

The role of commercial bison production in conservation strategies in Canada

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Abstract: In Canada, numerous actors manage American bison (*Bison bison*) and assist in population restoration after bison near extinction in the late 19th century. The largest number of bison in Canada are managed by commercial bison farms. This research maps commercial bison farms and bison livestock as reported by the 2021 Census of Agriculture in Canada. The dispersion of commercial bison on the landscape depicts their important contribution to species restoration in Canada. Commercial bison producers, wildlife conservationists, and Indigenous communities need to be included to ensure full breadth of species restoration, especially at the landscape level.

Keywords: North American Buffalo, livestock farming, in situ conservation, census mapping

In Canada, multiple actors are involved in bison restoration. There are roughly 2,200 plains bison and 11,000 wood bison as a part of free-roaming and wildlife captive herds in Canada (Clifton-Ross, 2016). Elk Island National Park is considered the genetic storehouse, as they have two herds: pureblood plains bison (*Bison bison bison*) and pureblood wood bison (*Bison bison athabascae*), which are known to be disease free. For these reasons, Elk Island National Park animals are most often the seed herd for other bison reintroduction and restoration efforts in Canada. Other disease-free genetic pools have been identified, such as the Ronald Lake Wood bison Herd, which was identified by First Nation Indigenous communities (Ball *et al.*, 2016). Some Indigenous Nations within Canada have restored bison to their lands; often these animals derive as wildlife transfers from Elk Island National Park, or from commercial bison livestock producers. To date, it is understood that commercial production of bison has increased their numbers by the largest margins through the sectors creation of an ecologically and culturally relevant (niche) meat market in Canada and for exports. Bison meat is included under the Canada-European Union Comprehensive Economic and Trade Agreement.

This short communication outlines the spatial dispersion of commercial bison farms in Canada, according to 2021 Census of Agriculture in Canada (Ag Census) data while discussing commercial bison livestock production's continued role in the bison restoration movement in Canada. The Ag Census is carried out every five years in Canada and collects data on e.g., number of farms per spatial unit, farm size, farm type, animal populations on farm, and operator demographics. The Ag Census is voluntary to complete and is only requested from farms, as defined by an agricultural operation collecting revenues and/or accounting expenditures for tax purposes. Unfortunately, the Ag Census does not keep track of Indigenous participation within the sector at the regional and/or specific farm type level. Furthermore, the Ag Census is not disseminated within the northern territories of Canada, such as the Yukon, Northwest Territories, and Nunavut (most northerly geographical units from west to east). The two formers are home to wild bison herds and most certainly have commercial bison operations. The Yukon Territory invested in bison mobile abattoir outreach materials (Yukon Inc., 2006), which would imply that commercial bison farming is being carried out in the territory.

Nonetheless, according to the 2021 Ag Census data, approximately 0.5% of all farms reported bison as a part of their operation. However, farms reporting bison only account for 0.009% of privately-owned land. The median number of acres reported by Canadian farms with bison was 509 acres/farm. The median bison herd size per farm in Canada is 57 animals. The 2021 Ag Census reports 149,954 bison as livestock within Canada. The animals are dispersed amongst 989 farms.

Fig. 1 depicts the dispersion of bison farms across Canada. The spatial units are "census divisions" which often include one or more municipality within a federal province. The range of bison farms per census division spans from 0 (white) to 75 (black). As is apparent, most bison farms are located in what is often referred to as Western Canada, coinciding with the last remnants of bison historical range prior to extirpation in 1886.

The number of farms is not an ideal indicator to mapping the species itself. Fig. 2 highlights where the most concentrated areas of bison as livestock are located within Canada. Animal numbers within a census division range between 0 to 13,358 animal heads. The largest number of animals is found in the Peace River Region (most left black census division); yet this region only boasts 25 bison farms.

When mapping out the animals as a unit of measurement per census division, it becomes clear that bison does have a presence within Canada, geographically. Although bison may still be considered a niche livestock market, just based on the immense amount (approx. 12 million) of beef cattle within

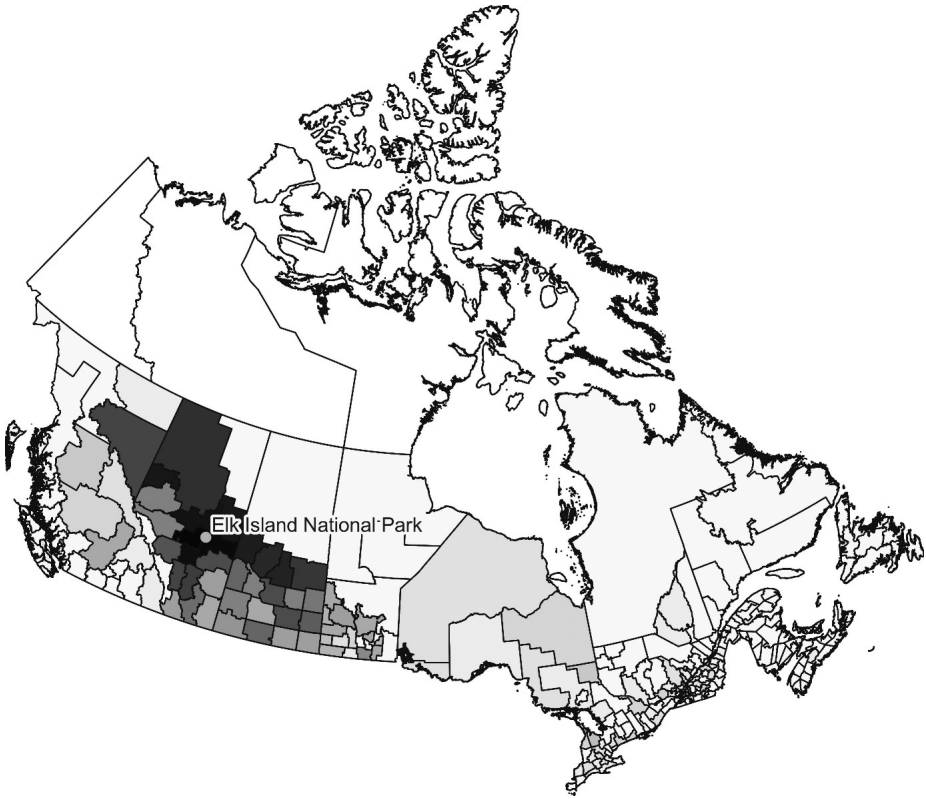


Fig. 1: Spatial distribution and density of bison farms per census division in Canada (greyscale range; white = 0 farms, black = 75 farms)

Canada (2021 Ag Census). Bison’s wide dispersion across Western Canada is an example of how diversifying livestock production and ecologically-based farming (e.g. high nature value farming) can contribute to, and even drive, *in situ* conservation and species restoration.

As exemplified by their wide-spread distribution throughout Western Canada and the large number of livestock animals comparatively to conservation animals, we argue that commercial bison livestock production needs to be acknowledged for its role in contributing to species restoration within bison’s historical range. In addition, the number of bison livestock speaks to the importance of the species and its restoration as a food source. This evidence contradicts Pejchar *et al.* (2021) conclusions that bison are likely to be supported as wildlife and cultural animals, rather than livestock.

Bison production in Canada is largely based on extensive low-input grazing and browsing, with occasional hay supplementation throughout the winter months (Galbraith *et al.*, 2014). The extensive management system related

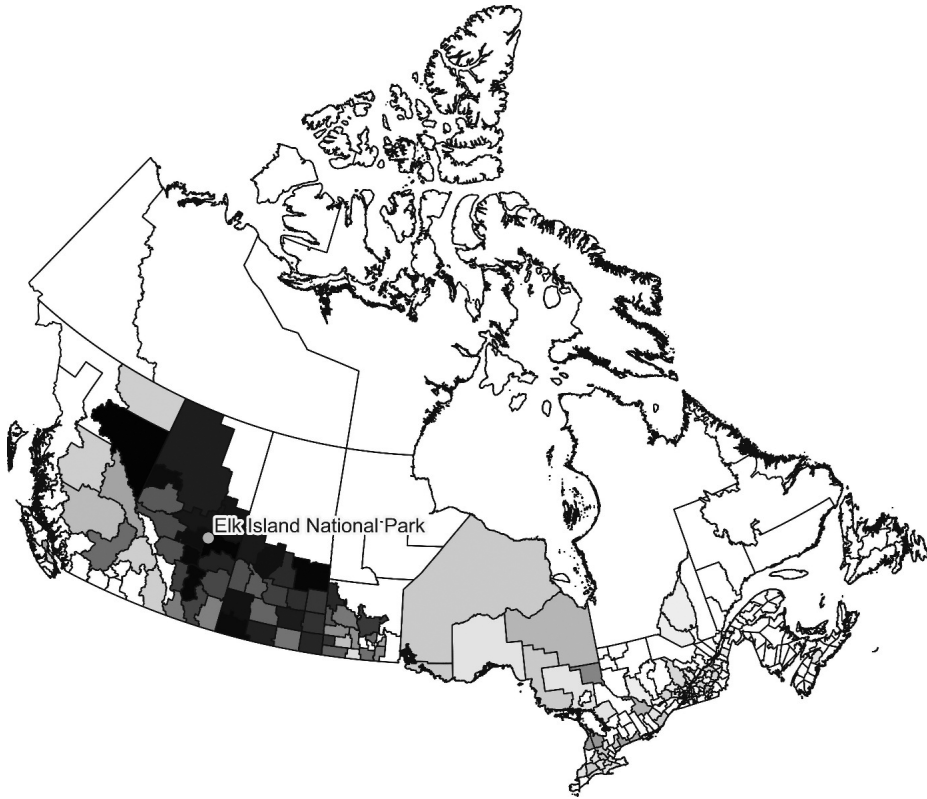


Fig. 2: Spatial distribution and density of bison (animal livestock head per census division) in Canada (greyscale range; white = 0 animals, black > 10,000 animals)

to bison farming provides benefits for plant and animal biodiversity (Tielkes & Altmann, 2021) while maintaining resilient drought-tolerant ecosystems (Ratajczak *et al.*, 2022) and sequestering carbon (Teague *et al.*, 2016). Commercial bison farming in Canada would be comparable from a natural ecosystem maintenance standpoint to wildlife captive herds within wildlife and national parks. Shamon *et al.* (2022) support bison reintroduction founded on ecological restoration for climate change resilience and socio-economic opportunities, especially within Indigenous communities and on their lands.

Although our data is not able to identify the number of Indigenous bison farms, and those on Indigenous managed lands, we do acknowledge that a number of such bison farms exist, and this number is increasing, providing economic opportunity and local culturally-appropriate food production for Indigenous communities. At the same time, we acknowledge that the current legislative and regulatory system in Canada does not allow for Indigenous

communities to fully make decisions regarding bison restoration and bison as a food source in Canada.

To further bison restoration in North America, wildlife conservationists, Indigenous communities, and commercial bison livestock producers will all need to work together (Martin *et al.*, 2021). The Buffalo Treaty (Buffalo Treaty, 2014) is a grassroots movement bringing all actors, but specifically sovereign nations, together to restore bison in North America. Although only sovereign nations may sign the Buffalo Treaty outlining bison agency and a shared vision of bison expansively returning to their homelands to contribute to climate change adaptation and mitigation, circular economies, and ecological restoration; industry associations and research institutions and wildlife conservation organizations have all signed on as supporting signatories. Contributing vast animal numbers throughout Canada, commercial bison farming has an important role to play in wholistically restoring bison as an ecological and cultural keystone species, while assisting in providing wholesome food for North Americans.

Acknowledgements

The work leading to this publication was supported by the PRIME programme of the German Academic Exchange Service (DAAD) with funds from the German Federal Ministry of Education and Research (BMBF).

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Rola komercyjnego wykorzystania w strategiach ochrony bizona w Kanadzie

Streszczenie: W Kanadzie wiele osób i instytucji jest zaangażowanych w hodowlę i ochronę bizona (*Bison bison*) i pomagają w odbudowie populacji gatunku będącego mocno zagrożonego wyginięciem pod koniec XIX wieku. Największą liczbę bizonów w Kanadzie mają komercyjne farmy. Celem pracy była analiza komercyjnej hodowli i produkcji bizonów na podstawie wyników spisu rolnego przeprowadzonego w 2021 roku w Kanadzie. Rozprzestrzenienie ferm zajmujących się hodowlą bizona dowodzi, jak ważny jest wkład w odbudowę gatunku w Kanadzie. Komercyjni producenci, działacze na rzecz ochrony przyrody i rdzenne społeczności muszą połączyć swoje działania, aby zapewnić pełny zakres odtwarzania gatunku, zwłaszcza na poziomie regionalnym.

The enzootic balanoposthitis

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Abstract: In 2021, the PODPLUD bull was treated at the Pszczyna-Jankowice European Bison Breeding Center based on a study of necrotic balanoposthitis (in Polish NZN). The attempt to treat this disease resulted in a retreat of clinical symptoms. Another case of NZN was noted in 2022 in the bull PONSE, which had purulent necrotic lesions and sepsis caused by the bacterium *Trueperella pyogenes* during *post-mortem* treatment. Further observations in several bulls confirmed the suspicion of this disease. Twenty-three bulls were immobilized, a clinical examination was performed, and swabs were collected for bacteriologic examination. Based on the results of these examinations, seven animals were eliminated. *Post-mortem* examinations bring anatomical-pathological changes to the development of severity and a variable proportion of pathogenic bacteria.

Keywords: posthitis, necrotic changes, *Bison bonasus*

Introduction

Necrotic postitis (*postitis necroticans*) in wisent occurred in numerous individuals in the 1980s in the Białowieska Forest (Jakob *et al.* 2000, Kita *et al.* 2003, Krzysiak *et al.* 2014, Piusinski *et al.* 1997). The disease affected bulls and caused lesions on the foreskin and penis. The disease process, which has the character of fibrinous necrosis, usually begins at the edge of the foreskin opening and gradually covers larger and larger parts of it, penetrating into the cavity of the organ and including the glans. The advanced form resulted in autoamputation (autotomy) of the foreskin and glans and even necrosis and prolapse of the entire penis. The disease was considered a threat to the wisent population living in this ecosystem because the cause and pathogenesis of the disease were unknown. The few descriptions of the disease were

limited to transmission of morphological characteristics and attempts to identify potentially pathogenic agents isolated from diseased individuals. The disease was thought to be transmitted by a direct contact. It was assumed that diseased bulls should be eliminated from the population in hopes of reducing the incidence of the disease. Due to NZN, 1.5 to 15% of male wisent have been eliminated each year. Currently, cases of NZN occur in a small number of wisents in the Białowieska Forest. However, sporadic cases of NZN have been reported in other European bison populations.

In spring 2021, clinical signs of the disease were observed in the bull PODPLUD in the Breeding Center Pszczyna–Jankowice (Hławiczka *et al.* 2021) (swelling of the foreskin area, brush hairs clumped with brown exudate, urine excretion in an irregular intermittent stream, the first case of necrotic foreskin and penis inflammation). As a result, conservative treatment was carried out on the basis of surgery and complex antibiotic therapy. The treatment improved the health of the bull, although it is not known whether the individual retained its reproductive capacity.

Case description

In 2022, a case of NZN was detected in a bull PONSE. Due to the severe general condition (emaciation, lack of movement), it was decided to eliminate it, what took place on October 1, 2022. The anatomical-pathological autopsy revealed the presence of several fistulas on the abdominal skin, extensive necrosis of the tissues of the prepuce and penile area, forming a massive cavity filled with necrotic and purulent masses. This cavity extended from the area of the foreskin mouth to the perineal area. All lymph nodes available for examination were enlarged. *Trueperella pyogenes* (sepsis) was cultured from the lymph nodes removed for bacteriologic examination. The PONSE case prompted those responsible for the Pszczyna-Jankowice herd to conduct an examination of the males living in the herd. Twenty-three bulls were pharmacologically immobilized, visual inspection of the genitalia (prepuce and penis) was performed, and swabs were taken from the prepuce cavity for bacteriological examination. Based on the visual inspection and the results of the bacteriological examination, seven individuals were selected for elimination, which was performed on March 1, 2, and 9, 2023.

To evaluate the severity of disease symptoms, we used the scheme proposed by Malgorzata and Zbigniew Krasinski (Krasińska & Krasiński, 2017), which distinguishes five stages of NZN (*P-posthitis*):

- P + one necrotic-appearing focus at the edge of the foreskin outlet;
- P ++ several inflammatory foci at the edge of the preputial orifice;

- P + + + the disease process covers the entire periphery of the preputial orifice;
- P + + + + necrotic-purulent lesions involve the foreskin and penis, in the foreskin cavity stinking mass;
- P + + + (-) condition after overgrowth, often there is self-amputation of the penis, overgrowth of the prepuce opening and the formation of urinary fistulas, rarely to urinary retention.

Macroscopic changes in the foreskin were not noted in two bulls. In the remaining animals, the severity of lesions varied from swelling around the foreskin to advanced necrotic lesions of the foreskin and penis with autoamputation of the penile foreskin. In contrast, microscopic examination of tissue from the foreskin showed inflammatory cell infiltrates of varying severity.

Table 1. Summary of the results of *post-mortem* examinations of European bison eliminated in the herd of the breeding center Pszczyna-Jankowice

Name	Pedigree number	Age (years)	Severity of NZN	Pathogenic bacteria
PLĄDROWNIK	14116	5	+/-	<i>Trueperella pyogenes</i>
POLIS	14835	3	+ + + +	-
PLICJUSZ	14837	3	-	<i>Pseudomonas aeruginosa</i>
POBOŻNY	14065	5	+	<i>Corynebacterium pyogenes</i>
POLACJAN	14840	3	+ + +	<i>Trueperella pyogenes</i>
PLAMEK	14071	5	+ + + +	<i>Trueperella pyogenes</i>
POŚPIECH	14839	3	- (scar)	-

In Table 1 there is shown a summary of the lesions according to Krasiński's scheme. Macroscopic changes in the prepuce were not found in two bulls. In the remaining individuals, the severity of the lesions varied from swelling of the prepuce area to advanced necrotic lesions of the foreskin and penis, with autoamputation of the penile glans. In contrast, microscopic examination of tissues from the prepuce showed inflammatory cellular infiltrates of varying degrees of severity. No lesions of an acute nature were found in the bull POŚPIECH. Macroscopically, a scar-like pull from the edge of the foreskin mouth into the foreskin cavity was visible. Microscopic examination of a tissue preparation from this area, showed the presence of a band of compact fibrous connective tissue. This indicates a history of chronic repair process. This was a process that developed after the symptoms of acute inflammation had resolved. In the past, small scars at the edge of the foreskin's mouth were found at autopsy, but from self-healing prepuce inflammation. The case of the POŚPIECH bull is probably the first documented testimony of

self-healing of “non necrotic” foreskin inflammation (*posthitis non necroticans*). Although there was no complete recovery with restoration of normal structures (regeneration), there was a repair process (reparation), which, although imperfectly, allowed this individual to “mask” the dysfunction of the organ – no macroscopic features of inflammation were found. At the same time, this case is not fully satisfactory, as it is the only one of the seven. As can be seen from the summary of results, pathogenic bacteria were not isolated in two cases (POLIS, POŚPIECH). In contrast, in five cases pathogenic bacteria were found, and the most common was *T. pyogenes*

Conclusions

1. In the European Bison Breeding Center Pszczyna-Jankowice there is an outbreak of enzootic necrotic inflammation of the foreskin.
2. Under favorable conditions, spontaneous healing of foreskin inflammation may occur.

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Enzootia nekrotycznego zapalenia napletka

Streszczenie: W 2021 roku w Ośrodku Hodowli Żubrów Pszczyna – Jankowice u byka PODPLUD na podstawie objawów klinicznych zdiagnozowano nekrotyczne zapalenie napletka (NZN). Próba leczenia tej choroby spowodowała cofnięcie się objawów klinicznych. Kolejny przypadek NZN stwierdzono w 2022 roku u byka PONSE, u którego *post mortem* stwierdzono rozległe zmiany ropno-martwicowe powłok brzucha oraz sepsę związaną z bakterią *Trueperella pyogenes*. Obserwacje pozostałych byków wykazały u kilku z nich obecność objawów nasuwających podejrzenie choroby. Immobilizowano 23 byki, przeprowadzono badanie kliniczne oraz pobrano wymazy. Na podstawie wyników tych badań wytypowano siedem osobników do eliminacji. Badania pośmiertne wykazały zmiany anatomopatologiczne o różnym nasileniu oraz zmienny udział bakterii chorobotwórczych.
