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Essay

Lessons from Białowieża Forest on the history of protection and the world's first reintroduction of a large carnivore

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Abstract: *Understanding how the relationships between large carnivores and humans have evolved and have been managed through centuries can provide relevant insights for wildlife conservation. The management history of many large carnivores has followed a similar pattern, from game reserved for nobility, to persecuted pests, to conservation targets. We reconstructed the history of brown bear (*Ursus arctos*) management in Białowieża Forest (Poland and Belarus) based on a detailed survey of historical literature and Russian archives. From the end of the Middle Ages to the end of 18th century, the brown bear was considered "*animalia superiora*" (i.e., game exclusively reserved for nobility and protected by law). Bears, also a source of public entertainment, were not regarded as a threat. Effective measures to prevent damages to traditional forest beekeeping were already in practice. In the beginning of 19th century, new game-management approaches allowed most forest officials to hunt bears, which became the primary target of hunters due to their valuable pelt. This, together with an effective anticarnivore policy enhanced by bounties, led to bear extirpation in 1879. Different approaches to scientific game management appeared (planned extermination of predators and hunting levels that would maintain stable populations), as did the first initiatives to protect bears from cruel treatment in captivity. Bear reintroduction in Białowieża Forest began in 1937 and represented the world's first reintroduction of a large carnivore motivated by conservation goals. The outbreak of World War II spoiled what might have been a successful project; reproduction in the wild was documented for 8 years and bear presence for 13. Soft release of cubs born in captivity inside the forest but freely roaming with minimal human contact proved successful. Release of captive human-habituated bears, feeding of these bears, and a lack of involvement of local communities were weaknesses of the project. Large carnivores are key components of ecosystem-function restoration, and site-specific histories provide important lessons in how to preserve them for the future.*

Keywords: environmental history, extinctions, *Ursus arctos*, wildlife management

Lecciones del Bosque Białowieża sobre la Protección y la Primera Reintroducción en el Mundo de un Grandes Carnívoros Mayor

Resumen: *Entender cómo las relaciones entre los grandes carnívoros y los humanos han evolucionado y han sido manejadas durante siglos puede proporcionar conocimientos para la conservación de la fauna silvestre. La historia del manejo de muchos carnívoros mayores ha seguido un patrón similar, desde ser presa*

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reservada para la nobleza, luego plagas perseguidas, hasta ser objetivos de conservación. Reconstruimos la historia del manejo del oso pardo (Ursus arctos) *en el bosque de Białowieża (Polonia y Bielorrusia) en base a una revisión detallada de la literatura histórica y archivos rusos. Desde finales de la Edad Media hasta el fin del siglo XVIII, el oso pardo fue considerado "*animalia superiora*" (es decir, presa reservada exclusivamente para la nobleza y protegida por la ley). Los osos, también vistos como una fuente de entretenimiento, no estaban considerados como una amenaza. En esos tiempos ya estaban en práctica medidas efectivas para prevenir daños a la apicultura tradicional en el bosque. A principios del siglo XIX, las nuevas estrategias de manejo de presas permitieron que la mayoría de los oficiales del bosque cazaran osos, los cuales se volvieron el principal objetivo de los cazadores por su valiosa piel. Esto, junto con una efectiva política anticarnívoros promovida por recompensas ofrecidas, llevó a la exterminación de los osos en 1879. Aparecieron estrategias diferentes para el manejo científico de las presas (exterminación planeada de depredadores y niveles de caza que mantendrían poblaciones estables), así como las primeras iniciativas para proteger a los osos del trato cruel que recibían en cautiverio. La reintroducción de osos en el bosque de Białowieża comenzó en 1937 y representó la primera reintroducción en el mundo de un gran carnívoro motivada por objetivos de conservación. El inicio de la Segunda Guerra Mundial arruinó lo que pudo haber sido un proyecto exitoso; la reproducción en vida libre fue documentada durante ocho años y la presencia de osos durante 13. La liberación moderada de oseznos nacidos en cautiverio pero deambulando libremente con el mínimo contacto humano resultó ser exitosa. La liberación de osos cautivos acostumbrados al humano, la alimentación de estos osos, y una falta de participación por las comunidades locales fueron los puntos débiles del proyecto. Los grandes carnívoros son componentes claves de la restauración de la función de los ecosistemas, y la historia de sitios específicos proporciona lecciones importantes sobre cómo preservar a los carnívoros para el futuro.*

Palabras Clave: extinciones, historia ambiental, manejo de fauna, *Ursus arctos*

摘要: *了解几个世纪以来大型食肉动物与人类关系的演变和管理, 能为我们保护野生生物提供有益的见解。许多大型食肉动物的管理都经历过类似的模式, 从贵族的猎物, 到受迫害的有害动物, 再到成为保护的对象。基于对历史文献和俄罗斯档案的详细调查, 我们重建了波兰和白俄罗斯比亚沃维耶扎森林棕熊的管理历史。从中世纪末期到十八世纪末期, 棕熊被认为是*animalia superiora *(即专供贵族狩猎并受到法律保护的动物)。它们还被视作一种公众娱乐资源, 而不是一种威胁。当时已实行有效措施以避免棕熊破坏传统的森林养蜂业。十九世纪初, 新的狩猎管理办法允许大多数森林管理者猎杀棕熊, 棕熊也因其珍贵的皮毛成为狩猎者的主要目标。狩猎, 加之以赏金推动的反食肉动物政策的施行, 导致棕熊在1879年灭绝。后来出现了不同的科学狩猎管理方法 (有计划地消灭捕食者和以维持稳定种群为限的猎杀水平) , 类似于第一次保护圈养棕熊不受虐待的管理行动。棕熊重引入比亚沃维耶扎森林的计划始于1937年, 是世界上第一个以保护为目标的食肉动物重引入计划。第二次世界大战的爆发, 破坏了这一本可能成功的计划; 计划实施期间有8年记录到棕熊在野外繁殖, 有13年记录到有棕熊存活。圈养出生幼熊的软释放被证明是成功的, 在保持与人类最低接触限度的情况下幼崽可以在森林里自由活动。而这个项目的不足在于被人类惯养的圈养棕熊的释放、对它们的喂养以及缺少当地社区的参与。大型食肉动物是生态系统功能恢复的关键组成, 而特定地点的历史可以为未来如何保护它们提供重要经验教训。*
【翻译: 胡怡思; 审校: 魏辅文】

关键词: 棕熊 (*Ursus arctos)*, 野生生物管理, 灭绝, 环境历史

Introduction

Management history has greatly influenced the current distribution of large carnivores. Most—if not all—species have experienced large population declines and range contractions during the past 2 centuries (Ripple et al. 2014). As iconic animals, both admired and persecuted, large carnivores have been perceived and managed by humans in different ways throughout history. Many large carnivore species share a common management history, especially in Europe and North America, as their status passed from highly valued game to pest and from extinct to reintroduced species. Centuries ago a growing human population and associated land-use changes precipitated the development of methods to avoid large carnivore damage. Science-based approaches to large carnivore management were gradually introduced by 19th century naturalists, and different views appeared. The conservation policies and reintroductions that followed local extinctions are nowadays common conservation tools. Knowledge of the historical policies of large carnivore management and their outcomes can inform current conservation practice. We used a site-specific example, the history of brown bear (*Ursus arctos*) management in Białowieża Forest (Poland and Belarus), to illustrate the history of large carnivore management and extract relevant lessons for large carnivore conservation. We reconstructed the history of brown bear management in Białowieża Forest and the theoretical and scientific thought of the period through a survey of the literature (mostly published in Russian) and unpublished archival documents in the Complete Collection of Laws of the Russian Empire (CCL), Russian State Historical Archive in St. Petersburg (RSHA), and State Archive of the Russian Federation in Moscow (SARF).

Brown Bears as Royal Game

From the late 14th century until 1795, Białowieża Forest (at present 1500 km^2) was a royal hunting ground of the Grand Dukes of Lithuania and the kings of Poland, and the brown bear was one of the most valuable game species, part of *animalia superiora* (i.e., big game exclusively reserved for royal hunts) (Samojlik 2005). Next to the European bison (*Bison bonasus*), moose (*Alces alces*), red deer (*Cervus elaphus*), and Eurasian lynx (*Lynx lynx*), the brown bear was under legal protection in 3 Statutes of Lithuania: 1529, 1566, and 1588. In the first statute, the punishment for big game poaching was death, later the penalty was lessened to imprisonment and large fines. This statute applied to royal forests and to private woodlands in the Grand Duchy of Lithuania. Fines for poaching bison were the highest in all 3 statute editions (1440 grosz, the price of 12 horses); poaching a brown bear entailed a midrange fine (480 grosz, the price of 4 horses) (Samojlik & Jędrzejewska 2010).

Apart from being hunted by monarchs, wild bears were captured and transported to royal or magnate castles as gifts and for arena fights involving different animal species. Bear shows were presented to the lower classes in villages and towns of the Grand Duchy of Lithuania and in the Balkans (Tunaydin 2013), and specialized performing-bear schools were created, some of which used harsh methods. Bears were trained to walk on 2 legs, dance or bow when the trainer (*niedźwiednik*) played the trumpet or drums, and perform tricks such as serving at dinner or saluting with weapons (Gilibert 1805).

Until the end of the 18th century, bears, as royal game and a source of entertainment for masses, were not regarded as a threat. On the contrary, bears were present in numerous stories and traditions that showed their positive and beneficial aspects. For example, several cases of human children raised by bears were described. The most famous is Joseph Ursinus, a boy found in Lithuanian forests in 1661. Bear body parts were connected with medicinal and magical power, whereas the bear pelt was a highly valued hunting trophy (Kluk 1779).

Brown Bears as Pests

In the 18th century, the only problem bears caused was damage to traditional forest beekeeping. The basic form of a beehive was an artificial hollow in a tree (usually in Scots pines [*Pinus sylvestris*]). By the end of the 18th century, over 900 functioning and 6000 abandoned beehives were present in Białowieża Forest (Hedemann 1939). With such high numbers, the risk of bear damage to hives was high; thus, it was important to employ protection measures. Beekeepers invented several effective methods of protecting their property from brown bears in the forest, such as placing the beehives high in the trees. To protect hives from climbing bears, they would hang a large heavy log over the beehive hole. When moved by a bear, it worked as a pendulum hitting the animal and causing it to fall (Karpiński 1948; Samojlik et al. 2003).

From 1795 to 1915, Białowieża Forest was under Russian rule. New game management was introduced and lower-class forest officials were allowed to hunt for brown bears, wolves (*Canis lupus*), lynx, and other medium and small predators after paying an annual tax. Although the wolf reportedly caused the most damage to local animal husbandry and wild ungulates, it was the brown bear that became the main target of hunters, due mostly to its valuable pelt (Karcov 1903). In 1821 the authorities, looking for ways to preserve the decreasing population of European bison, prohibited all hunting (including for carnivores) in the forest for a short period to avoid disturbance. Although forest guards were keen to capture and tame bear cubs during that period, the species was treated as a pest, and the policy was to persecute bears and maintain a low-density population (Brincken 1826).

Hunts for large carnivores were renewed in 1827. Lower-class forest officials checked their forest sections for carnivore tracks and when they spotted a bear, wolf, or lynx, a battue was organized to hunt it (Imperatorska Akademia Nauk 1861). To make this anti-carnivore policy more effective, the local forestry administration considered paying 1 ruble for each wolf or bear killed and allowing locals to hunt carnivores. This policy was never implemented, and extermination of large carnivores was left entirely to the forestry service (RSHA 1840–1847).

Bears again became the main target of the extermination plans after a few sightings of bear attacks on European bison (RSHA 1840–1847; SARF 1860; Karcov 1903). Poachers also played a role in bear extermination, and by the 1860s there were almost no bears (Karcov 1903). In 1860, the first tsar's hunt in Białowieża Forest was organized for Alexander II. An article (Czas 1860) describing the preparations revealed that some bears were bought from Russian trainers for transport to Białowieża. One of them escaped and was shot in a nearby garden. The fate of other transported bears is unknown, but what is certain is that no bears were killed in the tsar's hunt (Daszkiewicz et al. 2012). After that hunt, bears were killed in Białowieża Forest only rarely. Single bears were shot in 1870, 1871, 1874, 1877, and 1878 (Karcov 1903). Afterwards, bears were seen only sporadically. One bear wandering in the forest in 1879 was immediately killed (Genko 1902–1903). Until 1890 an extra bounty of 50 rubles was offered to anyone who shot a bear in Białowieża Forest.

Listed in the catalogue of the historical archive in St. Petersburg, there is a document entitled "On Brown Bear Appearing in Białowieża Forest" dated 1 July 1908

that except for 1 page was destroyed. This remaining page suggests that in 1908 a bear or its tracks were observed in the forest and that the forest administration took it seriously enough to inform the Ministry of State Domains. Data on numbers of cattle killed by bears in different districts of the Russian Empire in 1898 does not mention Grodno Province, which suggest the species was rare or already absent not only in Białowieża Forest but also in the entire region (Silantiev 1898). The large carnivore extermination policy was successful because wolves and lynx were also almost extinct in Białowieża Forest by the beginning of the 20th century (Jędrzejewska & Jędrzejewski 1998, 2005).

Brown Bear Decline and Management Across Europe

The changes in large carnivore management that occurred in Białowieża Forest reflect what happened throughout the continent. The most dramatic decline of brown bear populations in Europe happened in the 19th and beginning of the 20th century, when their extermination was strongly incentivized by the states, following the German school of forest and game management that treated all carnivores as pests (Schaller 2007). Bear populations in European countries were drastically limited or even eradicated: the last bears were shot in Germany in 1835, in Bohemia in 1856, in Switzerland in 1904, and in Austria in 1913 (Servheen et al. 1999).

Extermination of predators, including small and medium-sized carnivores and birds of prey, was considered crucial for successful game management. This was the approach followed by Anatolii Silantiev (1868–1918), one of the founders of scientific game management in Russia. Silantiev described bears as evil pests that attack livestock and people, and placed them in the group of wildlife that should be eradicated "at all times and by all necessary means" (Silantiev 1898). The only bear-hunting method not approved by Silantiev was pit traps because wild ungulates and livestock could fall into them.

In contrast to the extermination approach, the prominent Russian naturalist Alexander von Middendorf (1815–1894) proposed a rational level of off take that would maintain a stable bear population in large forests. He also stressed that the brown bear could be treated as a predator only exceptionally because, according to his observations, most of their diet consists of plants and only 25% consists of meat. He noted that the bear distribution in Russia had shrunk in the 19th century due to hunting (Middendorf 1851).

At the time of the debate on wild bear management and when large carnivore extermination was at its peak, new voices started to claim that bears should be protected against cruel treatment in captivity. In 1866, the newly created Russian Society for Protection of Animals issued a letter to the Ministry of Internal Affairs asking for a prohibition on bear shows in villages because bear training was connected with cruel practices. The ministry of Internal Affairs ordered those practices to cease within 5 years from 1867 (CCL 1866). Although almost all trained animals were killed, the tradition of bear taming survived in various regions of Europe into the late 20th century (Tunaydin 2013).

This dichotomy between extermination and reasonable exploitation was followed by a new conservation policy in the beginning of the 20th century, when measures for bear protection were already being undertaken in parts of Europe. In Sweden, several laws were introduced beginning in 1913 that prohibited bear trophy hunting; in Italian Abruzzo National Park bears were protected beginning in 1922 (Servheen et al. 1999); in Estonia, where the number of bears dropped to around 10, legal protection entered into force in 1934 (Kaal 1972); and in Slovakia bears became protected in 1933 (Servheen et al. 1999).

Reintroduction of Brown Bears in Białowieża Forest

When Poland regained independence in 1918, the largest terrestrial mammals in the country, the European bison and the brown bear, had been either exterminated or were doomed to extinction. Illegal hunting led to the eradication of European bison in Białowieża Forest in 1919, 40 years after the bear became extinct there and 2 years before the Białowieża National Park was established in 1921. An international coalition of scientists, nature managers, and zoo personnel was formed to restore the species. In 1929, the first bison were brought to Białowieża Forest from the Warsaw zoo for captive breeding, and in 1952 the first bison was released successfully into the wild (Krasińska & Krasiński 2013). At that time, the question of reintroducing the main predator of the bison also arose in the Polish General Directorate of the State Forest, which then administrated the entire Białowieża Forest. Roman Kuntze (1902–1944), an eminent Polish zoologist, postulated in 1935 that only bears from the northeastern borderlands of Poland, rather than bears from the Carpathians, should be used (Kuntze 1935). Years before the development of molecular techniques, this was a very insightful recommendation, which is nowadays commonly applied in reintroduction projects (IUCN SSC 2013). Following Kuntze's remarks, the brown bear reintroduction in Białowieża Forest was planned with individuals from Belarussian forests.

In 1937, the decision to bring the brown bear back to Białowieża Forest was made and a reintroduction program led by the director of the Białowieża National

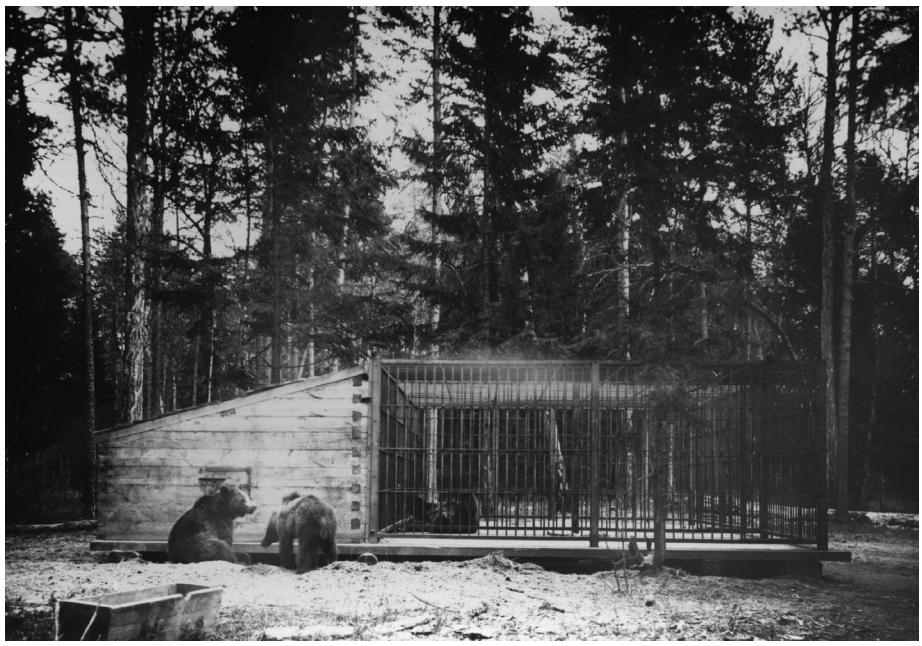

Figure 1. Cage in Białowieża National Park for the soft release of brown bears in 1937. Photo by Jan Jerzy Karpiński from the collection of Białowieża National Park.

Park, Jan Jerzy Karpiński (1896–1965), started. The reintroduction consisted of 2 parallel strategies. First, in November 1937, a pregnant female named Lola was transported from the Poznań zoo and put in a cage in the heart of the Białowieża National Park. The cage was divided into 2 "apartments" (one for Lola, the second for other bears). Each apartment was 5 × 5 m and included a wooden shack that served as a den (Fig. 1). In January 1938, Lola gave birth to 2 cubs, a male and a female, named Jaś and Małgosia (names from Grimm fairy tale "Hansel and Gretel"). The bars of the cage were bent so as to allow the cubs to easily go outside and become accustomed to the life in the forest by themselves (Karpiński 1949). This method, a type of soft release (IUCN/SC 2013), was first put into practice in Białowieża during bear reintroduction.

The second strategy consisted of the soft release of animals to the forest after a period of acclimatization in a cage (Buchalczyk 1980). Just after placing Lola in her enclosure, 4 young bought in Belarus were placed in the second compartment of the same cage. Nearby, a small lodge was built for wardens to guard the bears permanently and note important events in their lives in a book (the whereabouts of which are unknown). Except for 2 wardens, bears were not supposed to have any contact with humans (Buchalczyk 1980). Wardens fed the bears with potato soup with beef, hardtack, vegetables, apples, and in the evenings gave them milk with honey. From time to time, a trough with water was placed in the cages for the bears to bathe (Lindemann 1938). After wintering in the cage, in April 1938, the 4 bears were released.

Although feeding of bears was strictly prohibited, their friendly behavior and begging for food encouraged forest workers and visitors to feed and pet them. Bears then started to approach people outside the forest. As a result, one of these 4 bears was killed and 2 others were transported to Warsaw zoo (Buchalczyk 1980). In June 1938, another 4 half-tame bears (1.5 to 2.5 years old) were brought to the cage in the park, 3 of which were released to the forest in July 1938 (the oldest, a 2.5-year-old male, was kept captive). The result was similar—the bears became increasingly habituated, and human-bear encounters increased (Karpiński 1949). In the summer of 1938, a bear attacked and severely wounded a girl. Consequently, 1 of these bears was captured and sent to Warsaw and 2 were probably killed by villagers. Of the 7 half-tame bears that were released, only 1 survived without conflicts with humans (Lindemann 1938; Buchalczyk 1980).

In contrast, Lola's cubs quickly adapted to life in the wild and avoided contacts with humans (Fig. 2). From the very beginning of reintroduction, the bars of Lola's cage were bent in one place to create an opening large enough for the cubs to freely walk in and out of the cage, but too small for their mother to squeeze through. At the end of summer 1838, bear wardens straightened the bars so the cubs could no longer walk into the cage. First, the cubs tried to get back to their mother in the cage, but they finally came to terms with the new situation and visited her only occasionally (Karpiński 1949). Jaś and Małgosia survived the following winter of 1938 and 1939 in the wild and only sporadically appeared around the cage in spring 1939 (Buchalczyk 1980). The future of the reintroduction seemed bright, but then World War II broke out. In 1939, presumably in Autumn and Winter, when Białowieża Forest was occupied by Soviet troops, Lola was freed from her cage by wardens and the reintroduction program was abandoned. When German troops took over Białowieża Forest in June 1941, it was proclaimed

Figure 2. Free-ranging brown bear in Białowieża Forest during the reintroduction of 1937–1939. Photo by Jan Jerzy Karpiński from the collection of Białowieża National Park.

a Third Reich's Hunting Reserve. Obsessed with the idea of primeval Germanic wilderness, the Nazi administration released 5 completely tame bears into the forest. Unable to adapt to the life in the wild, the bears approached villages and broke into houses, causing damage. The first tragedy came in 1942, when a mother picking berries in the forest with her son were attacked and killed by a bear. By the end of the war, all tame bears had been poached.

After World War II, a newly established border between Poland and USSR cut Białowieża Forest in half and reports of bear sightings still came from both sides of the forest. Four bears were reported in 1945 in the Polish part of the forest (2 adults and 2 young); one young bear fell victim to poachers (Buchalczyk 1980). In 1946, 5 bears were observed, including 3 young (i.e., offspring), and again one young was poached (Karpiński 1949; Buchalczyk 1980). Successful reproduction was observed for some years after the reintroduction program stopped. In 1947, the last tracks of a single bear were observed in the Polish part of the forest (Jakubiec & Buchalczyk 1987), whereas on the Belarussian side, tracks of one adult bear were observed until 1950 (Jędrzejewska et al. 1995), 13 years after the reintroduction. In later years, tracks of bears dispersing to the Polish side of the border were occasionally observed, in 1963 (Buchalczyk 1999; Jakubiec 1996) and most recently in 2010 (J. Ługowoj, personal communication).

Lessons Learned

Local extinctions of different species in the 19th century led to the idea of reintroducing individuals where populations had been eradicated or augmenting reduced populations (Breitenmoser et al. 2001). The first reintroduction or conservation translocation consisted of the release of captive animals into the historical range from which the species had been extirpated and was conducted for the American bison (*Bison bison*) in 1907 in a reserve in Oklahoma (Kleiman 1989). The second reintroduction was in 1922, when a pair of beavers (*Castor fiber*) was transported from Norway to Jämtland, Sweden (Hartman 1994). The brown bear reintroduction in Białowieża Forest was the third in the world and represented the first reintroduction of a large carnivore for conservation purposes (Fig. 3). The next large carnivore reintroduction was 2 decades after Karpiński's project. In 1958, 254 American black bears (*Ursus americanus*) from Minnesota and Manitoba, Canada, were released in Arkansas (U.S.A.) (Breitenmoser et al. 2001; Clark et al. 2002). Afterward, other large carnivore reintroductions followed on almost all continents.

Translocations of bears occurred in the 20th century, but they were exclusively for hunting purposes: in Pol'ana, Slovakia in 1905 by Habsburg prince Frederick and in Hungary in 1934 and 1938 by the hunter G. de Kiss de Nemeskér (Couturier 1954; Servheen et al. 1999). Introductions of bears as game in areas out of their recorded distribution were not rare (e.g., black bears from Yosemite National Park were released in 1933 in California [Clark et al. 2002]). After the Białowieża project, no reintroduction of brown bears occurred in Europe, only augmentations (i.e., releasing animals into areas where bears already occurred). Over 50 years later, in 1989–1993, 3 bears were released into an area in Austria with a naturally occurring male bear. Later, there were 2 other augmentations of European bear populations in the Italian Alps and French Pyrenees. In those

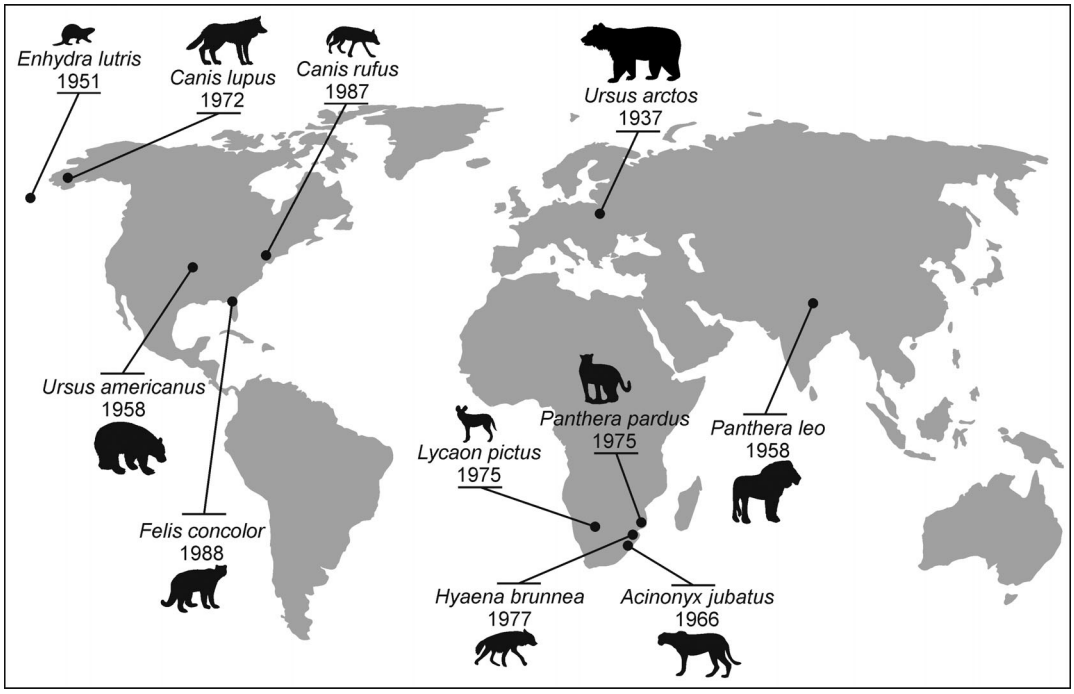

Figure 3. Reintroductions of large carnivores worldwide in the 20th century. Only the first reintroduction of a given species is shown. Large carnivores defined as species attaining an adult body mass >20 kg (Carbone et al. 1999). Carnivore body masses from Gittleman (1985). Data on reintroductions from Breitenmoser et al. (2001). Drawn by T.S.

cases, free-ranging bears were captured in the wild, transported from these areas, and immediately released (hard release) (Swenson et al. 2000; Clark et al. 2002; Martin et al. 2012).

It is not just the fact that the brown bear reintroduction in Białowieża Forest preceded all other large carnivore reintroductions that makes this story worthwhile. The idea behind Karpiński's endeavor seems to have been to restore natural ecosystem functions and processes by restoring lost megafauna species. Thus, this can be treated as the first large carnivore reintroduction motivated by conservation goals (IUCN SSC 2013). The approach was very innovative at the time: it included genetic considerations of the released animals, soft-release methods, an experimental design, and close monitoring of the animals and project outcomes. Karpiński applied soft release to a large carnivore for the first time (previously it was tested only in the American bison reintroduction). Given that the release of captive-born animals was the only option at the time (Kleiman 1989), he adapted the method for a large carnivore species by restricting contact with humans and introducing the gradual release of cubs born captive but free to experience and go into the wild by themselves.

The literature classifies the brown bear reintroduction in Białowieża Forest as a failure (Swenson et al. 2000; Breitenmoser et al. 2001). However, reproduction in the wild was recorded for at least 8 years. Although reintroduction outcomes of other projects are not always properly documented, the available data from the 1970s and 1980s suggest the majority of those endeavors failed to establish viable populations (Seddon et al. 2007). Because those pioneering experiences, translocations for conservation purposes have increased exponentially and are now a powerful conservation tool in an increasingly defaunated world. In the Białowieża reintroduction, it was the outbreak of World War II that spoiled what might have been a successful first reintroduction of a large carnivore. War often has detrimental effects on wildlife and conservation due to military actions and the difficulties of conducting and advocating conservation work in conflict areas (Gaynor et al. 2016).

The history of the brown bear in Białowieża Forest illustrates the long and changing relationship between large carnivores and humans worldwide. Many large carnivores share all or part of the history told here, starting from game reserved for hunting by kings and elites to being treated as a threat and persecuted as pest resulting in extirpations. Although the general attitude toward large carnivores nowadays has changed significantly since the time of Białowieża reintroduction, some of the challenges remain the same, for instance, the reduction of large carnivore damage to human property. The legacy of the world's first reintroduction of a large carnivore provides insights and lessons for carnivore conservation in future. Captive and human-habituated bears did not adapt well

to living in the wild. They tended to approach humans, which often caused conflicts and sometimes ended up tragically for both humans and bears. The soft-release method in which free-ranging juveniles grew up in nearly natural conditions with minimal human contact proved successful. The Białowieża experience also supports the recommendation of not feeding bears. The fact that local residents, who had to coexist with the reintroduced animals, were not properly informed and trained about how to behave and protect their property, was a crucial weakness of the project. The involvement of local communities is essential for achieving goals in wildlife reintroductions. Finally, military conflicts jeopardize conservation efforts.

New challenges in large carnivore conservation have appeared as the human population continues to grow, occupy, and modify the habitats of large carnivores. Large carnivores have large spatial requirements, and some are expanding into human-dominated landscapes (Chapron et al. 2014; Ripple et al. 2014), which creates an urgent need to integrate large carnivore management and conservation into multiuse landscapes outside protected areas (Carter & Linnell 2016). As a result of increased interactions between large carnivores and humans, for example by facilitated access to large quantities of anthropogenic food, carnivore function may be altered through time via processes such as domestication and hybridization (Newsome et al. 2017). Despite these newly arising issues, there is growing awareness that large carnivores are key components of ecosystem functioning and a crucial element in ecosystem restoration. When reintroducing large carnivores to ecosystems, one should not forget to learn from past failures and successes.

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