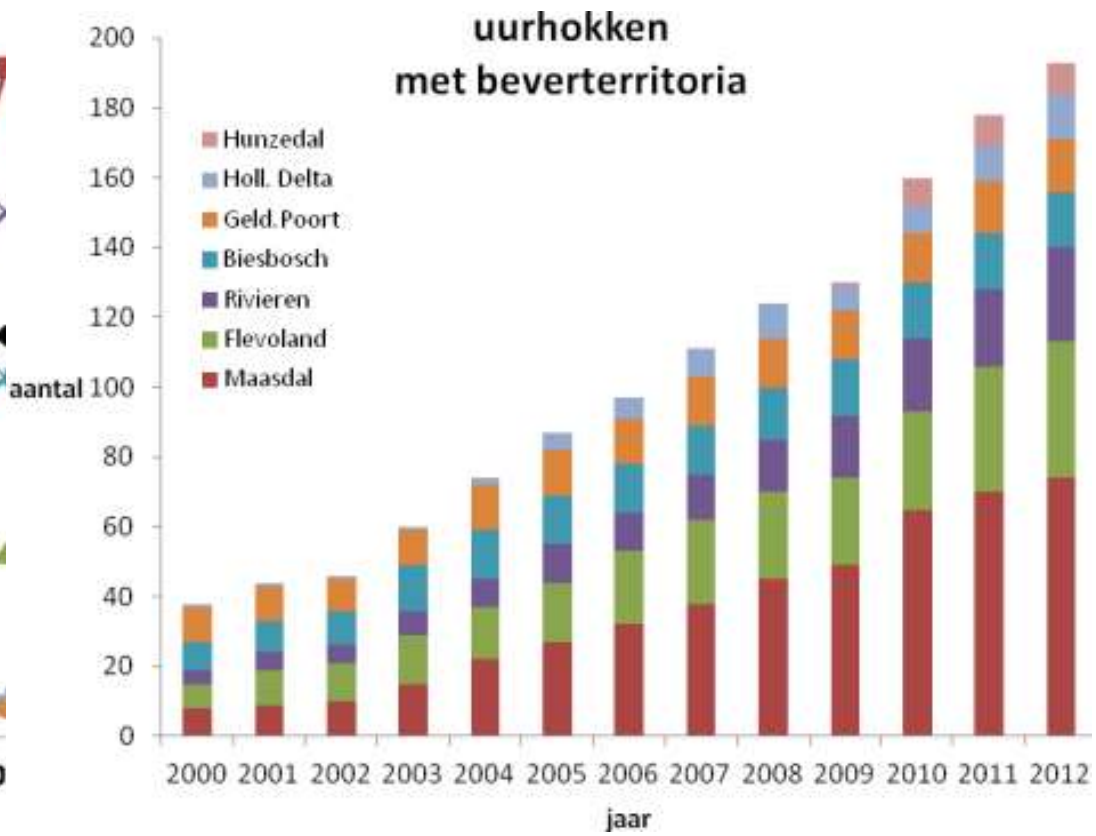
Netherlands (reintroductions 1988-2000)











Number of beaver territories in the Netherlands (2012: also 134 single animals)

Source: Niewold, F. 2012. The Beaver population to the spring of 2012.
Niewold Wildlife Infocentre. Report NWI-BE2012-05. Doesburg, The Netherlands: 71 pp.

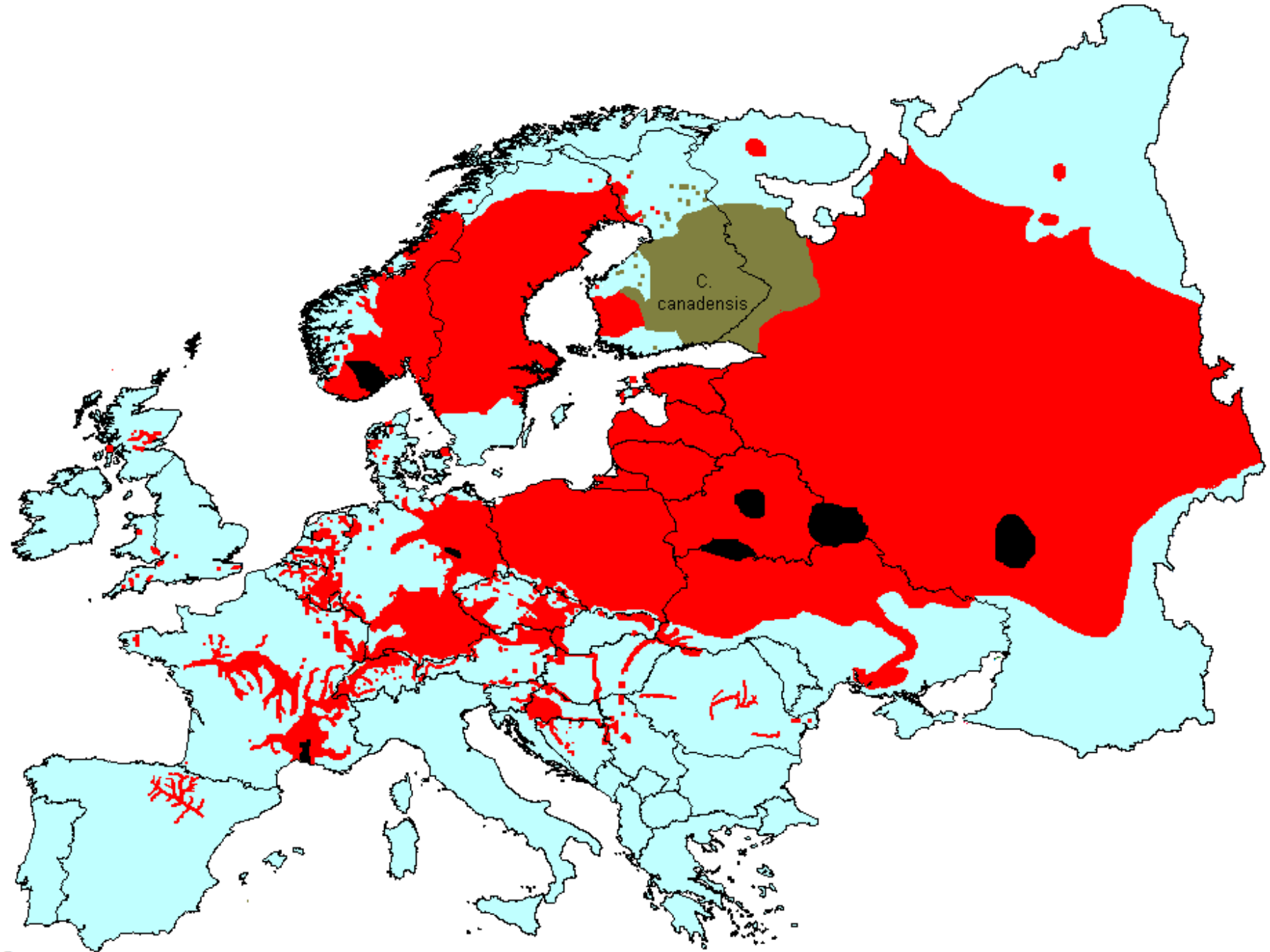
Siebe Swart © 2015

Photos: Willy de Koning

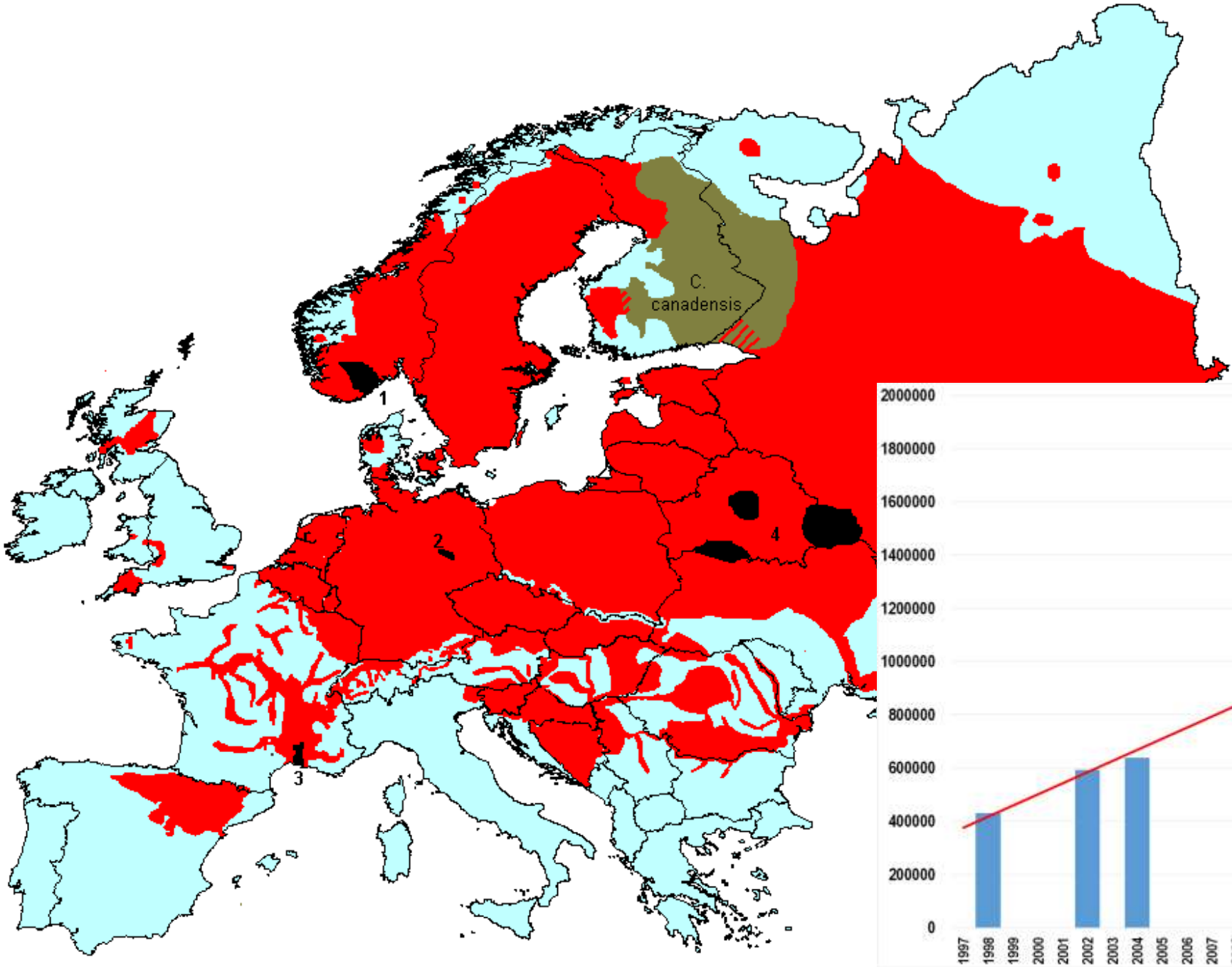
Photos: Willy de Koning

Photos: Willy de Koning

2020



2030?


C. canadensis
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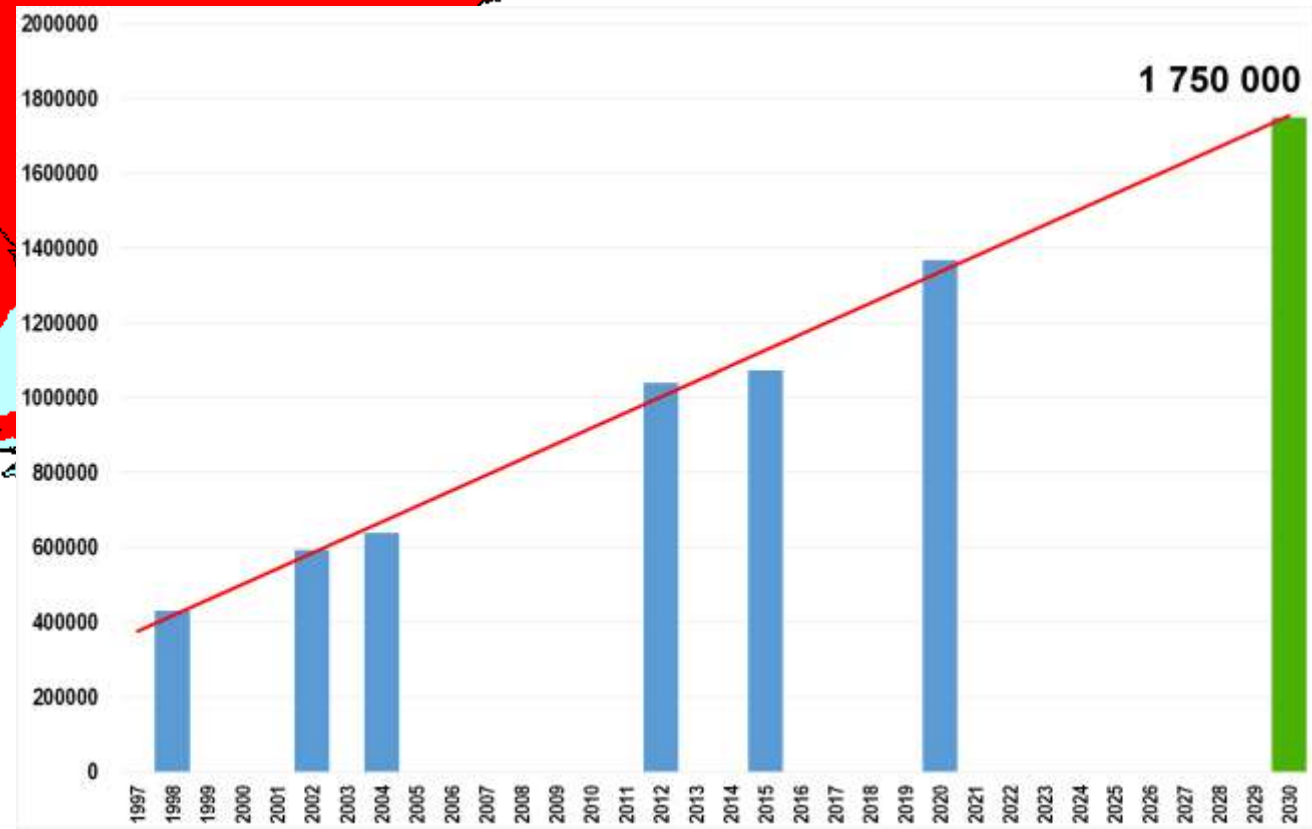
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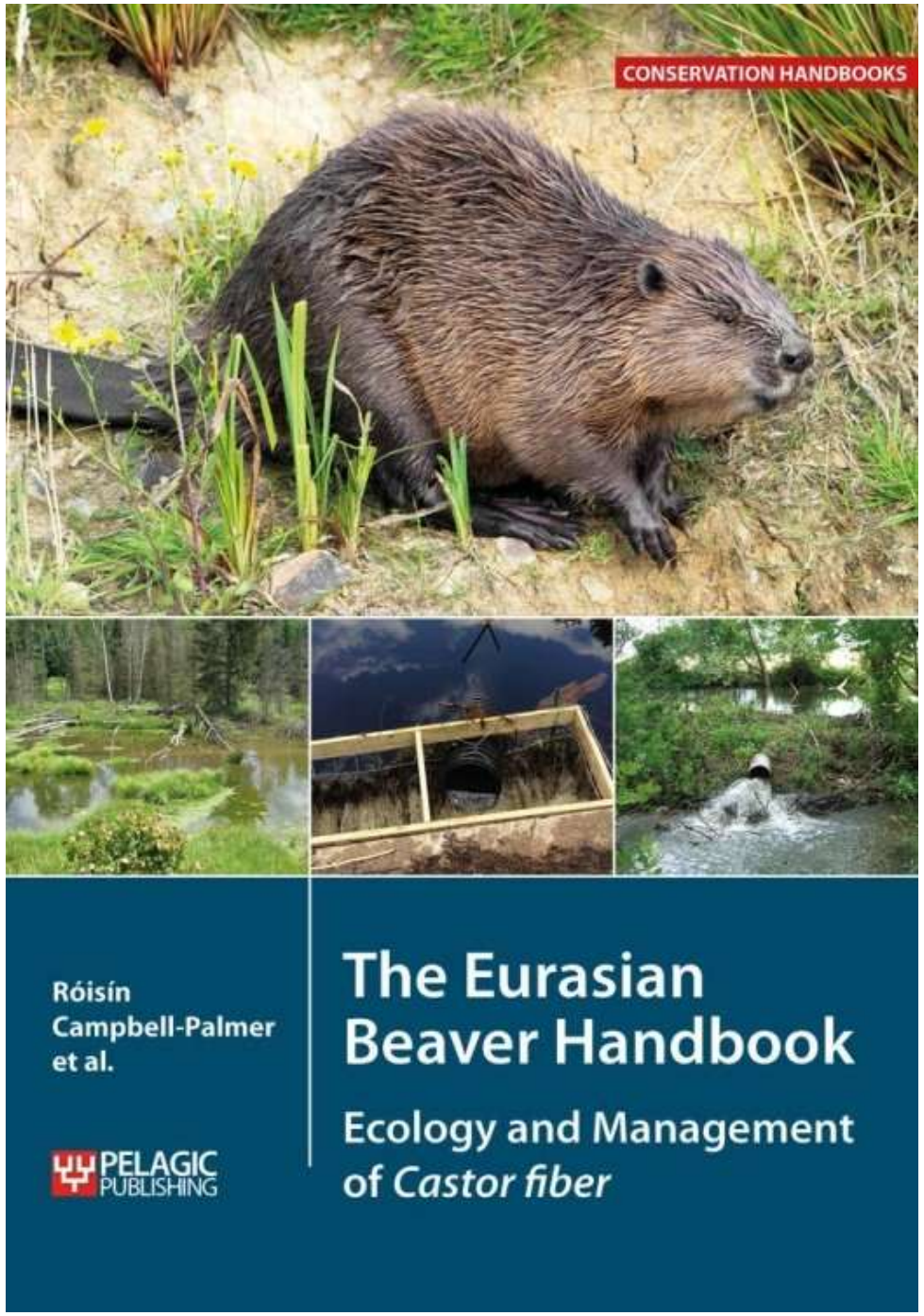
The future: not reinventing the wheel (44 times)?

Or, all having to make our own mistakes?

- Transfer knowledge ‘horizontally’ inside Europe – EU beaver network?
- Transfer knowledge inside countries – wildlife professionals to land managers/public (and vice versa)
- Bring in the State of the Art from N. America



Final slide-
Product placement!

Thank you!

(and buy our book!)