Legacy of large herbivores in Europe

Aurochs and Bison – natural range and habitat selection, de-domestication, back-breeding ("de-extinction") and ecological replacement with functional types

Questions:

What was the historical distribution of aurochs and bison in Europe?
What led to their extinction/near-extinction, and where were their last presence living in the wild
How was the bison reinstated into the wild?
What were the habitat preferences of aurochs, bison and domesticated cattle?
Are *new aurochs* an ecological equivalent to the extinct aurochs?
Is the bison an ecological equivalent to aurochs?
What would be the legal status of *new aurochs* or bison in Britain?

Historical distribution of aurochs and overlap with domestic cattle

HISTORY, MORPHOLOGY AND ECOLOGY OF THE AUROCHS (*BOS PRIMIGENIUS*).

T. van Vuure

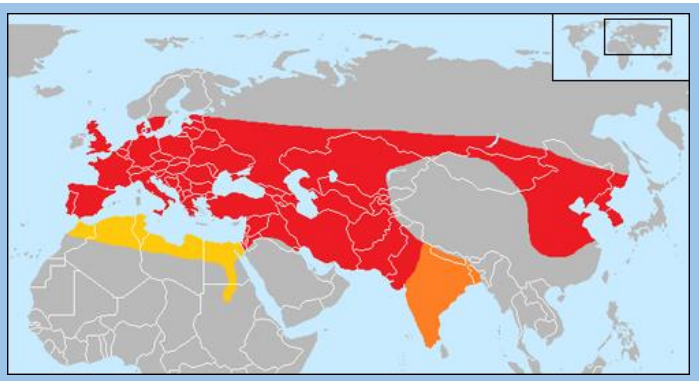
Van Vuure, C. T. (2002) History, morphology and ecology of the Aurochs (*Bos primigenius*). Lutra 45: 1-16

Fig. 1. The former distribution area of the aurochs during Pleistocene and Holocene periods (after many authors and own interpretations).
Utmost border during the Pleistocene. For Europe, North Africa and West Asia this border roughly holds for the Holocene too.
Probable utmost east- and southeast border during the Holocene.

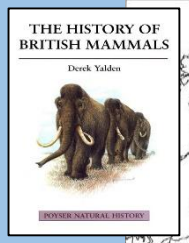
The IUCN Red List of Threatened Species™
ISSN 2307-8235 (online)
IUCN 2008: T136721A4332142

Bos primigenius, Aurochs
Assessment by: Tikhonov, A.

NOT EVALUATED	DATA DEFICIENT	LEAST CONCERN	NEAR THREATENED	VULNERABLE	ENDANGERED	CRITICALLY ENDANGERED	EXTINCT IN THE WILD	EXTINCT
NE	DD	LC	NT	VU	EN	CR	EW	EX



B. Primigenius = red, *B. p. mauretanicus* = yellow, *B. p. namadicus* = orange



Map of fossilised bones of aurochs dating ~ 400kya to 3.2kya

Quaternary Science Reviews 98 (2014) 144–165
Contents lists available at ScienceDirect
Quaternary Science Reviews
journal homepage: www.elsevier.com/locate/quascirev

Origin of British and Irish mammals: disparate post-glacial colonisation and species introductions

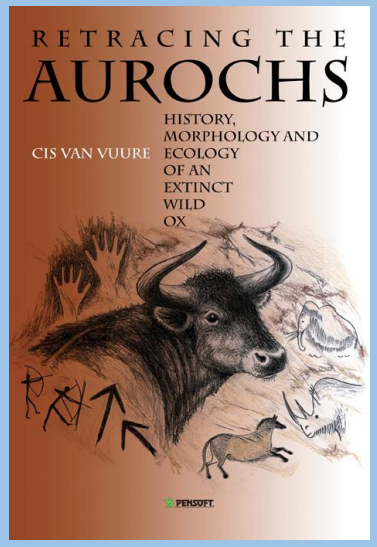
W. Ian Montgomery [a, *], Jim Provan [a], A. Marshal McCabe [b], Derek W. Yalden [c]

(c)

Britain	Species/taxon	*scientific name*	British archaeological/historical	
			Earliest record/presumed present	Latest record/extant*
Early Holocene extinctions	wild horse	*Equus ferus*	13 kya	9.3 kya
	elk	*Alces alces*	13 kya	3.9 kya
	beaver	*Castor fiber*	9 kya	1.0 kya
	aurochs	*Bos primigenius*	12 kya	3.2 kya
People, companion, animals domestic stock	people	*Homo sapiens*	12 kya	*
	domestic dog	*Canis familiaris*	9.5 kya	*
	domestic cattle	*Bos taurus*	5.5 kya	*
	domestic sheep	*Os aries*	5.4 kya	*
	domestic pigs	*Sus scrofa domesticus*	5 kya	*
	feral goat	*Capra hircus*	4.5 kya	*
	domestic horse	*Equus ferus caballus*	3.7 kya	*
	domestic cat	*Felis cattus*	2.5 kya	*

OVERLAP with arrival of **domesticated cattle**

Rise and fall of aurochs



Aurochs estimated to have evolved **1.5 - 2 mya** in **India**
- spread to other parts of Asia, to northern Africa and to Europe in **Pleistocene**
- **less adapted to cold** and dry as woolly mammoths, steppe bison and steppe horses
- aurochs in Europe **withdrew during cold periods** to Mediterranean area and expanded in warmer periods to north

Extinction started in S and W Europe, proceeded to NE
- increase in **human population** leading to increased **hunting** and then **reduction** in **habitat range** due to introduction and **expansion of farms and pasture**
- as aurochs decreased, hunting became a privilege of nobility
- forests to SW of Warsaw in **Poland** had **last surviving population**
- protected by King in Forest of Jaktorów through **guarding** and **hay-feeding in winter**
- population declined over C16 through lack of interest, corruption, **cattle diseases**, **competition for food** with domestic cattle, and **poaching**
- last aurochs, a cow, died in **1627**


ON THE SIZE OF THE URE-OX OR AUROCHS
(*BOS PRIMIGENIUS* BOJANUS, 1827)
Claude Guintard

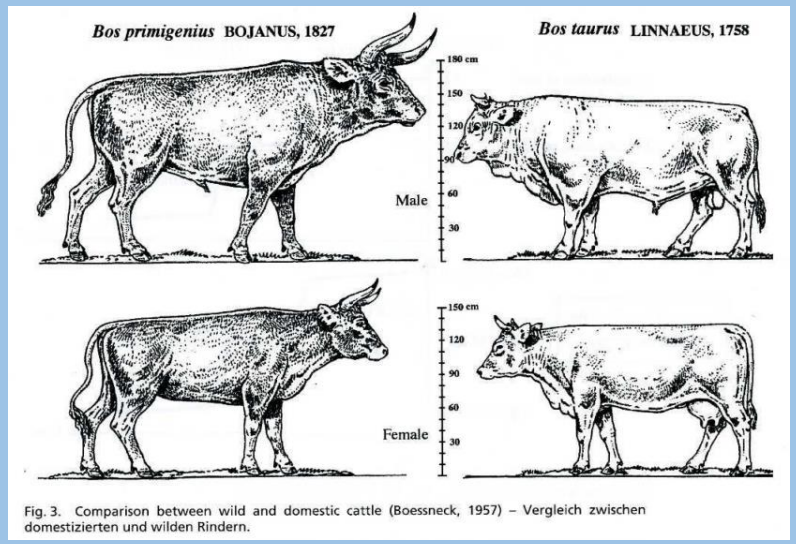
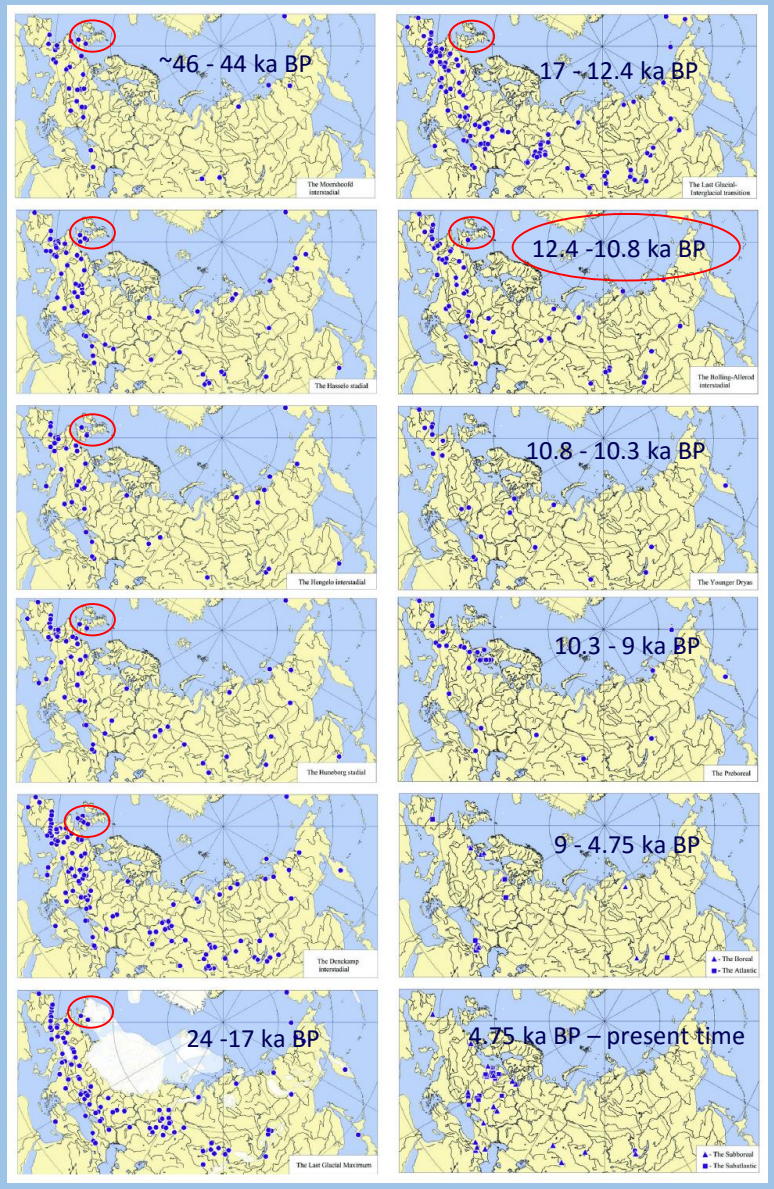


Fig. 3. Comparison between wild and domestic cattle (Boessneck, 1957) – Vergleich zwischen domestizierten und wilden Rindern.

GUINTARD C., On the size of the ure-ox or aurochs (Bos primigenius BOJANUS, 1827). In : G.-C. WENIGER (dir.), Archäologie und Biologie des Auerochsen. Wissenschaftliche Schriften des Neanderthal Museums, 1999, 1, 7-21

Extinction of steppe bison (*B. priscus*) and arrival of European bison (*B. bonasus*)



Geographical distribution of dated primitive bison/wisent (*B. priscus/bonasus*) remains in Europe and Northern Asia during the different time intervals of the Late Pleistocene and Holocene

Quaternary International 378 (2015) 99–110

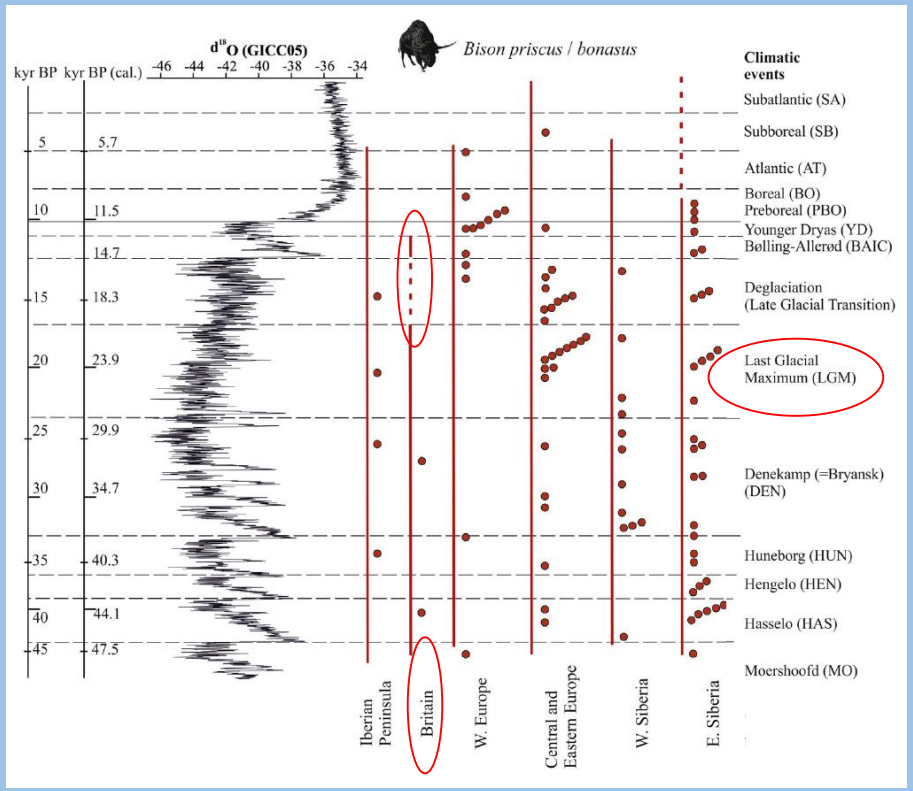
Contents lists available at ScienceDirect

Quaternary International

journal homepage: www.elsevier.com/locate/quaint

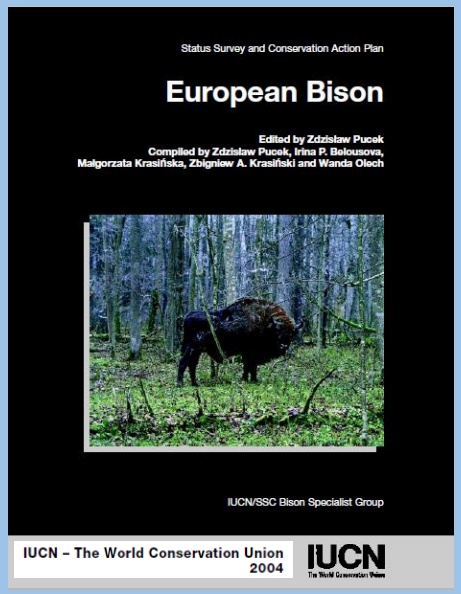
Changes in the Eurasian distribution of the musk ox (*Ovibos moschatus*) and the extinct bison (*Bison priscus*) during the last 50 ka BP

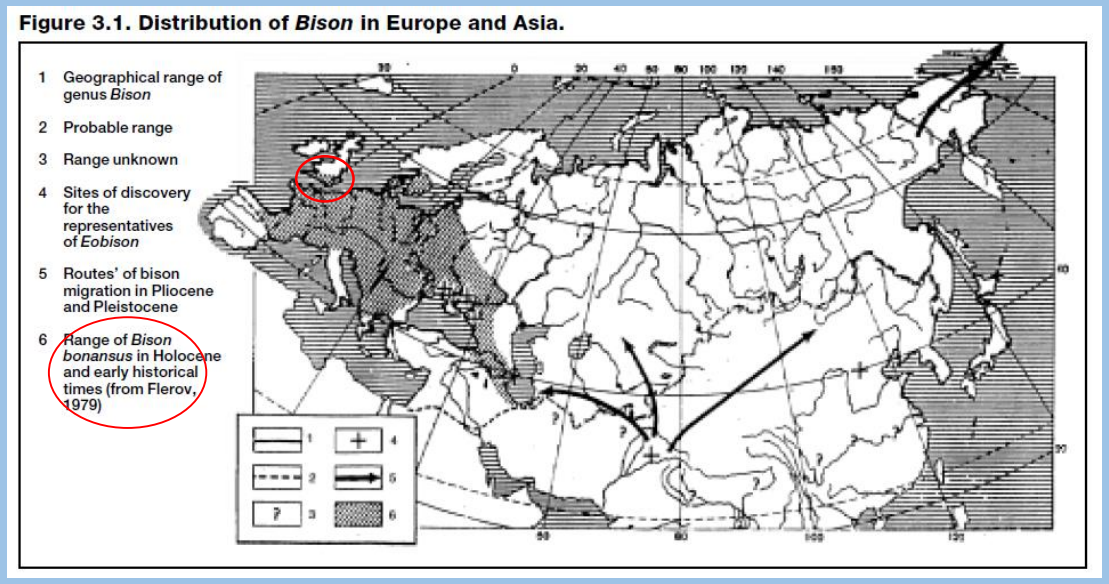
A.K. Markova [a], A.Yu. Puzachenko [a], T. van Kolfschoten [b, *], P.A. Kosintsev [c], T.V. Kuznetsova [d], A.N. Tikhonov [e], O.P. Bachura [c], D.V. Ponomarev [f], J. van der Plicht [b, g], M. Kuitems [b]

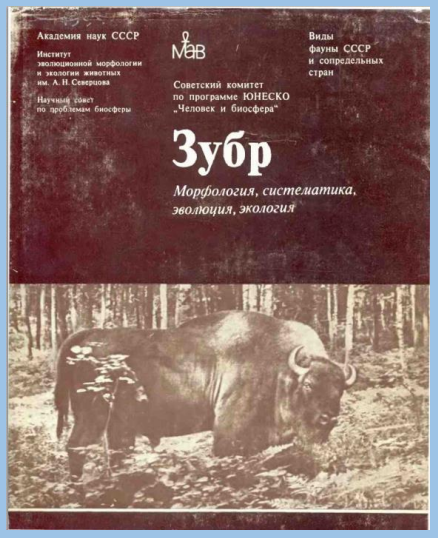


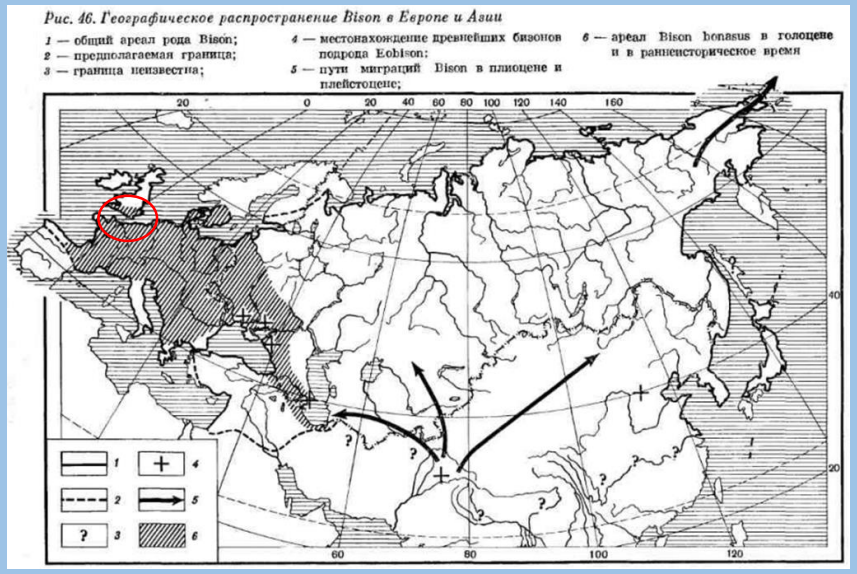
Changes in the Eurasian distribution of extinct bison (*Bison priscus*) during the last 50 ka BP - bars show the estimates of survival for the species in different parts of N. Eurasia

Holocene distribution of European bison (*B. bonasus*)



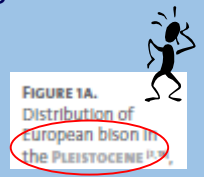






Perpetuation of **range error** for distribution in **SE England** into recent documents eg.

Zoological Society of London!



Flerov, K.K. 1979. Systematics and evolution. Pp. 9–127 in: European Bison (ed. E.V. Sokolov). Nauka, Moscow, USSR

In Russian

NO European bison in Pleistocene!

Rise, fall and rise in distribution of European bison (*Bison bonasus*)

MUNIBE (Antropologia-Arkeologia) 57 | Homenaje a Jesús Altuna | 421-428 | SAN SEBASTIAN | 2005 | ISSN 1132-2217

The Holocene distribution of European bison – the archaeozoological record

Norbert BENECKE*

Munibe (Antropologia-Arkeologia) 57, 2005 · Homenaje a Jesús Altuna

Fossil records show **European** bison **did not reach Britain**

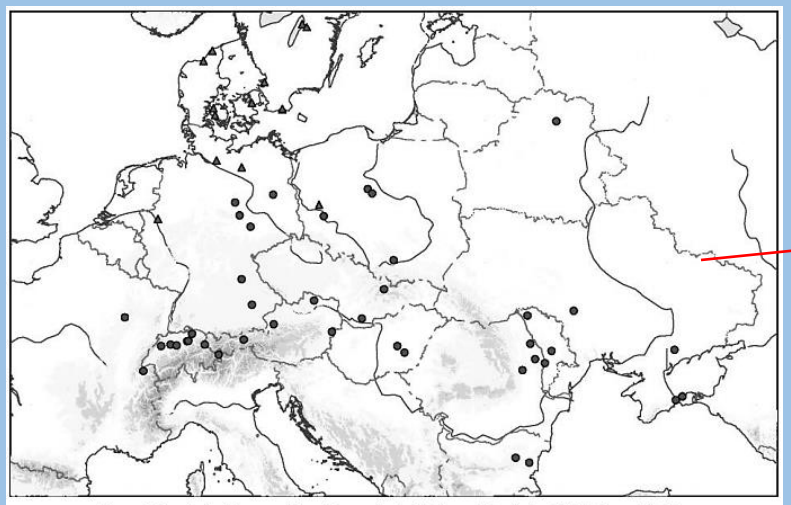


Figure 2: Bone finds of European bison dating to the Early Holocene (triangles) and Mid-Holocene (circles).

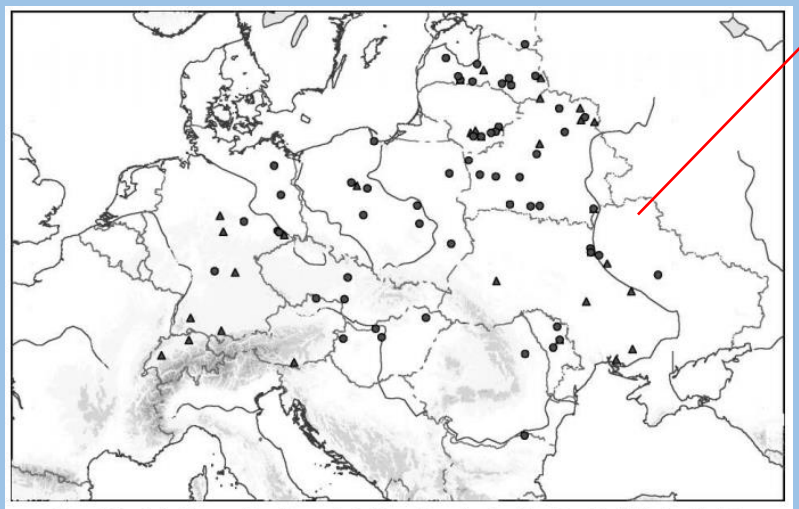
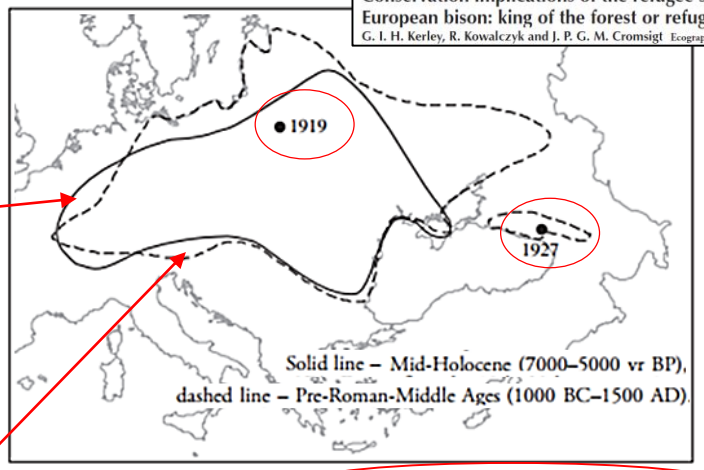


Figure 3: Bone finds of European bison dating to the Pre-Roman / Roman Iron Age (triangles) and the Middle Ages (circles).

Range expansion in Europe 3kya-500ya

Conservation implications of the refugee species concept and the European bison: king of the forest or refugee in a marginal habitat?

G. I. H. Kerley, R. Kowalczyk and J. P. G. M. Cromsigt Ecography 35: 519–529, 2012



Dots reflect the 19th–20th century relict population locations, with extinction dates

Ecological Applications, 21(3), 2011, pp. 830–843

Predicting potential European bison habitat across its former range

Tobias Kuemmerle,[1,2,12] Volker C. Radeloff,[1] Kajetan Perzanowski,[3,4] Piotr Kozlo,[5] Taras Sipko,[6] Pavlo Khoyetskyy,[7] Andriy-Taras Bashta,[8] Evgenia Chikurova,[6] Ivan Parnikoza,[9] Leonid Baskin,[6] Per Angelstam,[10] and Donald M. Waller[11]

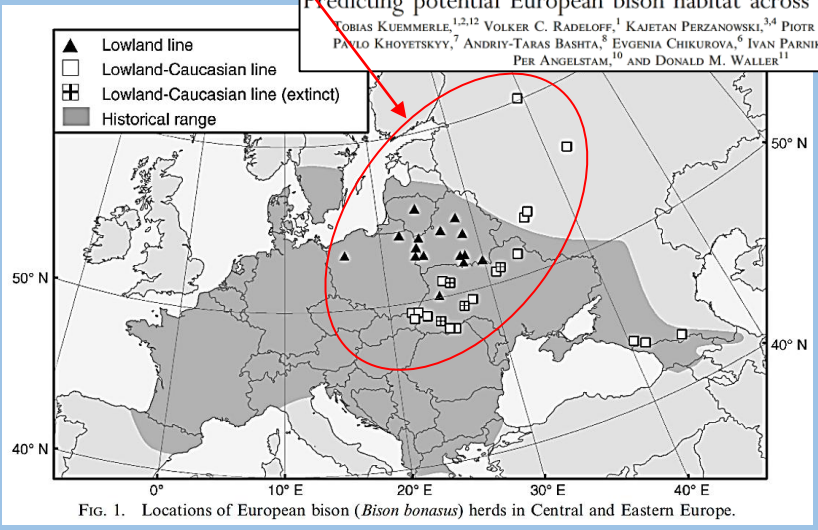


FIG. 1. Locations of European bison (*Bison bonasus*) herds in Central and Eastern Europe.

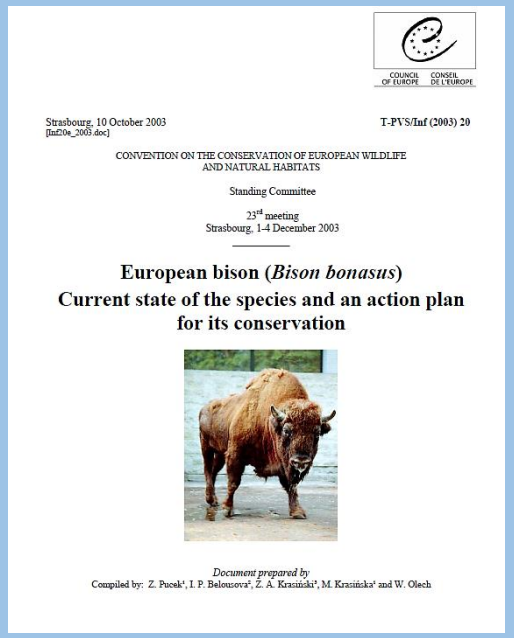
Do not believe all you read (or Wikipedia)!

Is the wisent (*Bison bonasus*) indigenous to the Netherlands and Belgium?

Cis (T.) van Vuure

Van Vuure / Lutra 58 (1): 35-43

*"Some documents claim that the wisent (Bison bonasus) was present in north-western Europe during the Middle Ages. With the introduction of the wisent into **Dutch nature management** these claims are being repeated again……This paper examines the **written sources** that make claims for the occurrence of the wisent in the Middle Ages in southern Sweden, **England**, Belgium and the **Netherlands**. It is clear that there are **no reliable data**. The claims partly arose due to **name confusion with aurochs** (Bos primigenius), partly through **inaccurate interpretations of texts**, and partly by people simply **advancing unsubstantiated assertions**"*



Strasbourg, 10 October 2003 [Inf20e_2003.doc] T-PVS/Inf (2003) 20

CONVENTION ON THE CONSERVATION OF EUROPEAN WILDLIFE AND NATURAL HABITATS

Standing Committee

23rd meeting
Strasbourg, 1-4 December 2003

European bison (*Bison bonasus*)
Current state of the species and an action plan for its conservation

Document prepared by
Compiled by: Z. Pucek[1], I. P. Belousova[2], Z. A. Krasiński[3], M. Krasińska[3] and W. Olech

research (Strategy… 2002). There is a consistent opinion that the shrinkage of the European bison range on the continent was caused by the progress of civilisation and that protective actions could not effectively protect the species. The process proceeded from the West, the South and the North. Bison in Gallia were the first to die (VIIIth century). In the north of Sweden bison only survived until the XIth century, and until the XIIth century in the south of England (according to some authors, only to the 5th–6th century, Szalay 1943). In the VIIth century, the European bison's existence was reported

The idea that the wisent occurred in England in the 12th century goes back to a text by Gen-the (1918). He wrote that 'probably in the 12th century there was evidence of wisents in Eng-land' but produced no further proof of this. According to Szalay (1938) he got this from a passage about the occurrence of aurochs and wisent in Europe in an article by Struckmann (1882). Struckmann was also misled by the name confusion and claimed (among other things) that the aurochs 'became extinct in England only in the 12th century', although he did not provide any evidence for this.

European bison

From Wikipedia, the free encyclopedia

History [edit]

The European bison became extinct in southern Sweden in the 11th century, and Southern England in the 12th.

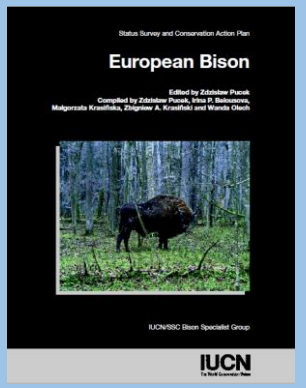
*"If the wisent occurred in the **Netherlands** and Belgium in the Middle and Late Holocene, it must have been just **a rare vagrant, not a resident species**"*

How **principled** is this?

GUIDING PRINCIPLES:

- Rewilding Europe will interpret the European bison range in relation to its ecological requirements and future climate change, rather than solely as its historical Holocene distribution.

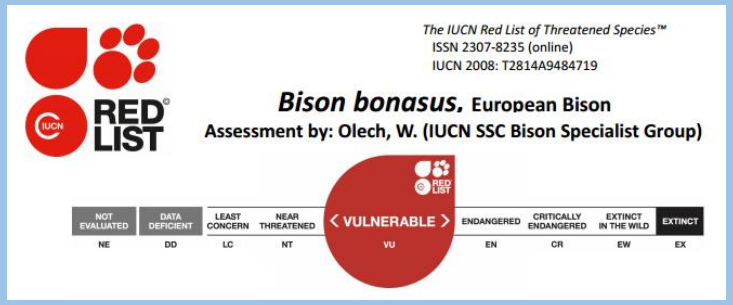
Rise, fall, and rise of European bison

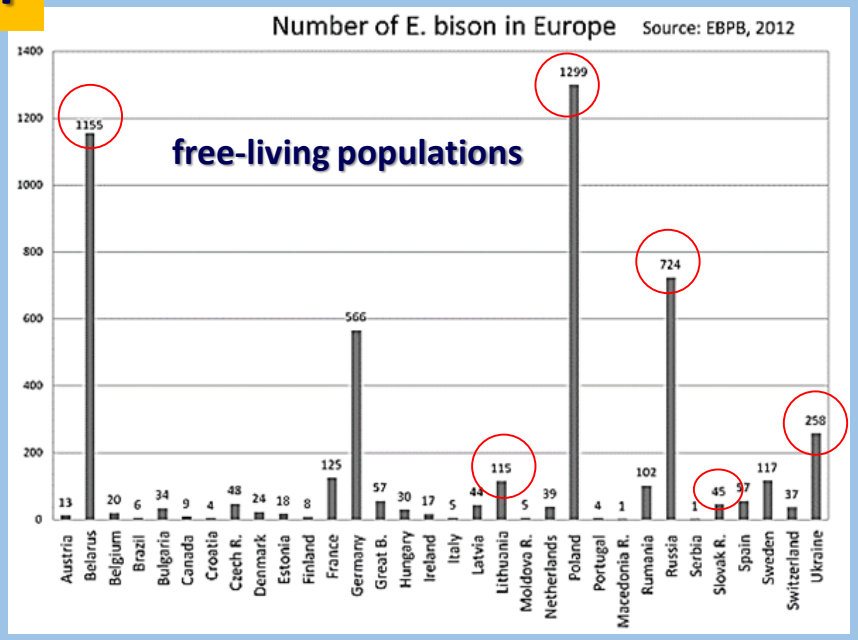


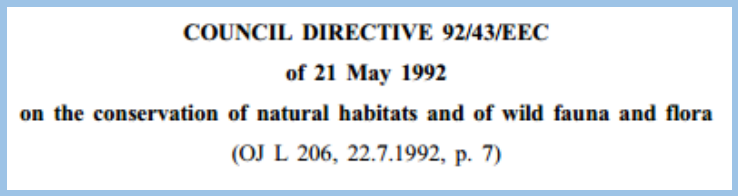
Origin of European bison (*B. bonasus*) unresolved
- could have been derived from **long horned** steppe bison (*B. priscus*) and a **woodland** bison (*B. schoetensacki*) both **present in Europe during Pleistocene**
- origin may have been in **Caucasus** during last glaciation , then spreading W and N, occurring in central Europe by **late Holocene**
- **extinction** started in C8th from W, continuing in S and N, **reduction in range** caused by **progress of civilisation,** pressure from **hunting,** running out of **space** for **free living** that did not **compete with humans**
- lost from Sweden in C11th, Germany in C14th, Hungary in C16th, Romania, Moldova, E Russia in C18th
- protected in Poland from C12th as royal game
- unsuccessful attempt to release European bison **bred in captivity** at Mecklenberg in 1689
- bison brought to Saxony from Prussia and Poland survived in enclosures until 1793
- **last European population** in Białowieża Forest, **Poland**, was protected until **extinction in spring 1919**
- last free-living population survived in **Caucasus** until 1927

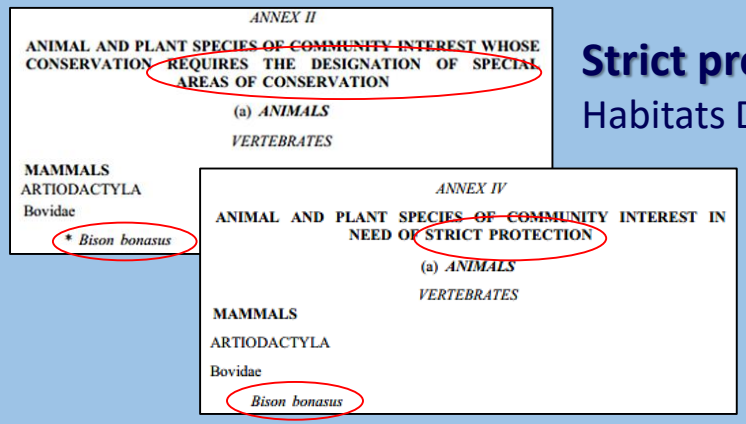
International Society for Protection of the European Bison founded in 1923 on the back of a proposal of **reinstating species from animals kept in captivity**
- survey revealed that 54 (29 males; 25 females) European bison with proved pedigrees survived in a few European zoological gardens, originating from 12 ancestors
- two lowland European bison returned to a reserve in Białowieza Forest in 1929
- **breeding program** continued in captivity **until 1952** in zoological gardens, parks, and created reserves
- first **free-living reproducing population** established in **Białowieża Forest** between 1952-60
- other free-ranging herds formed in Poland, Lithuania, Belarus, Ukraine, Russia and Kyrgyzstan, so that at the end of 2000 there were 30 herds
- choice of locations were areas of **least human activity** that could be **disturbed by their presence**, such as forests and national parks
- nearly all free-ranging bison herds are **distributed within the eastern part of historical range** of species although some are outside of that range

Present day status of European bison

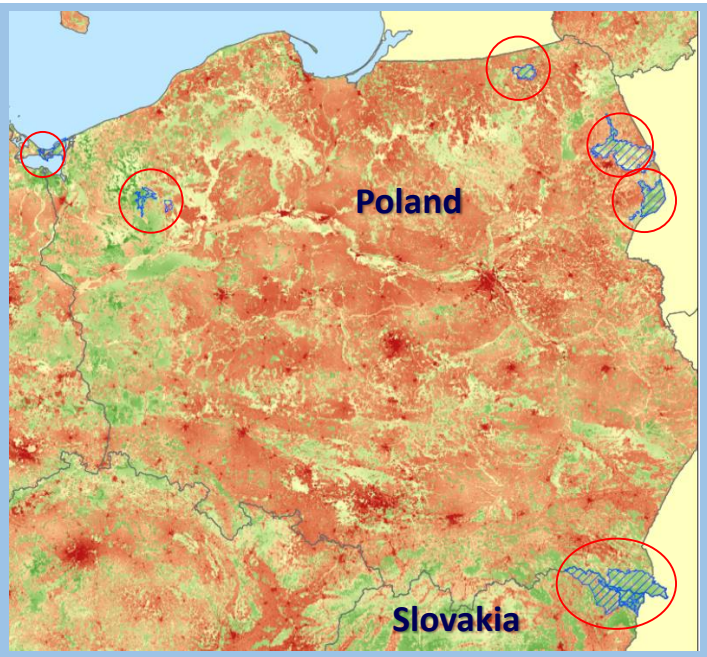








Strict protection under Habitats Directive



Natura 2000 sites for bison

Spectrum of herbivory based on digestive ability and intake of woody species

Evolutionary steps of ecophysiological adaptation and diversification of ruminants: a comparative view of their digestive system*,**

R.R. Hofmann Oecologia (1989) 78:443–457

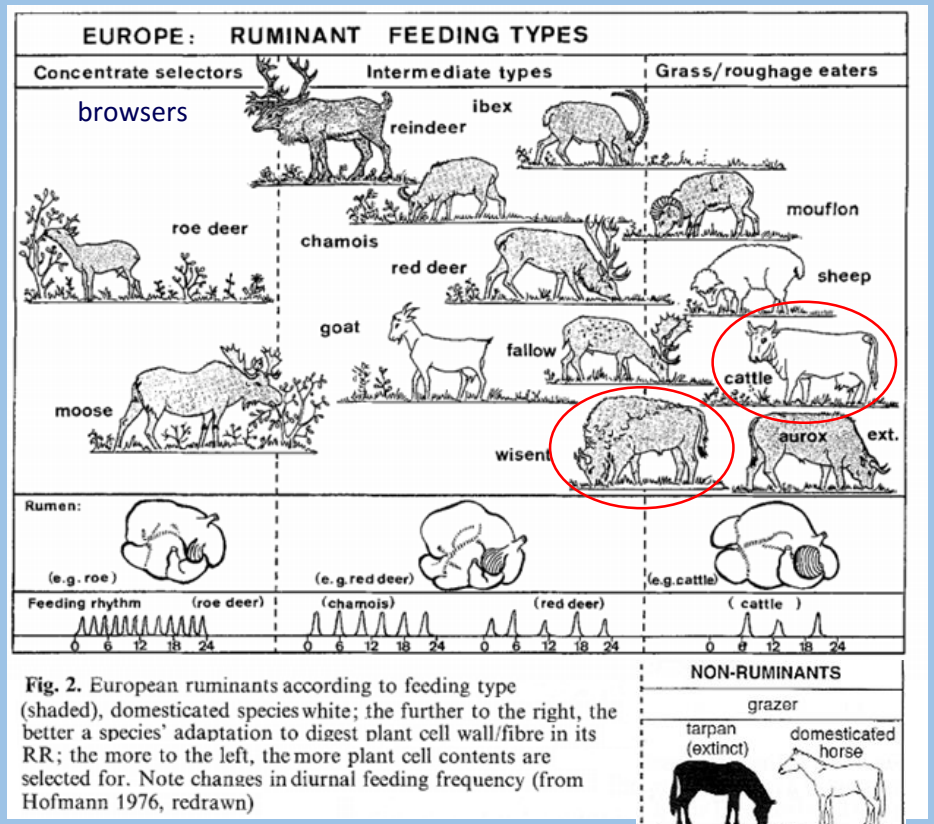


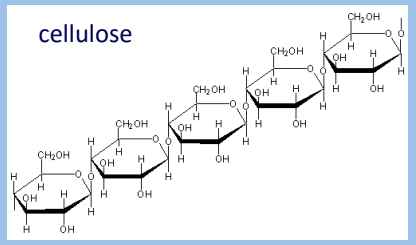
Fig. 2. European ruminants according to feeding type (shaded), domesticated species white; the further to the right, the better a species' adaptation to digest plant cell wall/fibre in its RR; the more to the left, the more plant cell contents are selected for. Note changes in diurnal feeding frequency (from Hofmann 1976, redrawn)

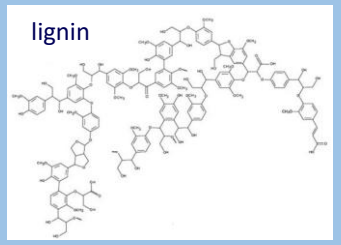
Ruminant herbivores have **cellulose digesting bacteria** in **rumen**, a compartment in enlarged stomach. Non-ruminant herbivores have digesting bacteria in a **functional caecum**

non-ruminants added

Polymers of **cellulose** and **lignin** are components of plant cell walls

- woody plants have higher lignin content
- bison differ from aurochs (cattle) in being **intermediate feeders**





A C T A T H E R I O L O G I C A

VOL. 19, 19: 283—289. BIAŁOWIEŻA September, 1974

A Comparison of the Digestibility of Nutrients by European Bison and Cattle*

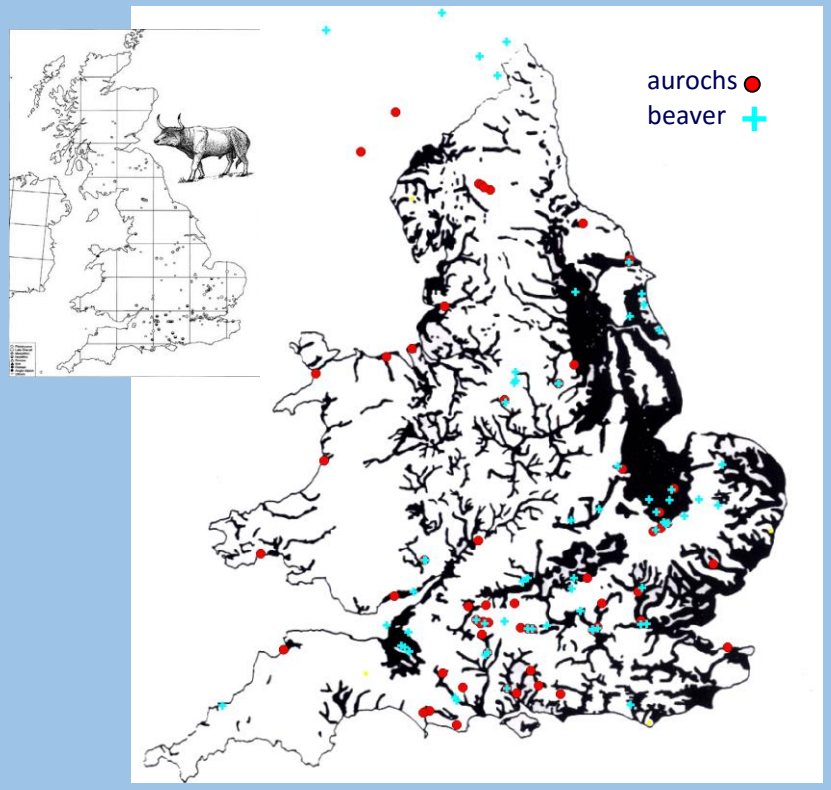
Zofia GĘBCZYŃSKA, Jan KOWALCZYK, Małgorzata KRASIŃSKA & Aleksandra ZIOŁECKA

Table 2

Apparent digestibility coefficients of nutrients of the ration for European bison and bulls.

	Crude fibre	N-free extractives	Monasaccharides	Readily hydrolysed carbohydrates	Cellulose	Lignin	Pentosans + hemicellulose
Bisons	56.60 ±2.37	74.49 ±1.01	99.09 ±0.21	96.70 ±0.45	61.06 ±4.46	25.95 ±2.90	68.09 ±1.85
Bulls	52.18 ±1.32	69.18 ±0.34	98.92 ±0.21	95.62 ±0.35	61.39 ±1.98	8.18 ±3.04	66.83 ±1.03

Wetland habitat selection for aurochs



Distribution fossil bone finds of auroch and beaver follow floodplains

A comparative analysis of the habitat of the extinct aurochs and other prehistoric mammals in Britain

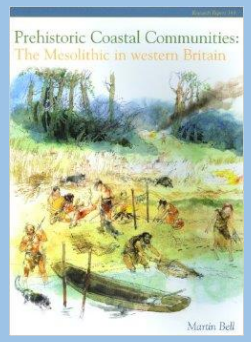
Stephen J. G. Hall Ecography 31: 187–190, 2008

Table 3. Species comparisons of quantitative characteristics of find squares. Medians for each species, with Kruskal-Wallis H statistics and significance. Sample sizes were as follows for spot height, number of contour lines, vertical distance between highest and lowest contours, total watercourses: beaver 68, aurochs 188, moose 27, roe deer 46, red deer 73, wolf 101, brown bear 96. Sample sizes for lowest and highest contours were, respectively, 54, 162, 24, 44, 68, 93, 93.

	Spot height of centre of map square (m)	Lowest contour (m)	Highest contour (m)	Number of contour lines	Vertical distance between highest and lowest contours (m)	Total watercourses (m)
Beaver	29.2	30	73.1	2	10	475
Aurochs	30.2	30	60.5	2	10	447
Moose	50	30.2	75	4	20	750
Roe deer	50	45	80	4	20	250
Red deer	55	50	70	3	20	250
Wolf	60.9	40	91.4	5	40	450
Brown bear	76.2	60.96	121.9	6	45.7	0
H statistic	27.52	13.82	37.66	41.18	52.81	8.86
p	<0.001	<0.05	<0.001	<0.001	<0.001	>0.05 n.s.

Comparative mapping analysis of contemporary habitat where fossil bones of aurochs and other prehistoric mammals found in Britain

- distribution of **beaver** fossil bones had a strong association with presence of **lakes** in the landscape
- brown bear and wolf with presence of cliffs and rock outcrops
- **aurochs** with **lower elevation** and **greater flatness** associated with wet **marshland** and **riverine flat-lands** in **lowlands**



The second significant weakness of the Vera hypothesis in the present context is that herbivore grazing is fore-grounded as the main relevant disturbance factor. However, it is but one of a range of factors requiring consideration (Bell and Walker 2005, fig 6.1). It has been shown, for instance, that beavers were a significant environmental disturbance factor in river valleys and lowlands in prehistory (Coles and Orme 1983; Coles 2001; Coles 2006). More sig-

The contribution of this study to the current debate on the role of large herbivores in determining the structure of northwestern European woodlands (Vera 2000, Svenning 2002, Mitchell 2005) is to suggest that in Britain the aurochs may not have been a prime determinant of the structure of the more upland woodlands.

Beaver probably more significant than aurochs in **shaping** wetland and riparian **vegetation cover**

Aurochs a **LOWLAND** wetland/riparian animal

Domestic cattle broke the bounds of aurochs habitat selection

Where the wild things are: aurochs and cattle in England

Anthony H. Lynch, Julie Hamilton & Robert E.M. Hedges*

ANTIQUITY 82 (2008): 1025–1039

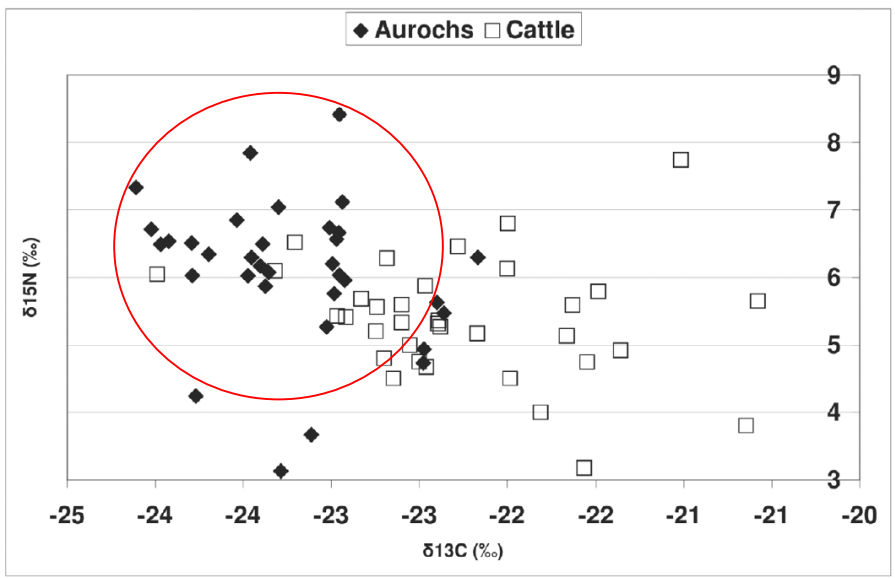


Figure 1. Plot of isotopic values from individual samples.

Compared **dental anatomy** and **isotopic signature** of fossil bones from aurochs and domestic cattle from a number of English Neolithic and Bronze Age sites

- on basis of dental anatomy and observed behaviour of historical aurochs and modern cattle, a **wetland habitat for aurochs** is arguably more probable than a forested habitat

- separation of habitats for domestic cattle and aurochs revealed by **isotope analysis** suggests that **Neolithic farming groups** exploited **environmentally-different areas** for their **cattle** from those used naturally by aurochs

DOMESTICATION cuts across **natural habitat selection**

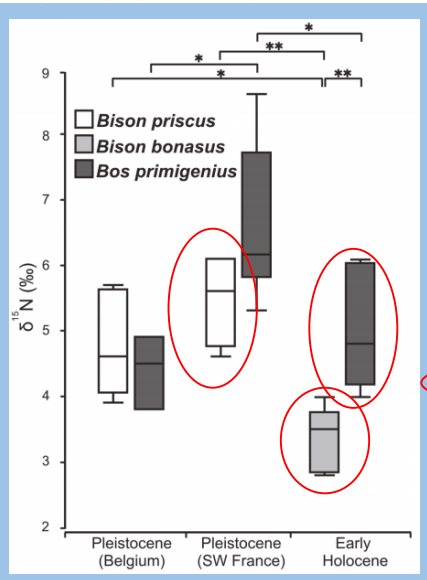
Fossil bones reveal dietary differences between bison, aurochs and moose

European Bison as a Refugee Species? Evidence from Isotopic Data on Early Holocene Bison and Other Large Herbivores in Northern Europe

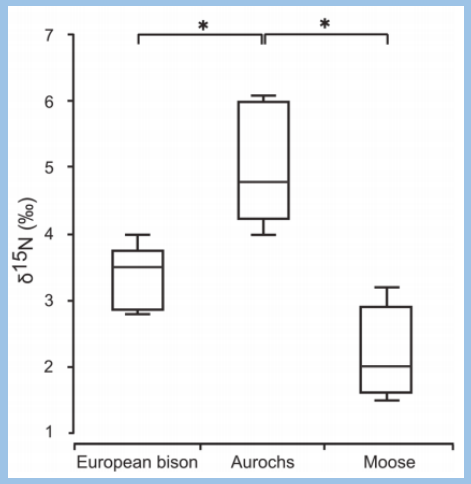
Hervé Bocherens[1,2], Emilia Hofman-Kamińska[3]*, Dorothée G. Drucker[1], Ulrich Schmölcke[4], Rafał Kowalczyk[3]

PLOS ONE | DOI:10.1371/journal.pone.0115090 February 11, 2015 1 / 19

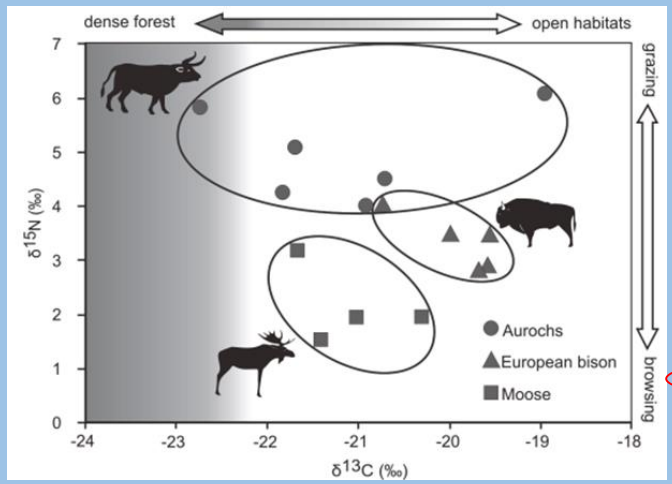
Investigated **stable isotopic signature** of radiocarbon dated fossil bones from **aurochs**, **moose** and **bison**
- **higher δ15N** values in **grasses, sedges** compared to shrubs, trees
- plants growing in more **open habitats** show **less depleted δ13C** abundance in comparison to plants growing in shade
- **less depleted δ13C abundance** in **drier areas** compared to wetter



- steppe bison (*B. priscus*) in **Pleistocene** exhibit **less woody plant diet** than early **Holocene** European bison (*B. bonasus*)
- early Holocene **bison** has **more woody diet** than **aurochs**

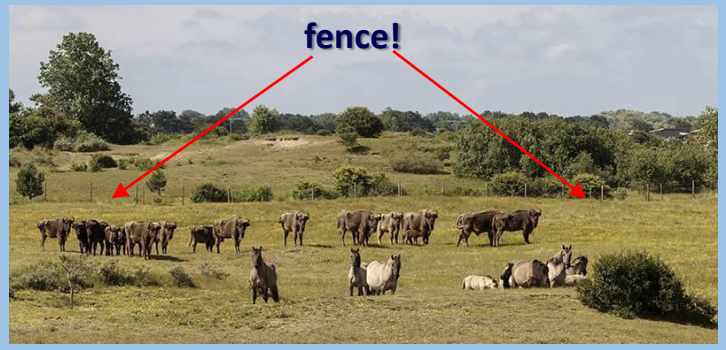


- early Holocene **moose** diet **more woody** than European **bison**, which is **more woody** than **aurochs**



- assert values of $\delta^{13}C$ and $\delta^{15}N$ isotopes reflected use of **open habitats by bison**, with their diet **intermediate** between that of aurochs (grazer) and of moose (browser)
- concluded results show early Holocene **large ungulates avoided competition** by **selection of different habitats** or **different food sources** within similar environments

Interpretation of depleted δ13C abundance could be **over-emphasising habitat open-ness** and **under-emphasising wetland habitat** of **moose** and **aurochs** compared to **drier habitat** of **bison**



Bison habitat selection becomes *pawn* in disputed natural vegetation cover of Europe

Kerley *et al* invoke "*small population paradigm*" to trash reinstatement of bison into mostly woodland areas
- a criticism of vulnerability of species conservation measures in **sub-optimal locations** with limited numbers
- claim woodland habitat selection of bison an artefact of withdrawing into those locations as a **refuge** from **human persecution**
- **IGNORES ABILITY OF FREE LIVING POPULATIONS IN MAKING OWN HABITAT SELECTION CHOICES**
- does not refer to **Kraansvlak**

De Kraansvlak pilot: wilde Wisenten in een Nederlandse context

Joris Cromsigt, Leo Linnartz, Ralf Verdonschot, Hans Esselink & Han Olff

21 april 2007, de Wisent (*Bison bonasus* Linnaeus 1758), Europa's laatste wilde rundersoort, doet zijn intrede in een Nederlands natuurgebied. Om 6 uur in de ochtend worden in het Kraansvlak, een afgesloten deel van het Nationaal Park de Kennemerduinen, drie Wisenten uitgezet, twee 2-jarige koeien en een 4-jarige stier. Twee volwassen koeien (7-8 jaar) en een bijbehorend kalf zijn nog achtergebleven in het Poolse Bialowieza en zullen naar het Kraansvlak worden gebracht zodra het kalf

Kuemmerle *et al* combined **Species Distribution Model** with a dynamic vegetation model based on **locations of fossil bone finds** to reconstruct the **natural range of bison** before large scale human influence
- found heartland of European bison to be in Central and Eastern Europe, but range of European bison stretched out further than previously thought on N and E edge during last 8000 years
- distribution during the Holocene did not extend substantially into W Europe (ie. **NOT Netherlands**) in line with fossil bone evidence
- habitat preferences of European bison during Holocene were broader than previously thought, with bison thriving in semi-open areas and in broadleaved, mixed and coniferous forests

Conservation implications of the refugee species concept and the European bison: king of the forest or refugee in a marginal habitat?

G. I. H. Kerley, R. Kowalczyk and J. P. G. M. Cromsigt

Ecography 35: 519–529, 2012

Reconstructing range dynamics and range fragmentation of European bison for the last 8000 years

Tobias Kuemmerle[1,2]*, Thomas Hickler[3], Jörgen Olofsson[4], Guy Schurgers[4] and Volker C. Radeloff[5] *Diversity and Distributions* (2012) **18**, 47–59

Cromsight et al trash Species Distribution Model based on Holocene fossil bone finds
- claim bison is already **in refuge before 8000bp** and so **habitat preference skewed**
- **WHAT ABOUT ORIGINATION AND DISTRIBUTION OF NEW SPECIES IN B. BONASUS DURING HOLOCENE?**
- **Kraansvlak** referenced as **pilot introduction** of European bison in **open dune landscape of Netherlands**, along with Konik horses, bison described as "*free-ranging*" - **FENCES**
- bison herbivory seen in context of **DUTCH NATURE DEVELOPMENT** where bison introductions in **semi-open landscapes** arising from farm abandonment would contribute to the conservation of these landscapes
- assert **experimental re-introduction programs**, like Kraansvlak, are predictors of habitat preference

*"Over the past 5 years, the bison in the Dutch pilot project **reduced woody plant cover through heavy debarking and resulting killing of trees** during the winter period. Hence, bison may contribute to management of shrub encroachment and maintaining a mix of grassland, shrub and woodland habitat"*

The difficulty of using species distribution modelling for the conservation of refugee species – the example of European bison

Joris P. G. M. Cromsigt[1,2]*, Graham I. H. Kerley[2,3] and Rafał Kowalczyk[3]

Diversity and Distributions (2012) **18**, 1253–1257

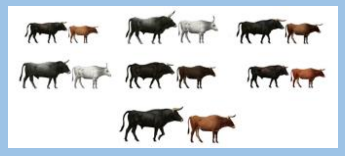
Kuemmerle *et al* expose **logic failures** and **lack of data** in assuming bison a refuge species in early Holocene
- reconstructions of human population and farming expansion in Europe **do not support view** that bison refugee species before 8000 BP, that human pressure had pushed bison out of S and W Europe
- human pressure in Southern and Western Europe was lower than in Central Europe
- no explanation why bison's range **severely curtailed by humans prior to 8000 BP**, but then **maintained stable for the next 5000 years**, although human pressure rose substantially during that time
- no European bison remains from the early Holocene found in W and S Europe, although many archaeozoological assemblages exist show remains of other prey species of human hunters like wild horses

Refugee species: which historic baseline should inform conservation planning?

Tobias Kuemmerle[1,2]*, Thomas Hickler[3], Jörgen Olofsson[4], Guy Schurgers[4] and Volker C. Radeloff[5] *Diversity and Distributions* (2012) **18**, 1258–1261

- point out that habitat preferences **in small-scale experimental reintroductions without predators and limited competition, and without natural disturbance** processes such as fire, have limited value when the goal is to identify optimal habitat, especially when bison occupy large territories and have ability to migrate
- question **reintroductions into densely settled Southern and Western Europe**, where conflicts with people and land use would be huge, where **European bison have not been present during the last 8000 years** and where conservation efforts incur high financial costs

New *aurochs* : de-domestication, back-breeding (“*de-extinction*”)



Tauros Programme set up by **Taurus Foundation**, **private Dutch** Foundation, 2008, to re-create **extinct** aurochs from “*primitive*” cattle breeds by **back-breeding**

- selected from Limia, Maronesa, Maremmana, Sayaguesa, Pajuna, Podolica, Tadunca, Alistana-Sanabresa and Boškarin cattle, allegedly **most closely related** to aurochs
- hundreds of **second- and third-generation crossbred** cattle in *“Rewilding”*Europe project areas in Spain, Portugal, Croatia, Romania and **Netherlands, enclosed by fencing**

“Tauros animals are expected to around the year 2025, again have the right, ***fully natural*** *characteristics of the aurochs and to by then be* ***officially*** *recognized as a normal wildlife species”*

Original co-founder of Tauros Programme leaves in 2012 to set up **Megafauna Foundation**, a **private Dutch** Foundation after disagreement over best way to back-breed

- changes name from **Megafauna** to **True Nature Foundation**
- Uruz programme restricts cross-breeding to only four breeds
- aim is to breed back an animal that **resembles aurochs** in appearance and behaviour, but using **genome editing** as well as cross-breeding “*wild cattle species of Europe”* that have a *“strong resemblance to the Aurochs”*
- initial herds at Open Air Laboratory for Experimental Archaeology in Lorsch, Germany, and Breda, **Netherlands**
- cross-breeds will be placed with *“Aurochs Breeding Stations”* in Ukraine, Portugal, Spain, Romania and **Netherlands**

Watusi, African breed, donated to programme from Dutch zoo

Questions:

Are *new aurochs* an ecological equivalent to the extinct aurochs?

Ecological replacement with functional types?

- domestic cattle are **not wild animals**
- breeding in *"wildness"* from *"primitive"* cattle is an **anthropogenic action** that **lacks any means of evaluation**
- phenotypic similarity (**looking like an aurochs**) does not guarantee genetic or **behavioural similarity**
- **de-domestication** of livestock through *"naturalistic grazing"* (free-ranging and resource limited) is wishful thinking
- only turns clock back 1,000 years (**concentrating** of cattle began) and not 3,000 ya when last aurochs in Britain
-doesn't return **native instinct** for preservation from **predator attack**
- evidence suggests aurochs had a **distinctive distribution**, depending on flat land of **lowland floodplains** (wetland more than forested) and were **co-located with moose**
- **separation of habitats for domestic cattle and aurochs** suggests that Neolithic farming groups exploited **environmentally-different areas** for their cattle from those used **naturally by aurochs**
- the inevitable enclosure of these grazing animals in **Dutch nature development** by **fencing**, and **absence of behavioural modification from carnivores**, means there is **no spatial element** in their herbivore effect, nor **ability to migrate through larger landscapes** depending on season, nutrient variation etc.

What will happen to the first **wolf** that **jumps the fence** and kills a ***new aurochs****?*

Question:

Is the bison an ecological equivalent to aurochs?

AND…….

Question:

What would be the legal status of *new aurochs* or bison in Britain?

Wildlife and Countryside Act 1981

14 **Introduction of new species etc.** E+W

(1) Subject to the provisions of this Part, if any person releases or allows to escape into the wild any animal which—

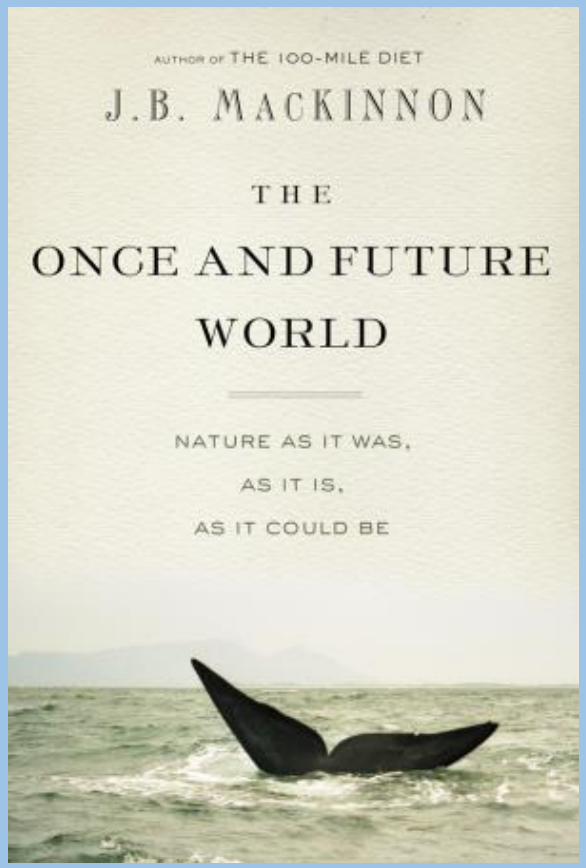
(a) is of a kind which is not ordinarily resident in and is not a regular visitor to Great Britain in a wild state; or

They would never be allowed to be free living

- are not and have never been **"ordinarily resident in a wild state"**
- not a **"regular visitor to Great Britain in a wild state"**
- bison would only have reached here with **human assistance**
- very unlikely to receive a **licence for release** under Section 16 WACA

Condemned to an existence behind fences

Next week's seminar topic



Islands first settled:

< 500 years ago - Chagos Islands, Ascension Island, Diego Garcia, Falkland Islands, and Macquarie Island
< 1,000 years ago - New Zealand, Easter Island, Hawaii and Iceland
< 2,000 years ago - Madagascar

Final chapter devoted to **imagining a large undiscovered island**. MacKinnon paints an irresistible picture of **Lost Island**:

- teeming fisheries of the ocean; reefs that are explosions of colour, seals and sea lions bobbing among them; the blow holes of whales; hungry sharks making the sea hiss and boil from the frenzy of shoals of fish
- the land, shaped by its plants and animals, has wildlife trails that bore through the stands of ancient forest and traverse the grasslands; there are herds of wild bison, mammoths and sabre-toothed cats, giant camels, giant lizards, giant parrots, and giant tortoises; and there are fields of wildflower bulbs
- large enough to sustain *"tens of thousands of people"*

"How do we live in a wilder world? And what is the wildest world we can live in?"

The challenge of LOST ISLAND

What would you do if you discovered Lost Island?
- would you tell anyone else about it?!
- what would you do differently if it was settled?