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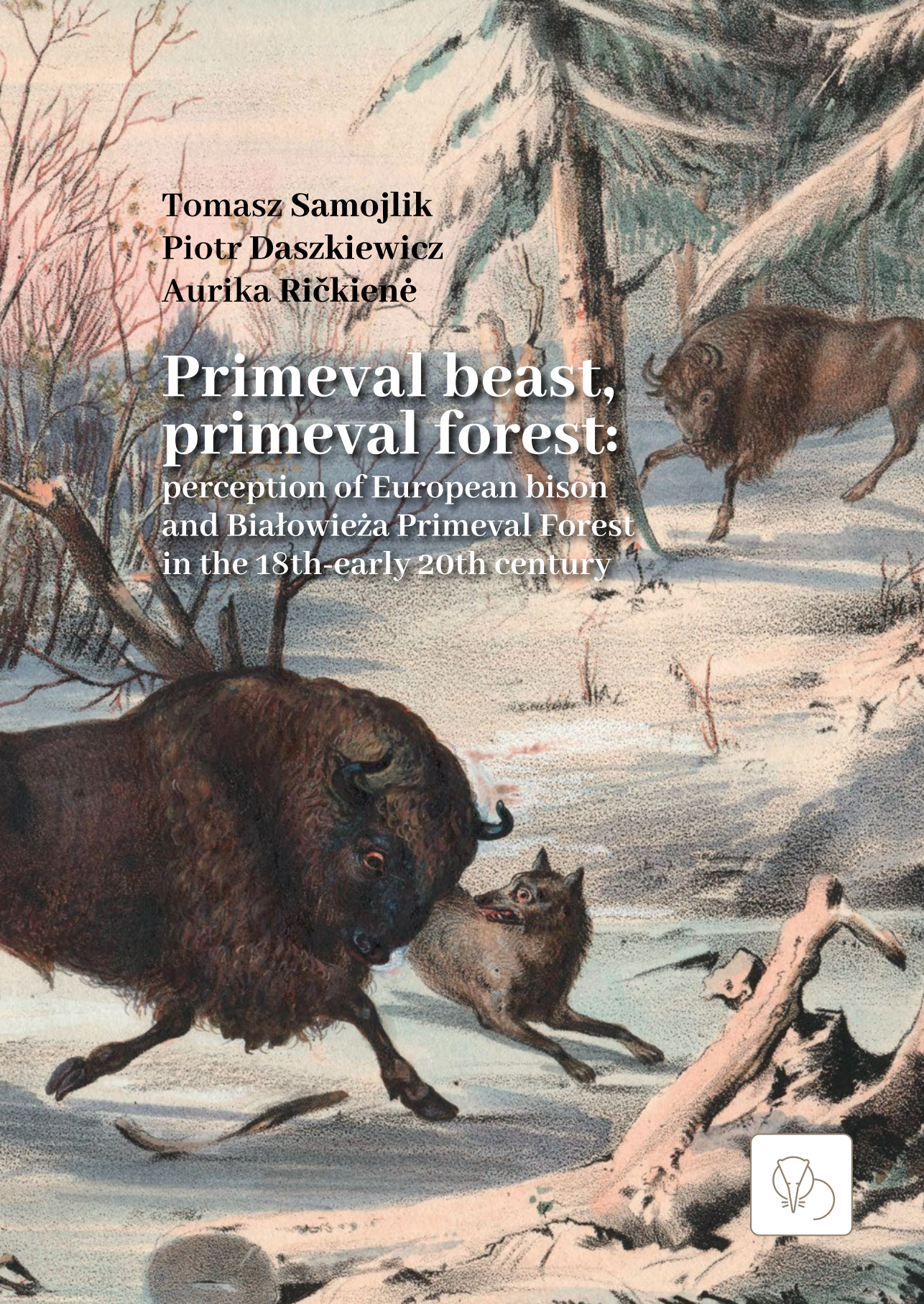
perception of European bison and Białowieża Primeval Forest in the 18th-early 20th century



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Authors' statement

We started this book project in a world different from the one in which we are finishing our research. We were studying the evolution of the concept of a primeval forest, perceptions of Białowieża Primeval Forest across time periods and places, and the process of building an iconic status of European bison – all on the backdrop of a period seemingly long-gone, with imperialism, annexation of parts of other countries, censorship and prohibition of education in native languages, as a gloomy echo of history. That history is supposed to be the greatest teacher of humankind. The brutal attack by Russia on Ukraine in February 2022 indicates, sadly, historic recurrence. We wish to express our support to Ukraine and its people, including our colleagues – researchers who cannot participate in scientific discourse as their lives are threatened and derailed by Russian attacks on civilians and devastation of land, including forests.

Introduction

> *So what is left of the Primeval Forest today? Is it only the remnants burdened with history, still called the Primeval Forest for the sake of remembrance? No, Białowieża Primeval Forest is still today the largest forested area in Europe's lowlands, and its pristine nature, despite the German devastation of such a large area, is still maintained within the limits of what is possible for rational management, not to mention its wild heart – the National Park.*
> (Karpiński 1937B)

Białowieża Primeval Forest (later: BPF) is nowadays considered one of the best-preserved temperate forests in European lowlands. It holds a variety of animal, plant and fungi species, diverse forest environments with abundance of dead and decaying trees, and natural processes driving the ecology of the forest. The forest, covering 1450 km^2 of the borderlands between Poland and Belarus, is a closed-canopy mosaic of different forest habitats with a small extent of open areas made up of forest gaps, river valleys, and marshes (Jaroszewicz et al. 2019). The majority of the Polish part, spread over an area of 600 km^2, is managed commercially under state forestry. Protected areas include Białowieża National Park (105 km^2 with 47.5 km^2 of old-growth forest strictly protected since 1921) and 21 smaller nature reserves (little over 120 km^2 in total) scattered within the managed part. The importance of BPF has been observed internationally: the Polish part of BPF was pronounced a UNESCO Biosphere Reserve in 1976, and the entire forest is a transboundary UNESCO World Heritage Site 'Białowieża Forest' since 1992. In 2004, the Polish part of BPF was also included in the Natura 2000 network of nature protection areas in the European Union (Jędrzejewska & Jędrzejewski 1998, Kavalenia et al. 2009, Pabian & Jaroszewicz 2009).

There are numerous papers, monographs and dissertations focusing on the history of European forests (just as examples: Kirby & Watkins 1998, Agnoletti & Anderson 2000, Williams 2003, Birks 2005, Mitchell 2005, Szabo 2005), including BPF (Hedemann 1939, Samojlik 2007, Samojlik et al. 2020). However, to our knowledge, there is not a single book devoted to the evolution of one of the most important ideas in the history of natural sciences: primeval forest. The idea born both from the experience of deforestation in Western Europe and from philosophical deliberations

on the ideal state of nature. The countries in which modern forestry was born – France, Germany, Switzerland and Austria – had an average forest cover of 14% already in the beginning of the 15th century. Meanwhile, countries that constituted the Commonwealth of Both Nations (nowadays Poland, Lithuania, Ukraine and Belarus) had an average forest cover of more than three times that: 45.9% in the same period (Kaplan et al. 2009). Modern, science-based forestry aimed to simplify the biological composition of forests, to tame and organise them to maximize timber production and financial revenue, in stark contrast to "Lithuanian woods", especially BPF, in which first attempts to introduce elements of modern forestry appeared as late as the 19th century (Więcko 1984, Samojlik et al. 2020). When naturalists from Western Europe started visiting and observing forests of Central and Eastern Europe, especially in the Polish-Lithuanian Commonwealth of Both Nations in the 18th century, the discarnate idea of primeval forest suddenly found its embodiment. The clash between the Western European vision of forests treated as plantations and the untamed and wild woodlands of BPF has led directly to 19th-century (unsuccessful) attempts to organize Białowieża according to rational forestry (Samojlik et al. 2020) and is still present in discussions concerning the stewardship and future of Białowieża Primeval Forest. The sole idea of primeval forest is important not only from the historical point of view, but plays a crucial role in modern natural sciences and nature protection. Yet, the meaning and definition of "primeval" is not unambiguous, as it is frequently used in mass media and in political discourse.

Similarly, there exists a vast bibliography of works focused on European bison history, ecology, and conservation (e.g. Cromsigt et al. 2012, Kerley et al. 2012, Krasińska & Krasiński 2013, Hayward et al. 2015, Bocherens et al. 2015), yet there is very limited knowledge on the perception of the species in contemporary times, not only among scientific society, but also, and maybe more importantly, among the wider European public. Retracing the way by which the European bison was discovered and perceived might reveal the process by which its contemporary iconic status was erected, and may also show how the idea of conservation of this prehistoric beast and its habitat developed and was linked to the idea of primeval forest.

Our book aims at reconstructing the emergence and evolution of the idea of primeval forest – from the first mentions in highly theoretical works on modern, scientific forestry and works on national identity and connection between nations and nature, to the actual descriptions of the features of primeval forest on the basis of observations of BPF. We will attempt to trace influences of BPF on the development of the idea of primeval, pristine and natural forest, the importance of information about BPF published both by naturalists and laymen, and also the impact of the imagery connected with European bison on wider perceptions of the species and its conservation.

Our book should be treated as a collection of scientific essays touching on themes of roots of the idea of primeval forest in the connection with BPF (chapter one), scientific recognition of BPF and European bison in European research of the 18th-19th century (chapter two), specimens of European bison from BPF in European nature

museums and their significance in building the iconic status of the species (chapter three), the perception of BPF in popular writings (chapter four), initiatives to reintroduce wild animals as an attempt to re-create the fauna of a primeval forest (chapter five), evolution of the visons of European bison in art (chapter six) and the need for a new definition of primeval forest better suiting contemporary conservation needs (chapter seven). If not indicated otherwise, original texts cited in the book were translated into Polish by the authors.

Chapter 1.

Roots of the idea of primeval forest

The loss of primary forests, defined as wooded areas with naturally regenerated native species and minimal signs of human intervention, is considered one of the main conservation problems facing Europe (Sabatini et al. 2018). These forests play a pivotal role in biodiversity conservation worldwide and provide crucial ecosystem services (Di Marco et al. 2019, Sabatini et al. 2020). Decisions concerning the type of protection or management of forested areas in Europe are largely guided by their assessed natural state and concepts of primary and secondary forests (Bradshaw et al. 2015, FAO and UNEP 2020), yet still over half of European primary forests are not incorporated into strictly protected zones; instead, they are protected in small patches or are subject to management activities (Sabatini et al. 2018).

The beginning of modern nature conservation in forests, both in Europe and North America, was connected with the perception of wilderness, untouched and unchanged by man. In many ways, the expected natural state or "benchmark" is an intellectual construct, not achievable especially in the modern world where human footprints are directly or indirectly imprinted on each of Earth's landscapes. In contemporary discussions about nature conservation and the future of especially ecologically valuable forests in Poland and across Europe, arguments often revolve around the concepts of primeval, virgin and natural forest. In fact, these ideas were born more than two hundred years ago among European thinkers concerned with the overexploitation and destruction of forests.

The discourse about the consequences of deforestation started as early as in the 18th century, firstly based on the observed impact of British, French, and Dutch exploitation of colonies on tropical islands, later also in continental Europe itself, connected with the destruction of forests across nearly the entire western and central parts of the continent (Ghosh 2021). Prominent thinkers of that age, such as Bernardin de Saint Pierre (1737–1814) and Jean-Baptiste Rougier de La Bergerie (1762–1836) in France, or Alexander von Humboldt (1769–1859) in Germany, were concerned with the impact of forest loss on climate, droughts and rivers drying or increased floods in different regions of Europe (Grove 1995, Andréassian 2004, Pausas & Bond 2019).

In 18th-century France, growing needs of industry and military, along with poor forest management, were widely recognised as the causes of crisis in forest production. This was one of the most burning issues for France, as timber consumption had begun to outpace the regeneration capacity of French forests. High prices and rapidly falling supplies of wood made forest destruction and forest management methods a point of interest for the French public. And, understandably so, discontent over the lack of timber for the poorer part of French population was one of the causes of the eventual Great Revolution of 1789 (Devèze 1964). Prior to that, the French royal administration attempted to mitigate the effects of deforestation. Eminent naturalists, among them René-Antoine Ferchault de Réaumur (1683–1757), Henri Louis Duhamel du Monceau (1700–1782), Georges-Leclerc comte de Buffon (1707–1788), Jean-Etienne Guettard (1715–1786), Jean-Emmanuel Gilibert (1741–1814), and Philibert-Charles Marie Varenne de Fenille (1730–1794) were asked to analyse the issue of forest destruction and propose possible remedies. The search for methods of more effective forest management and reforestation seemingly fell along the lines of modern "rational" forestry based on the German example, yet efforts of this group contributed also to the development of non-forestry sciences. The majority of naturalists involved ascribed to G.-L. Buffon's view that in order to manage (or, actually, cultivate) forests well, it is necessary to imitate nature after first learning its laws and mechanisms (Buridant 2006). The great naturalists of this era understood well that the sheer existence of forests does not require human intervention – it is only the production purposes that require management.

In their discourse, a set of new terms appeared: primeval forest ("forêt primaire"), virgin forest ("forêt vierge") and natural forest ("forêt naturelle"). It was probably the first time these terms were used, and their meaning was defined by putting them in juxtaposition. They differentiated the primeval or virgin forest and the natural forest. It was observed that after the destruction of primeval forest (without regard to the cause of destruction, natural or anthropogenic), a forest regenerated naturally and differed from a forest that had previously grown at the same site. The natural forest was understood as the one resulting from natural regeneration, without intervention of man. Both Duhamel du Monceau and René-Antoine Ferchault de Réaumur (Reaumur 1721) blamed poor forest management for the French wood crisis and both of them proposed replacing some of the forests that regenerate by themselves with forest plantations (Buridant 2000, Daszkiewicz 2016). Duhamel du Monceau even highlighted the "failure" of natural regeneration in the light of the country's demand for wood. Similarly, the presence of dead wood in forests was seen as a negative characteristic for a natural forest, that is, one that, although not primeval, lives without human intervention (Blondin 2012).

In this context, J. E. Gilibert's publication "On the Forests of Lithuania" (Gilibert 1781A, 1781B) stands in stark contrast. Gilibert, having worked in Lithuanian Forests (including BPF) by the invitation of Polish king, Stanisław August Poniatowski, praised the primeval forest and controverted the concept of the alleged degeneration of these forests and the necessity of human intervention: "*In the refuge of these vast*

desolated areas away from human pursuits and almost free from humanity claims, many species of animals find survival and ensure the species lives on (...). *But a researcher delving deep into this forest as old as the ground he covers unsuccessfully looks for the traces of degeneration of nature, which the scientist, the author of a general and detailed natural history drew from his first glance at his boards. Almost no trees are seen disturbing each other, no dead, decomposing plants burdening the soil and stifling seeds ready for germination, keeping the decay and sheltering poisonous and terrible animals. On the contrary, everything here seems to be full of movement and life, trunks overturned by the wind or old age* [on which] *parasitic plants: mosses, lichens, fungi suck the substance, numerous insects, many species of beetles, many kinds of longhorn beetles and bees attack the wood layer and quickly destroy it. If an accident has not caused the trees to fall but if they fell under the burden of age, nature has already prepared the decay of the wood with its long hands* (...). *On the contrary, if you want to see traces of disorder, degradation and damage caused by man in nature, visit forests often wandered by people; traces of fire blacken the bases of the trunks, resinous juices removed, the trees wounded according to their age to extract a few litres of resin or tar from each trunk. It is here that the prematurely fallen trees cover the ground and show the image of destruction to the traveller; here the demands of crafts—depriving trees of leaves or bark, or cutting them with deep incisions—force nature to present a spectacle of weak and imperfect vegetation. By continuous felling, the destructive human hand partially reveals the soil and destroys the connections in this entire system, and the rarer, more timid animals seem to flee from humans. You will not hear these numerous and repeated concerts of singing birds that nature sent to the backwoods. The spectacle of life and movement weakens and moves away from the frequented forests which will become similar to vast deserts*" (Gilibert 1796).

The novelty of Gilibert's approach was also in pointing out that species rare or absent in overexploited forests with bigger presence of man are present and thriving in the primeval forest. He also approved the presence of dead wood and was one of the first authors in the 18th century who recognised its significance (which we would now call an "ecological role"). Dead trees in forests were for most 18th-century authors synonymous with wilderness and primevalness, at the same time being evaluated negatively, as not bringing expected benefits to man (Deuffic 2010, Daszkiewicz 2018).

The above dispute encompassed different views on the usefulness or profitability of forests regenerated naturally or artificially, but one notion was common: primeval, virgin forests in which humans have never set foot in, remained even in the 18th century essentially utopian ideas. They were derived strictly from the romantic philosophy of J. J. Rousseau and were thought to have survived only in remote parts of the Earth, untouched by European civilization and its ever-growing demand for wood. François-Antoine Rauch (1762–1837) wrote in this spirit: "*Nature has its crises and its ills; in the few places of the earth where it is still virgin, one sees it strong, vigorous, omnipotent and joyful with beauty: these edenic points are unfortunately rare today, and when the traveller encounters them still in a few rare and remote places,*

Fig. 1.1. Théodore Rousseau's "The Forest in Winter at Sunset", ca. 1846–67.

must perceive with bitterness in his admiration that either man was not there before, or that the nature remained there in the original state of creation. But in our climate, [nature] is often corrupted or withered by too many crops; where nature has been mutilated for long centuries its character is disturbed" (Rauch 1818).

Search for wilderness and contact with pristine nature became also an important current in French art, which was still following Neoclassical tradition aiming at emulating classical and Renaissance artists at the turn of the 19th century. The first decades of the 19th century brought a refreshing change – not only artists started to leave their studios to paint directly in nature, *en plein air*, but also some of them sought landscapes perceived to be as wild as possible. A group of painters that took inspiration from the Forest of Fontainebleau, and who usually lodged in the village Barbizon, created an entire school characterized by a search of wilderness – the Barbizon School. The most prominent member of the school was Théodore Rousseau (1812–1867), whose works often revolved around awe-inspiring untamed and wild forest (**Fig. 1.1**). His connection with the picturesque scenery of the forest went even further. His appeal to emperor Napoleon III to protect a part of Fontainebleau's old woodland ended with success and creation of a reserve in 1861 (Mathis 2014).

The road to "primeval forest" in the German thought was paved with different intentions. From the very beginning of scientific forestry, stemming from observations of wood shortages caused by the excessive use of wood and uncontrolled access to forests, planting was believed to be the only way for forests to regenerate and provide sustainable resources. Georg Grünberger (1749–1820), author of one of the first textbooks of scientific forestry, proposed a general rule of dividing forests into sections and then yearly clearing and replanting one of them. The size and number of sections was to be set by scientific forestry based on mathematical precision, local geography, botany and foresters' experience (Hölzl 2010). The goal of sustainable use of forests was universally accepted and, soon enough, the only ideal state of the forests that was discussed in German lands was the one envisioned by forestry: high forest planted, grown and exploited according to a management plan. Such forests were devoid not only of dead wood, shrubs or open areas considered nonprofitable, but also of traces of traditional forest use like coppices, forest pastures or charcoal hearths (Hölzl 2010).

While the educated circles of naturalists and foresters seemed to be immune to the concept of valuing an untamed and uncivilized forest, this exact thought came from German Romanticism. Its representatives reached back to ancient descriptions of German forests. In "Commentaries on the Gallic Wars" in the first century BC, Gaius Julius Caesar mentioned impenetrable, vast Germanic forests abundant with enormous animals, among them aurochs just a little smaller than an elephant (Zechner 2013). Similarly, Tacitus' described the immense Hercynian forest, full of beasts that went extinct elsewhere, and most of all – ancient, prehistoric (Schama 1995). Romantics like Wilhelm Heinrich Riehl (1823–1897), drew abundantly from that concept building their vision of dark, mysterious and impenetrable forests as a contrast to civilization, including spruce and pine plantations established by German scien-

tific forestry: "*In the highlands, where the wilderness reigns, where forest and field are eternally marked by nature, the countryside rules over the cities*" (Riehl 1851). They presented wild woods as a sanctuary, alternative to domesticated parks or gardens. Those visions were soon intertwined with national ideology, linking Germanic tribes with modern Germans, and seeking their specialness in deep connection with mythical immeasurable and untouched forests (Zechner 2013). Forests, and especially oaks became a symbol of German people's special connection with nature (Morton 2002), which was mirrored in German art, especially works of Caspar David Friedrich (1774–1840). His masterpieces, like "Forest in late autumn" (**Fig. 1.2**) represented the longing for untamed nature, in this case forests that in reality were erased by pursuing a goal of sustainable scientific forestry.

Fig. 1.2. Caspar David Friedrich's "Forest in late autumn", 1835.

This longing was satisfied soon after – the chief forester of the Kingdom of Poland, German Julius von den Brincken found such forest in the woods of Białowieża. He visited BPF in 1821 and 1823 on the orders of the Russian Tsar and described his impressions in the book "Mémoire descriptif sur la forêt impériale de Białowieża, en

Fig. 1.3. The pristine woodlands of Białowieża nowadays (Photo by Krzysztof Onikijuk).

Lithuanie" published in 1826 (Brincken 1826). In his book, Brincken defined BPF as primeval:

"*Numerous large remnants of these primeval forests still exist in Lithuania today, presenting an image of the ancient Germania described by Caesar and Tacitus. It is here that the nature that was left behind presents itself to our eyes in its primordiality, but also in its strength. In the Białowieża Forest, we see one of the most important and distinctive remnants of these ancient forest areas (...). During long walks through the Forest, one would look in vain for traces of that industry which should have enlivened the forest wealth. Nowhere can one hear the noise of forges, saws or woodcutters' axes, nowhere can one see the fumes from charcoal hearths, metal- or glassworks. You rarely even meet people on the forest roads. The location of most forest settlements, their small number and sparse population make the Forest unusually quiet. It retains the character of a primeval forest, sustaining and multiplying almost all the game species that have lived here since ancient times*" (Brincken 1826).

Strikingly, this highly trained forestry specialist, selected by the Tsar to advise on how to make BPF more profitable and bring it closer to German sustainable forestry, left a description of a forest that can cope perfectly well on its own, without interference from the forester: "*This primeval forest helps in fighting superstitions that still prevail in many countries where there are no longer forests managed solely by*

nature. There, it is sometimes believed that a forest that is left unexploited until it reaches physical maturity is bound to disappear. Nature, however – as we have seen – never destroys without renewing at the same time. Regeneration might be slow, other times rapid, depending on favourable circumstances or obstacles. It is an acknowledged truth, however, that a forest protected from the attacks of its greatest enemies – humans and herds of cattle – would never stop regenerating itself" (Brincken 1826).

Since the 18th century, when Western European scientific circles "rediscovered" wild lowland forests of the Grand Duchy of Lithuania, descriptions of BPF made the forest famous and recognized for its pristine features (**Fig. 1.3**). Centuries of protection of BPF as a royal hunting ground and general status of the majority of Lithuanian forests as „wotczyna", i.e. private, hereditary property of the Lithuanian Grand Dukes dynasty resulted in a very good state of preservation of this area until the 19th century. The stark contrast between Lithuanian forests and deforested and highly modified areas of Western European lowlands made the former a perfect place for scientific studies. Additional asset drawing naturalists from the entire continent was the last free-living population of lowland European bison, preserved in BPF thanks to accumulation of several favourable circumstances: legal protection of the species as *animalia superiora*, large game reserved for monarchical hunts, traditional utilization of the forest which created favourable feeding conditions for bison, and the system of additional feeding and monitoring of bison population since the 18th century.

However, as shown in the examples of J. E. Gilibert and J. Brincken, already in the 18th and beginning of the 19th century, descriptions of BPF paid heed to numerous remnants of past anthropogenic disturbances. It became clear that BPF was far from the untouched virgin forest without a long history of human use which shapes forest environments: forest-pasturing of cows (Samojlik et al. 2016), haymaking (Samojlik & Jędrzejewska 2004), traditional beekeeping and non-timber utilization of tree stands leaving traces in the form of culturally modified trees or charcoal hearths or wood tar kilns (Samojlik et al. 2019B). These human aspects are yet almost completely uncredited in modern definitions of "primeval forest", with some exceptions (e.g., the forest gardens of the Pacific Northwest; Armstrong et al. 2021). The hierarchical terminology of forest naturalness (Buchwald 2005) virtually rules out the existence of primeval and virgin forests, and the scarcity of cases in which forests are not affected by human intervention was reported as one of the main reasons to change the criteria of primary forest assessment (FAO 2020). The French Dictionary of Nature Conservation (Bioret et al. 2009) adopts a definition of primeval forest as "an ensemble of forest ecosystems that has retained its natural characteristics. It is formed by native species and the evolutionary processes taking place in it as well as the balance between ecological components have not been disturbed by human activity". In other words, human activities and land uses are excluded as part of the evolutionary processes. Historical-ecological information on woodland antiquity, ecological continuity, structures and processes of forest landscapes is seen as an important guide for contemporary management and conservation (Rotherham 2011, Lindbladh et al.

2013) – what to do then, when forests described as primeval or virgin do not fit this definition anymore (for example, in Poland, the *Puszcza*)?

One of the proposed ways to overcome this obstacle is a push to move beyond the literal understanding of primeval forests as "untouched" and deriving conservation decisions from this understanding, e.g., assessing forest environment quality using "Intact Forest Landscape" measure (Potapov et al. 2008, Bernier et al. 2017). Changing the baseline of forest protection decisions is especially important in the light of emerging concepts of decolonisation of nature (Schnitzler 2014) or politics of common survival (Cielemęcka 2020), both putting emphasis not on preserving "intact" nature but rather embracing the plethora of forest-human interactions existing for centuries if not millennia. A team of historians, foresters, naturalists, ethnologists and linguists led by Andrée Corvol (Corvol et al. 1997) working on the history of forests, forestry and their perception in France have pointed out that our perception of the forest does not coincide with what it was in the past and what it is today. Our attachment nowadays to the forest and its protection is often linked to concepts that are a mixture of scientific definitions and colloquial terms of an idealised and sentimental nature, which usually include very vague notions of the primeval, virgin and natural forest. Moreover, Ritter (2011) argues that forests, popularly regarded as wild and untouched places, are in fact heavily affected by a myriad of types of human activities and uses which date back to the earliest stages of forest expansion after the retreat of glaciers.

In the second half of the 18th century, not only the administration of European countries, but also an enlightened section of the public became interested in the issues of forest destruction, regeneration and the definition of basic forestry concepts. A similar situation can be observed nowadays, with climatic and hydrological crisis not looming but actually observed. In recent years, Poland has witnessed a heated discussion on logging, destruction and protection of BPF – concepts previously reserved for specialists have become one of the hottest topics of discourse in media and among the general public. It is especially important when the assessment of the forest being primeval or not is used as a crowning argument in decisions made on the future of such valuable forests as BPF. Decisions made in BPF in recent years, i.e., the introduction of intensive management practices in the area assessed as disturbed by forestry management, will have consequences for the entire forest and connectivity between fragments perceived as natural (Mikusiński et al. 2018). It seems it is high time to move from strict definition to broader discussion on natural and artificial elements (for example, degree of exploitation, planting of trees according to a certain pattern, species diversity, variety of age classes of trees, and so on), keeping in mind that replacing ancient forests with forest plantations or forests with a high degree of human intervention is extremely risky (Dupouey 2018): "*We've never had so many trees, and so few forests*.".

Chapter 2.

Scientific recognition of Białowieża Primeval Forest and its European bison population in the 18th-19th century

Białowieża Primeval Forest (BPF) survived until the end of the 18th century in a remarkably good state: less than one tenth of the forest was deforested, one third of the area bore traces of human use, and well over half constituted forest with minor or undetectable anthropogenic modifications. BPF, on the backdrop of European forests, was thus an extraordinary example of natural area preserved so long without suffering major destruction due to overexploitation or expansion of agricultural land and settlements (Samojlik et al. 2013A). The first scientific descriptions of BPF in the 18th century have whetted the appetite of European academic circles for more thorough surveying of the forest and its features. However, BPF appeared in the European literature well before that, mainly due to its status as a royal hunting ground and due to the presence of European bison in the forest. Spanish adventurer, diplomat and traveller Estebanillo Gonzalez visited Białowieża and participated in a royal hunt of King Władysław IV Vasa in 1643. The account of his experiences, published in 1646, reached European-wide audiences (González 1646, Daszkiewicz & Samojlik 2016). Gabriel Rzączynski's mention of European bison dwelling in BPF in his "Historia naturalis curiosa Regni Poloniae, Magni Ducatus Lituaniae..." (Rzączyński 1721) or Jean-Etienne Guettard's handwritten note listing plants he wished to find in BPF in the years 1760–1762 (Daszkiewicz et al. 2004) show, on the other hand, the developing scientific approach to BPF's natural wealth.

Jean Emanuel Gilibert (1741–1814), whose description of primeval features of BPF was mentioned in the previous chapter, was the first prominent naturalist who spent an extended time studying forests of the Grand Duchy of Lithuania. Professor of

anatomy, surgery, and natural history at the College de Médecine in Lyon was invited to create a veterinary and medical school in Grodno by King Stanisław August Poniatowski in 1775. Having succeeded in creating the Royal Medical School, Gilibert actively engaged in botanical and zoological research, which resulted in the first descriptions of Lithuanian flora (Gilibert 1781A) and fauna (Gilibert 1781B).

While there is no evidence that Gilibert personally visited BPF, his description of the forest and detailed study of European bison diet, anatomy, and behaviour published in 1781 in "Indagatores naturae in Lithuania" (Gilibert 1781B) entered scientific circulation and was for many decades the main reliable source of information on these creatures.

Gilibert observed wild animals of the Grand Duchy of Lithuania in their natural habitat, but also received a number of them by the way of the royal forest guards to study them in captivity. The list included both animals that were relatively known, like beaver (*Castor fiber*), European badger (*Meles meles*), red fox (*Vulpes vulpes*), and European hedgehog (*Erinaceus europaeus*), and animals that were more rarely observed and obscure such as moose (*Alces alces*), brown bear (*Ursus arctos*), lynx (*Lynx lynx*), European pond turtle (*Emys orbicularis*), and especially European bison. Gilibert reared a bison female calf for four years, which presented a perfect opportunity to note all anatomical details of European bison in comparison with domestic cattle, observe bison behaviour, experiment with the animal's diet and even attempt cross-breeding with cattle (Gilibert 1781B). Gilibert's accounts were cited in French natural history encyclopaedias of the time, e.g., Georges Buffon's "Histoire naturelle" (Buffon 1764, 1807) and works by established naturalists, like Georges Cuvier (Cuvier 1812).

Gilibert's praise of "*primeval nature, free from human actions and not disturbed by accident or by the impatience of human desires*" (Gilibert 1796) in forests of the Grand Duchy of Lithuania and BPF sounds relevant today but was way ahead of its time, at the end of the 18th century. The German model of scientific forestry, focused on turning forests into sustainable plantations that would provide set amounts of timber each year, viewed forests regenerated without human intervention, even more so forests of primeval origin, as economically unprofitable. Gilibert's remarks reached beyond this understanding of forest, emphasizing that primeval forest is abundant with species absent or rare in forests overexploited by humans, and that its uniqueness lies also in the presence of dead trees (Bobiec et al. 2005, Deuffic 2010, Daszkiewicz 2018).

Although Gilibert's publications were widely known and cited, the work on European bison by Ludwig Bojanus (1776–1827), professor at Vilnius University and pioneer of comparative anatomy and veterinary science, had far greater impact on dissemination of scientific knowledge on European bison and its habitat – BPF. "De uro nostrate eiusque sceleto commentatio scripsit et bovis primigenii sceleto auxit" (Bojanus 1825), published in Latin in an esteemed series "Nova Acta Physico-Medica Academiae Cesareae Leopoldino-Carolinae Naturae Curiosum", played a key role in developing an understanding of bison anatomy and in the debate on the distinction

between European bison and aurochs species (Bojanus firmly stated that these were different species existing in Europe in historical times). Bojanus most probably never visited BPF, which does not mean his work was only theoretical. Apart from analysing historical sources and reading modern works, including Gilibert's, he visited several zoological collections in Germany with specimens of European bison and other bovidae and managed to get two fresh carcasses of bison directly from BPF. Bojanus used two skeletons of male and female bison for his studies and anatomical figures contained in the book (**Fig. 2.1**). "De uro nostrate..." and additionally incorporated information on European bison habitat and deliberations on species' survival only in BPF. He ascribed this to the process of gradual destruction of areas suitable for bison as it could be described not by a naturalist of the 1820s, but as an ecologist of the 20th century: "*Because of the growing agriculture, these animals were surrounded by cultivated fields from everywhere, and exterminated by constant hunting. After felling forests near rivers in temperate zones of Europe, they were deprived of suitable places where they could survive. As they could not escape to the north due to severe winter climate not providing them with sufficient food, they sought the last refuge in the vast forests of Poland beyond the Vistula river. They would probably not have chosen such harsh conditions if they were not forced to do so. They would also gradually die out due to lack of food without great care of people, who, after banning any bison hunts, prevent this shortage of food by accumulating haystacks as winter fodder on forest clearings*" (Bojanus 1825). In a way, Bojanus foresaw the modern concept of European bison as a refugee species (Bocherens et al. 2015).

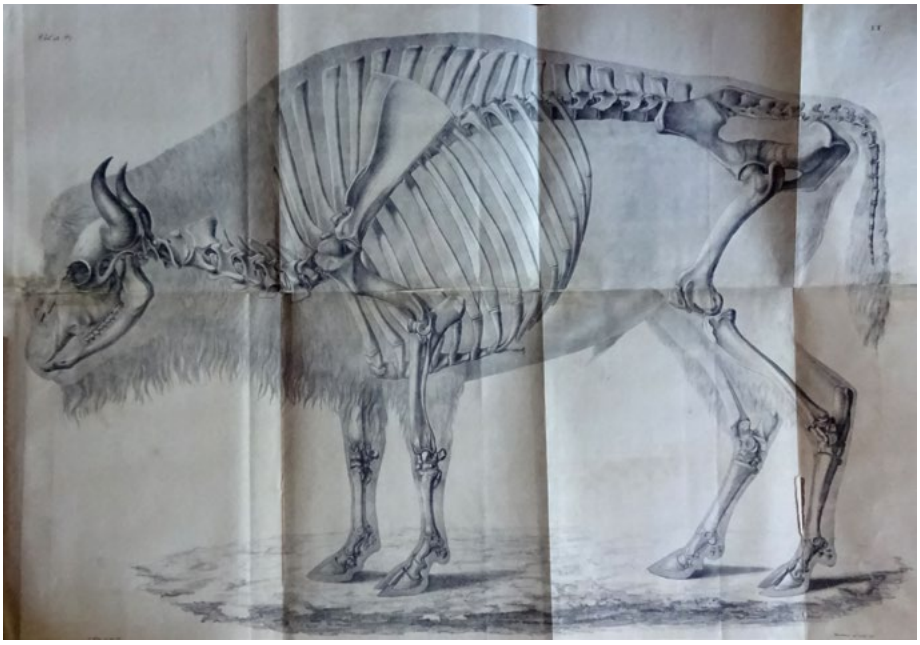
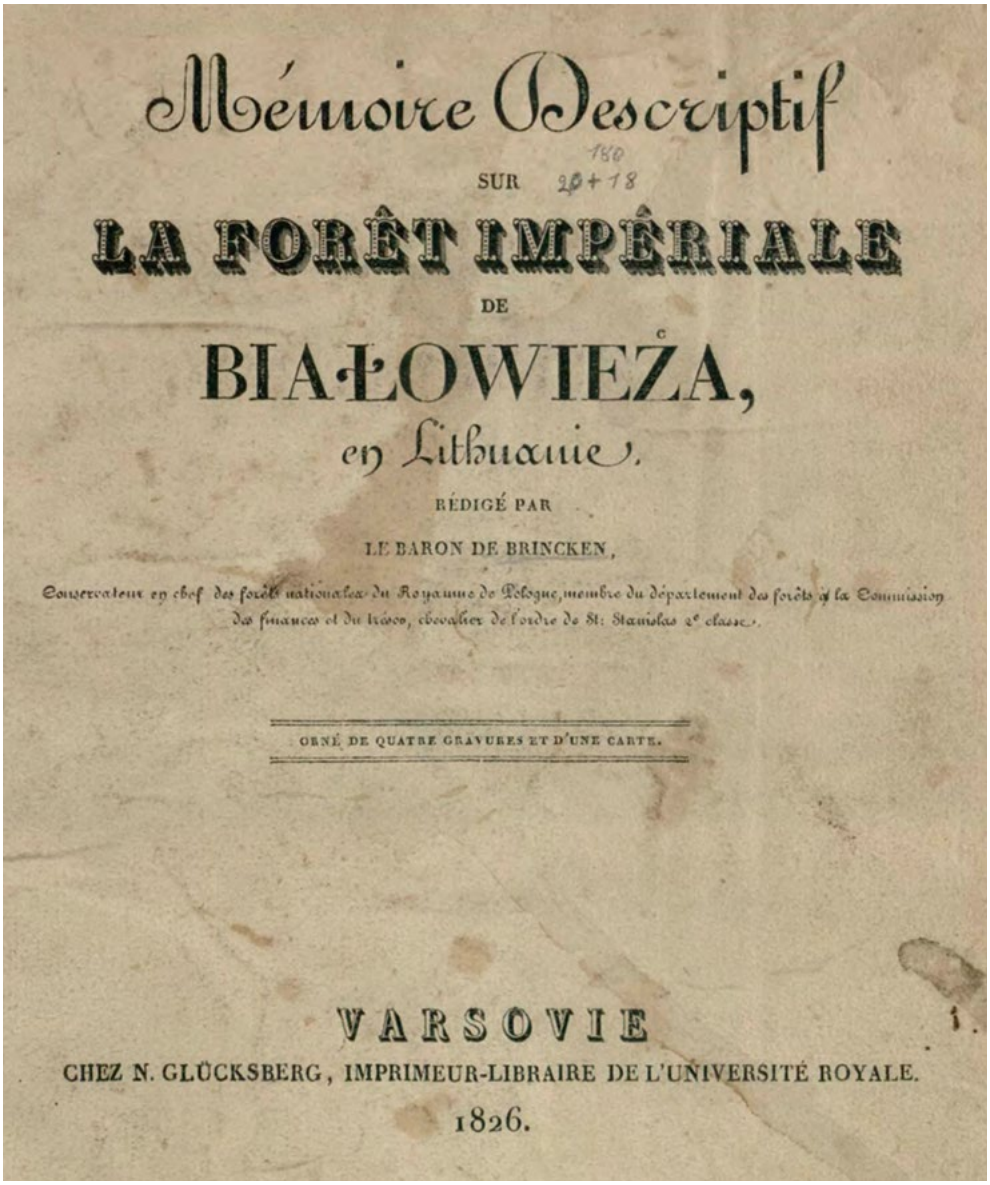


Fig. 2.1. European bison skeleton and an outline of animal's body from "De uro nostrate eiusque sceleto commentatio scripsit et bovis primigenii sceleto auxit" (Bojanus 1825).



Mémoire Descriptif

SUR

LA FORÊT IMPÉRIALE

DE

BIAŁOWIEŻA,

en Lithuanie.

RÉDIGÉ PAR

LE BARON DE BRINCKEN,

Conservateur en chef des forêts nationales du Royaume de Pologne, membre du département des forêts à la Commission des finances et du trésor, chevalier de l'ordre de St. Stanislas 2e classe.

ORNÉ DE QUATRE GRAVURES ET D'UNE CARTE.

VARSOVIE

CHEZ N. GLÜCKSBERG, IMPRIMEUR-LIBRAIRE DE L'UNIVERSITÉ ROYALE.

1826.

Fig. 2.2. Title page of the J. Brincken's book "Mémoire Descriptif sur la Forêt Impériale de Białowieża, en Lithuanie" (Brincken 1826).

The next description of BPF that entered the scientific discussion was based on personal observation of a trained forester, Julius von den Brincken, who, as mentioned in Chapter 1, visited BPF in 1821 and 1823. His monograph "Mémoire descriptif sur la forêt impériale de Białowieża, en Lithuanie" was published in 1826 (Brincken 1826) as the result and summary of these visits (**Fig. 2.2**).

Brincken travelled through the forest, hunted with a special permission from the Russian Tsar, and was provided information by the heads of the local forestry administration – forstmeisters Karl Brenner in 1821 and Eugeniusz de Ronke in 1823 (Samojlik et al. 2020). Brincken's travel had a specific purpose – to sketch a plan for future administration of the forest with the goal of transforming it into a profitable enterprise based on the best examples of modern forestry. Brincken's remarks on the unique character of BPF as the last primeval forest in Europe and the last refuge of European bison fell in line with his critique of the lack of "proper" management in the period when the forest belonged to grand dukes of Lithuania and Polish kings. Furthermore, Brincken's publication was soon compromised as containing several inaccuracies or plain errors, including zoological, botanical and even geographical mistakes. This, in turn, triggered a series of publications referring to Brincken's mistakes, correcting not only his information on natural features of the forest, but also his view on the dwellers of the region, whom he saw as uncivilized and primitive/brutish (for more on the polemic with Brincken's statements by Eugeniusz de Ronke see Samojlik et al. 2020).

One of the works devoted to correcting Brinken's errors turned out to be also one of the most prominent collections of botanical information on BPF. Stanisław Batys Górski's (1802–1864) description of BPF's flora of the Białowieża Primeval Forest "O roślinach Zubrom upodobanych, jakoteż innych w puszczy Białowiezkiey" [On grasses preferred by European bison and others in Białowieża Primeval Forest] was published in 1829 (Górski 1829) and was apparently only a part of a planned but never realized monograph "Wycieczka do puszczy Białowiezkiey, w celu botanicznym odbyta" [Excursion to Białowieża Primeval Forest, arranged for botanical purposes], mentioned only in the footnote of the published article. Górski, instructed by his scientific supervisor, botanist Johan Friedrich Wolfgang (1775–1859), undertook three expeditions to BPF in 1822, 1823 and 1826, as the first botanist to study the forest's flora (Ričkienė et al. 2021A).

Professor of pharmacy at Vilnius University J. F. Wolfgang sketched a plan of scientific investigation of BPF reaching far beyond specifically botanical aspects – it included the general description of the forest, local economy, prehistoric monuments in BPF, location and specification of plants preferred by European bison (Grębecka 1998). The latter was connected with widespread, at the time, belief that the European bison population survived in BPF because of some endemic plant or plants constituting the major part of the species' diet. Manuscripts from the first expedition are still stored at the Department of Manuscripts of Vilnius University Library (**Fig. 2.3**).

Górski's paper summarized results of all his expeditions to BPF (1822, 1823 and 1826) at the same time rebutting several false claims made by J. Brincken. In total, Górski confirmed forty species as actually present in BPF and identified three of them as the ones most often selected by European bison (southern hollygrass *Hierochloe australis*, creeping buttercup *Ranunculus repens* and cabbage thistle *Cirsium oleraceum*). The significance of Górski's botanical research in BPF consisted on pre-

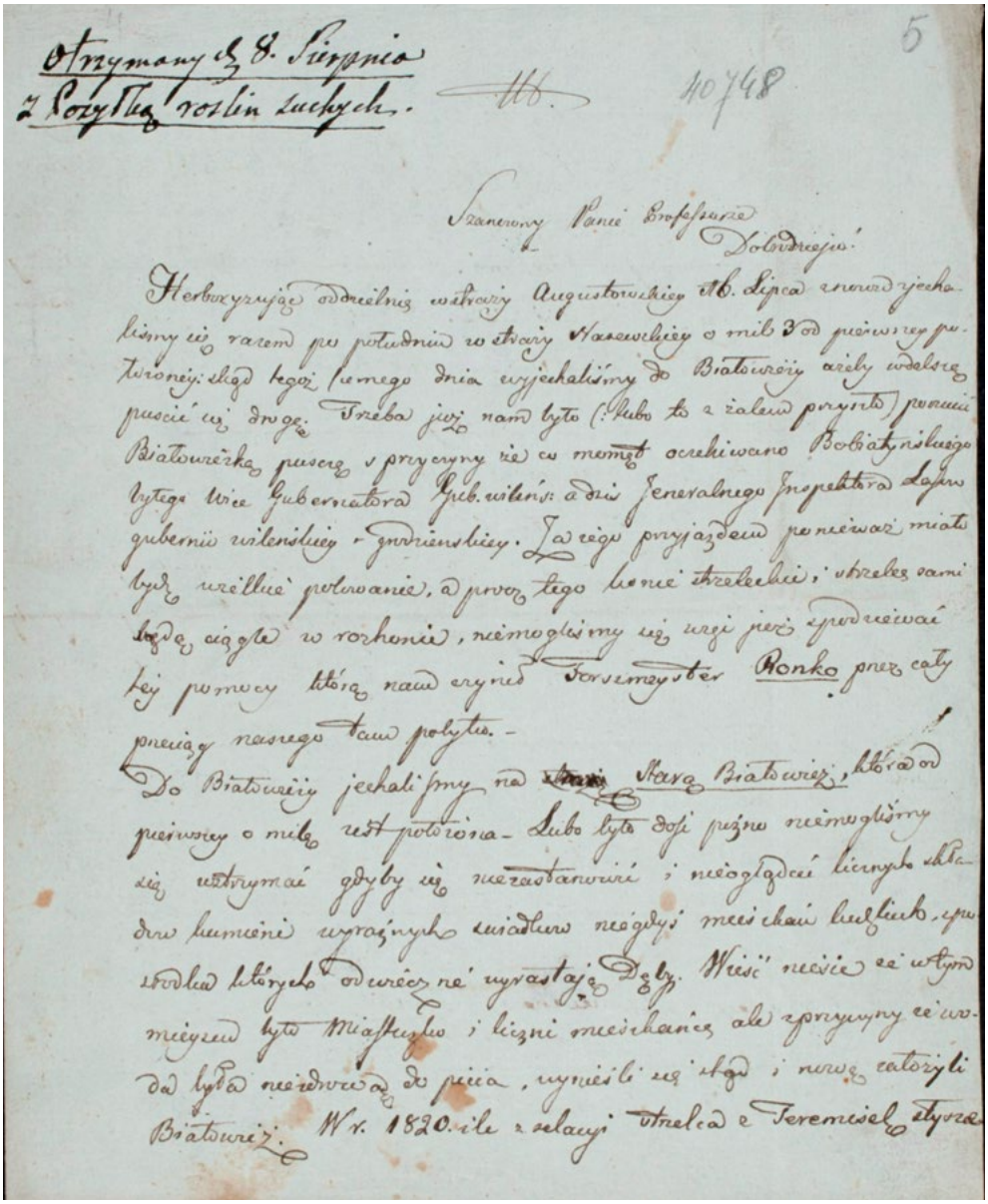


Fig. 2.3. A page from a handwritten report from expedition to BPF in 1822 handwritten by S. B. Górski, from the collection of Vilnius University Library, code No 20–28b (https://virtualibiblioteka.vu.lt/permalink/f/gi1gc3/VUB01000660194).

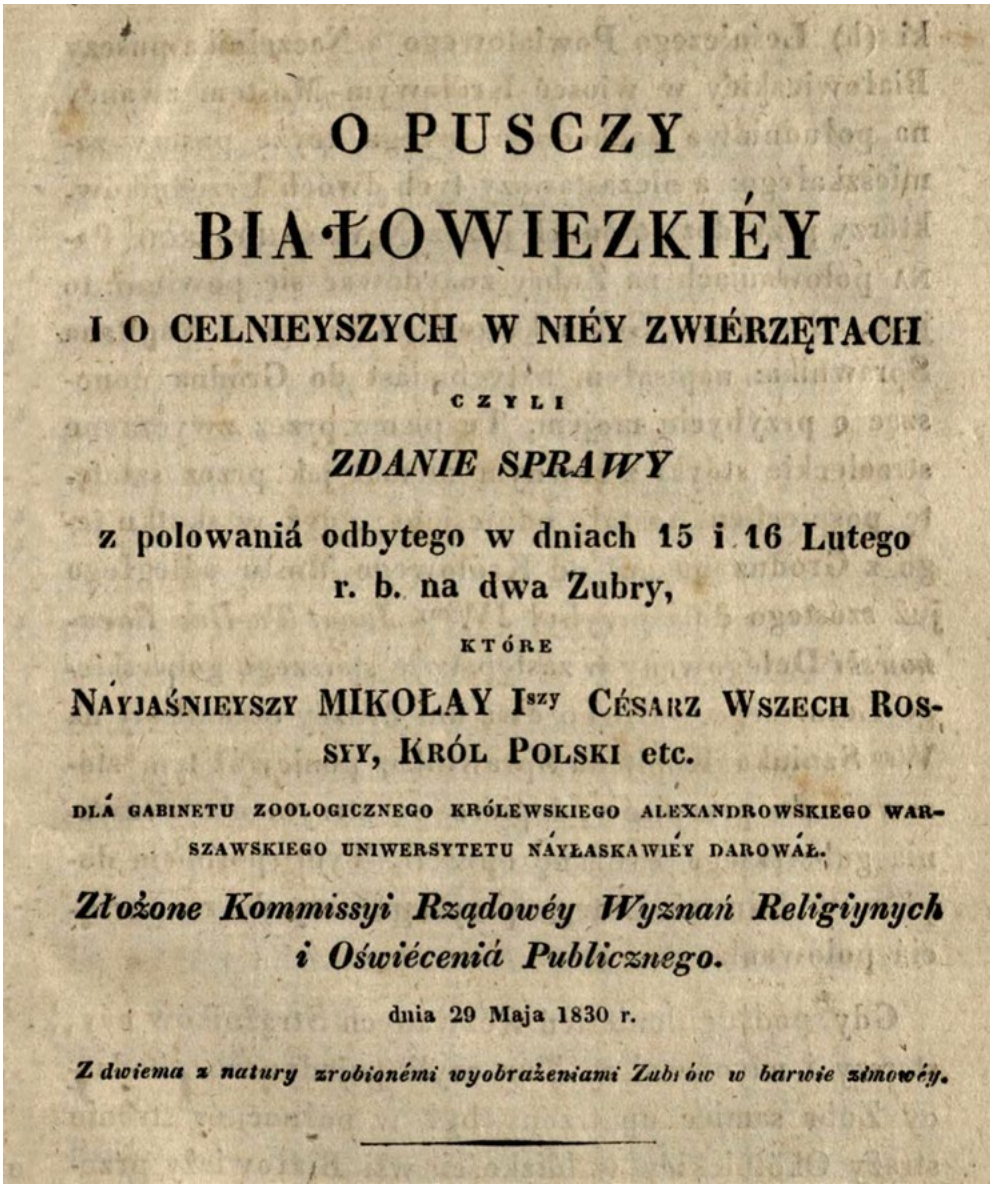
senting accurate information on localities and habitat of plants found in the forest on the background of their distribution in the Grand Duchy of Lithuania. Secondly, Górski contributed to the discussion on the reasons behind European bison survival exclusively in BPF. One of the most popular explanations of this phenomenon before

Górski's study (but unfortunately also far after his publication) presumed that a particular plant exclusive for BPF kept the species in the forest, at the same time preventing it from seeking refuge in other areas. Plants identified by Górski as preferred by European bison turned out to be widespread and common for entire Lithuania (Górski 1829). Survival of bison in BPF was most probably an effect of overlapping and synergistic factors occurring here since the late Middle Ages: the royal status and conservation of the forest, protection of the species as *animalia superiora*, game reserved only for monarchical hunts, the indirect positive impact of centuries-long traditional uses like haymaking inside the forest, creating open areas full of flowering herbs and offering bison additional winter fodder in the form of haystacks (Samojlik et al. 2019A). Furthermore, since 1700, European bison conservation became more intentional – leaving haystacks for animals became a regular practice sanctioned by law, and annual winter counts of European bison herds in BPF were introduced in the second part of the 18th century (Samojlik 2005, Samojlik et al. 2019A).

The year 1829 saw another visit of a prominent naturalist to BPF. Professor of zoology from the Royal University of Warsaw, Feliks Paweł Jarocki (1790–1865), came to the forest to hunt – with the permission of Tsar Nicholas I – two European bison for the university's Zoological Cabinet. After his expedition, Jarocki published a monograph entitled: „O Puszczy Białowieskiej i o celniejszych w niej zwierzętach..." [On Białowieża Forest and its more quintessential animals...] (Jarocki 1830B). The book (**Fig. 2.4**) contains corrections of many of J. Brincken's errors, descriptions of animal characteristics, including of European bison, and some remarks on local human activities like beekeeping (which Jarocki saw as one of the most beneficial types of forest uses).

He contrasted his observations of the natural diversity of BPF's tree stands with rather negative assessments of homogenised composition of managed forest plantations: "*If we turn our attention to the woods of the Forest, we can see in it an engaging exuberance combined with the characteristic of a truly natural forest, as one can rarely find homogeneous stands, but almost everywhere* [there is] *the greatest mixture of various coniferous and deciduous trees. Fir, oak, pine, ash, hornbeam, aspen, elm, birch, wych elm, lime, alder and spruce grow here in a disorderly way, and the gaps between them are filled with guelder-rose, yew, hazel, juniper, goat willow and common sallow. And since, for the peace and safety of animals and for the lack of demand, the export of timber from the Forest is almost completely forbidden, there are huge logs lying and rotting among the greatest thicket of diverse trees and shrubs, overturned by age or winds, and in which swarms of tree insects can nest and breed freely. Despite this, neither in the legends of the local people nor in the records of the Forest did I find any mention of any noticeable damage done by insects. Which, in my opinion, is the most obvious proof of the superiority of mixed forests over artificial homogeneous ones, which, although they are the pride of systematic foresters, are of no use when insects so often cause invaluable damage in them*" (Jarocki 1830).

However, it is important to note that parts of Jarocki's work are either heavily inspired by or plainly copied from Eugeniusz de Ronke's letter published in 1830 in



O PUSCZY
BIAŁOWIEZKIÉY
I O CELNIEYSZYCH W NIÉY ZWIÉRZĘTACH
CZYLI
ZDANIE SPRAWY
z polowaniá odbytego w dniach 15 i 16 Lutego r. b. na dwa Zubry,
KTÓRE
NAYJAŚNIEYSZY MIKOŁAY Iszy CÉSARZ WSZECH ROSSYY, KRÓL POLSKI etc.
DLÁ GABINETU ZOOLOGICZNEGO KRÓLEWSKIEGO ALEXANDROWSKIEGO WARSZAWSKIEGO UNIWERSYTETU NÁYŁASKAWIÉY DAROWÁŁ.
Złożone Kommissyi Rządowéy Wyznań Religijnych i Oświécenią Publicznego.
dnia 29 Maja 1830 r.
Z dwiema z natury zrobionémi wyobrażeniami Zubrów w barwie zimowéy.

Fig. 2.4. Title page of „O Puszczy Białowieskiej i o celniejszych w niej zwierzętach..." (Jarocki 1830B).

"Dziennik Powszechny Krajowy" (Ronke 1830). Forstmeister de Ronke, who accompanied and hosted Brincken during his second stay in BPF, felt obliged to correct inaccuracies, unreliable information and gross errors he found in Brincken's book – and he did so by publishing his letter to Jarocki in a daily newspaper in Warsaw. What is more, de Ronke included a lot of new data in his letter, to which Brincken replied

in the form of a letter in the same Warsaw newspaper (Brincken 1830). Brincken's answer was highly emotional and lacked any substantive arguments. This series of letters was closed by the third one by Jarocki, who supported de Ronke in straightening out Brincken's errors (Jarocki 1830A).

In the same year, another naturalist published his account of BPF's uniqueness. Karl Edward von Eichwald (1795–1876), head of the zoology department at Vilnius University, travelled through the Volyn, Podolia, Kherson, and Lithuania in 1828–1829. His book "Naturhistorische Skizze von Lithuanien, Volhynien und Podolien" (Eichwald 1830), published in German, contained information on BPF mostly collated from other works. The only original part was a small passage with Eichwald's own observations and a map, the first professional and reliable map of BPF available for the wider public and most probably based on forestry maps (**Fig. 2.5**).

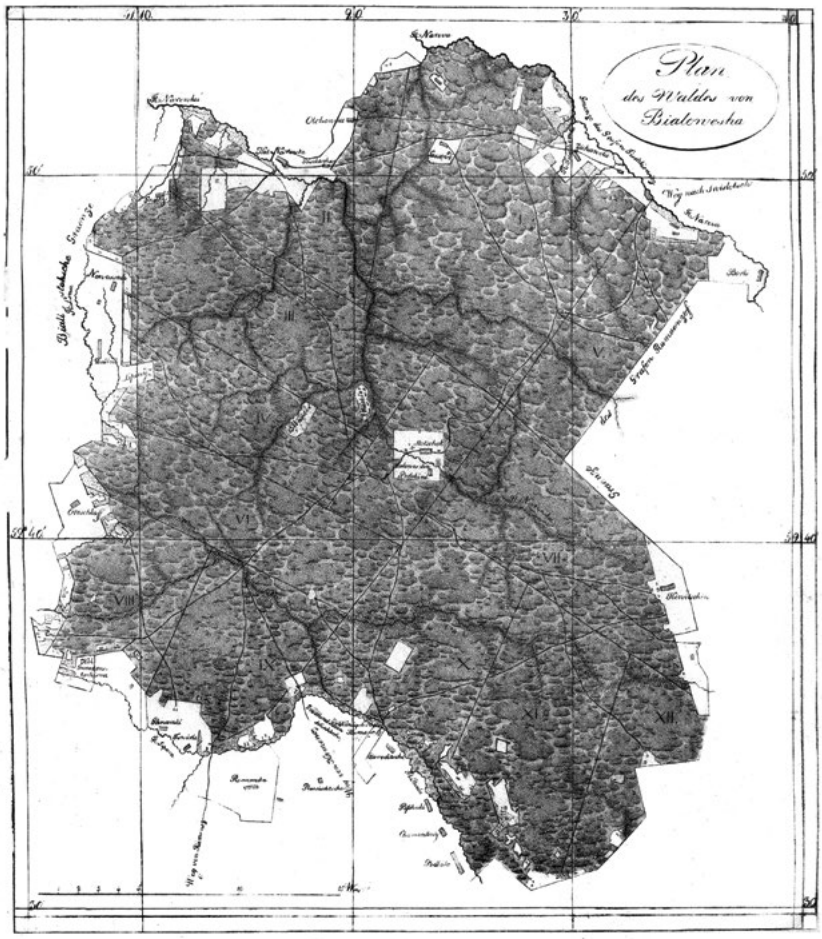


Fig. 2.5. Map published in 1830 by E. K. Eichwald in "Naturhistorische Skizze von Lithuanien, Volhynien und Podolien" (Eichwald 1830).

In 1835, a description of BPF and European bison was published in the first volume of richly illustrated "La Pologne Pittoresque" [Picturesque Poland], a compendium of Polish geography and history (Chodźko 1835–1836). The three-volume edition was published in Paris by members of the Great Emigration, a movement that saw some of the most prominent Polish intellectuals seeking refuge in Western Europe after the fall of November Uprising in 1831. The editor of the compendium, Leonard Chodźko (1800–1871), devoted several pages to BPF, calling it "La foret primitive" – primeval forest (**Fig. 2.6**).

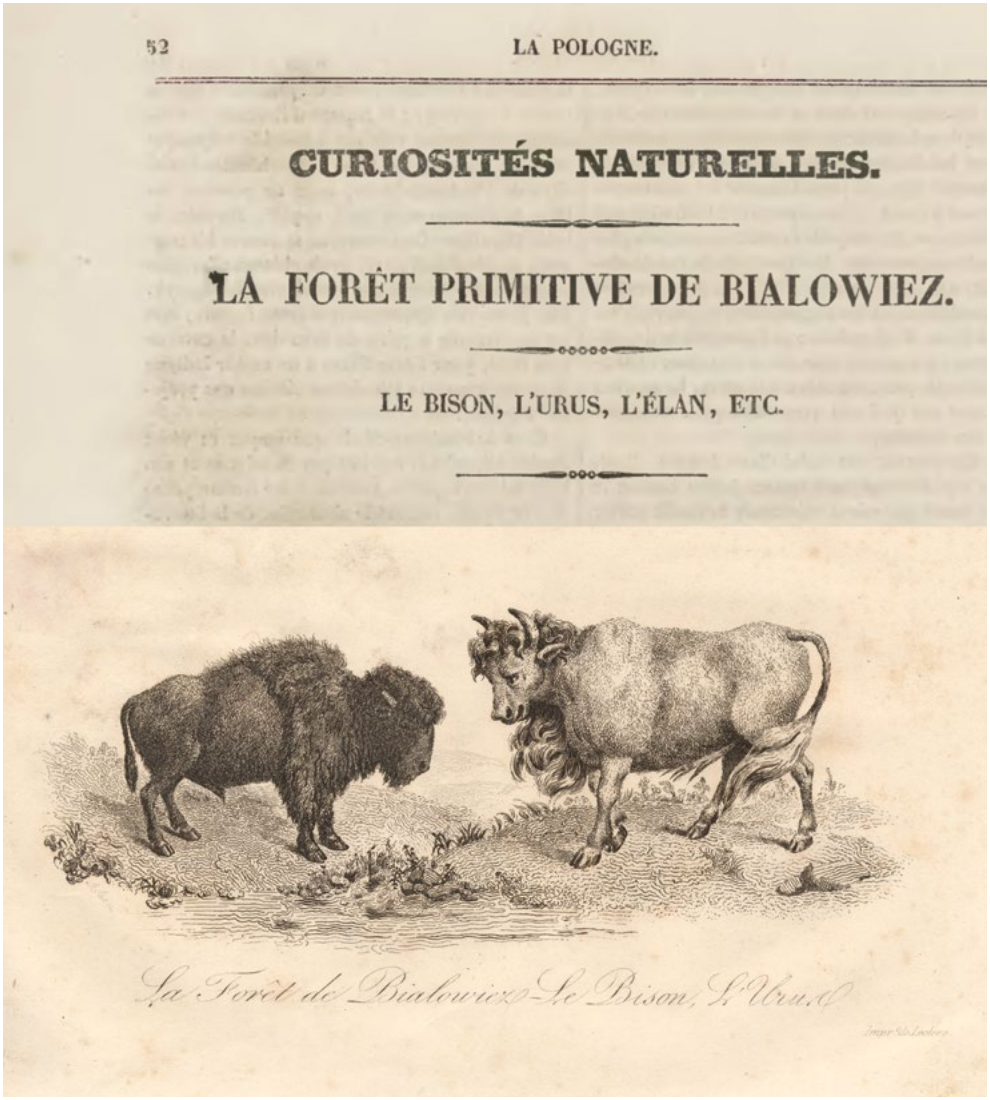


Fig. 2.6. Fragment of the title page of the chapter devoted to BPF and an illustration showing a European bison and an aurochs from the first volume of "La Pologne Pittoresque" (Chodźko 1835–1836).

The entire compendium served a grander role of acquainting Western Europe, especially French-speaking circles, with Polish history, nature and customs, including differences across regions. The characteristic traits of dwellers of BPF were also presented in a volume "Les costumes du peuple polonais suivis d'une description exacte de ses moeurs, de ses usages et de ses habitudes: ouvrage pittoresque" (**Fig. 2.7**) by Leon Józef Zienkowicz (1808–1870), Polish emigrant and publisher (Zienkowicz 1841).

Fig. 2.7. "Inhabitants of the Forest of Białowieża" from „Les costumes du peuple polonais suivis d'une description exacte de ses moeurs, de ses usages et de ses habitudes: ouvrage pittoresque" (Zienkowicz 1841).

In 1845, European bison was described in a book by Roderick Impey Murchison (1792–1871), one of the most prominent geologists of the 19th century. In 1840, he took part in a scientific expedition to the European part of Russia and the Urals, results of which were published as a monograph on the geology of Russia (Murchison et al. 1845). Murchison was interested in European bison from the perspective of geological change and extinction of other species of large mammals – in his view the bison was a steppe species that survived thanks to the geological granite layers on which European bison made its way to the Lithuanian forests, where it survived as a relic of a bygone era. His remarks were highly original and innovative in that era, not only because of describing the bison from the point of view of palaeontology and geology of the time and attributing the species extinction to geological changes and not solely to anthropogenic pressure, but especially by challenging the prevailing notion that the bison is a forest species. It was only in the 21st century that researchers confirmed that the ancestors of European bison were indeed living on the steppes of Europe (Bocherens et al. 2015).

It was also Murchison who presented, to the Zoological Society of London, a description of the capture of live bison donated to Queen Victoria by Dolmatov (Dolmatov 1848) – see below.

Another example of a professional description of BPF that stressed its unique natural values was by Michał Baliński (1794–1864) and Tymoteusz Lipiński (1797–1856), published in 1846 in the third volume of "Starożytna Polska pod względem historycznym, jeograficzne, statystycznym opisana" [Ancient Poland historically, geographically and statistically described]. Apart from sparking wide interest in Polish history, important in the age of partitions and in the middle of an epoch when Poland was erased from the map of Europe, Baliński and Lipiński's work showed the value of the natural world of the Commonwealth of Both Nations, including BPF: "*This magnificent monument of the primeval, ancient forests of ancient Europe, inhabited by European bison, which found here their last refuge for their tribe, covers more than 30 square miles of the borderland between Lithuania and Poland* (...). *Never has a human axe touched the aged trees in the middle of this eternal primeval forest (speaking of the historical times which our work focuses on* [in the original book this explanation is in the footnote]). *They themselves have fallen from old age, or from the storm forming large piles and making inaccessible the already deafening seclusion; they themselves have been reborn in the healthiest and most beautiful youth*" (Baliński & Lipiński 1846).

Among cited historical sources, authors included new and previously rarely mentioned information about Jean-Jacques Rousseau's plans to move to BPF: "*To this brief description of Białowieża Forest we should add another circumstance which, if it had taken a more favourable turn, would have earned a great renown in Europe. It is known that the celebrated Jean Jacques Rousseau, invited by Wielhorski, wrote around 1770 a draft for a government law for Poland. For this purpose, he studied the history of our nation, made a point of learning its customs and laws, and in the course of this work formed the most favourable opinion of Poles, and was heard to say that he would rather be happy living among them than in corrupt Paris. Hearing this, Antoni Tyzen-*

hauz, Court Treasurer of Lithuania, during his stay in the French capital in 1778, had the idea of persuading the Genevan philosopher to move to Poland. Knowing his hatred of company and preference for a solitary life, decided to offer Białowieża Forest for his future stay, probably the most deserted place in the entire Europe. He promised to build a house according to a plan given by the philosopher, to provide all the comforts of life, a service, a passage for rides, without imposing any obligations or duties on him. A priest we know from our literature, Xawery Bohusz, prelate of Vilnius Cathedral, who was in Paris with Tyzenhauz, was used for this negotiation. At first, the Parisian recluse liked it, and seemed eager to agree to Bohusz's propositions, when one unexpected event spoiled all of Tyzenhauz's efforts and persuasions. The notorious adventurer Vyazevich appeared in Paris, to the misfortune of his compatriots. Taking advantage of Rousseau's eccentricities, he stroke up an acquaintance with him, faked his misfortune and shamefully deceived him. Rousseau, outraged at his betrayed confidence, became angry with all the Poles, completely abandoned his intention to live in Białowieża Forest and moved to Ermenonville near Paris, where a friend offered him a refuge. And that was the end of Rousseau's fantastic idea" (Baliński & Lipiński 1846).

By the middle of the 19th century, BPF and European bison were still the subject of interest for European naturalists but also entered the mainstream of public interest through the publication of popular articles and travel memoirs (see more on this subject in Chapter 4). Any first-hand accounts from the forest or connected with the bison were eagerly published. Such was the case of Dmitry Dolmatov (vel Dalmatov, around 1812–1870 or 1871), forester who served in the Grodno province in the 1840s. Dolmatov, keen supporter of the Russian plan of quick modernization and transformation of BPF into a managed forest, compared the forest to "an abandoned factory in which the expensive machineries and stocks rot and rust, and everything leads only to increase of losses" (Dolmatov 1846). As the direct supervisor of BPF forestry administration, Dolmatov was involved in capturing, rearing and sending two European bison to London Zoo (more on the subject of European bison in the collections of European museums and zoos in Chapter 3). His correspondence with the famous palaeontologist Richard Owen (1804–1892) and introduction by Roderick Impey Murchison, helped him in publishing a note on the process of capturing and observations of behaviour of captive European bison in the "Proceedings of the London Zoological Society" (Dolmatov 1848) and then again in "The Annals and Magazine of Natural History" (Dolmatov 1849B). Despite his far-reaching plans regarding the exploitation of BPF (Samojlik et al. 2020), in the English version of his article Dolmatov observed the unique value of the Forest: "*The day was superb and the sky serene; there was not a breath of wind, and nothing interrupted the calm of nature, so imposing under the majestic dome of the primitive forest*" (Dolmatov 1849B). His article echoed in the European scientific press which, most probably, motivated Dolmatov to prepare a monograph "Natural History of the aurochs or bison and Białowieża Primeval Forest". The manuscript, however, remained unpublished (**Fig. 2.8**).

Owen himself took advantage of European bison pelt and skeleton received by the British Museum from Białowieża in 1845. He studied the differences between the aurochs and the European bison and compared the anatomical features of contemporary and fossil bison and aurochs (Owen 1846, 1848).

In the middle of the 19th century, BPF and European bison appeared in several publications touching upon the subject from diverse perspectives. Franz Müller, professor of animal anatomy and veterinary medicine from the Vienna Veterinary Institute visited BPF in 1851 and published an article containing descriptions of European bison biology (mostly compiled from previous works) with some remarks on the hunt organized for him (Müller 1859).

Jacques Boucher de Perthes (1788–1868), a pioneer of prehistorical archaeology visited BPF in 1859. He was especially keen to observe European bison, an ancient animal he knew only from the remains found during excavations. In connection to the still poor state of knowledge about BPF and in general Lithuanian forests in Western Europe, he noted: "*It is impossible that this land, so poorly known, would not present the naturalist and the seeker of antiquities with a wide field for new discoveries*" (Perthes 1859). Despite being naive from today's perspective, his hope of finding other animals known from palaeontological collections in BPF most probably reflected the spirit of Western naturalists eager to study Białowieża's woods: "*I am convinced that these woods should host creatures whose existence we have already stopped believing in. If only a detachment of pioneers and naturalists was sent here, the ancient fauna of Gaul would appear to us, with all the animals, living equivalents of those whose remains we find in the bogs and forests submerged beneath the waters of the English Channel*" (Perthes 1859).

R. T. Viennot (no information on the author is available) presented a paper on European bison at the meeting of the French Acclimatization Society in Paris, later published as an article (Viennot 1862).

Fig. 2.8. Drawing "Białowieża's aurochs or bison (Bison Europeen)" from Dolmatov's unpublished "History of aurochs or bison and Białowieża Primeval Forest" – author unknown (SARF 1860).

The text is an encyclopaedic and comprehensive compilation of various sources on the bison and BPF, along with corrections of frequently repeated errors. The Acclimatization Society's goal was to acclimatize economically-useful plants and animals in France, which explains the society's interest in BPF as the last refuge of European bison.

In the 1860s until 1880s, BPF was not visited by well-established researchers, but it was still present, together with European bison, in scientific circulation. Descriptions of the Forest and the bison appeared in several publications touching upon different topics. Bobrovskii's description of the Grodno Province published in Russian (Bobrovskii 1863) provided statistical information on the Forest and was focused on management for forestry. Sergei Usov's Russian monograph on European bison (Usov 1865) became the main source of data on European bison for Russian-language naturalists. An entry on BPF was published in 1882 in an encyclopaedic series "Zhivopisnaya Rossiya" [Picturesque Russia], written by Adam Honory Kirkor (1818–1886), archaeologist and Curator of the Museum of Antiquities in Vilnius. Although Kirkor's text was a compilation of already known information, it gave an interesting perspective on an ancient forest seen by a professional interested in antiquities: "*Białowieża Primeval Forest has its history, its legends and the tombs of forefathers protected as sanctuaries. Only the forests of Białowieża can rightly be called virgin, and their inaccessible backwoods and impassable thickets resemble the times of the primitive man. This forest is a valuable monument of the distant past: being there, one travels in thoughts to the times when most of the area currently occupied by Lithuania was covered with such inaccessible, dense forests*" (Kirkor 1882).

Polish zoologist Antoni Wałecki (1815–1897), a curator of the Mineralogical Cabinet of the Main School and the Imperial University of Warsaw, published the article in "Pamiętnik Fizjograficzny" [Physiography Memoir] presenting European bison as an endangered species (Wałecki 1885). Another Polish scholar who devoted an article to BPF was Józef Wacław Siemiradzki (1858–1933), geologist and palaeontologist (Siemiradzki 1885). His description of the Forest, published in the journal "Wszechświat" [The Universe] included its geological composition and remarks on the popular theory of degeneration and inevitable extinction of European bison. In his opinion there was no natural tendency of the species to degenerate and become extinct, he rather blamed poor management and wrong decisions in forestry for the decline in bison numbers (Siemiradzki 1885).

In 1887 and 1888 three botanists, Karol Drymmer, Franciszek Ksawery Błoński and Antoni Ejsmond, visited BPF with the goal to prepare as complete a list as possible of the plants of the forest flora. Their study, published in "Pamiętnik Fizjograficzny" (Błonski et al. 1888, Błoński & Drymmer 1889), included information on 1337 species of plants and fungi from BPF. Despite the fact that their expedition was undertaken in the period of the most repressive, anti-Polish policy of Russia and a period when no Polish university existed in the area annexed by Russia, researchers were able to discover and describe several species that were previously unknown to science.

Besides the two prominent BPF botanical studies mentioned above by Górski and Błonski, Drymmer and Ejsmond, another botanical work involving mosses was conducted by botanist Kazimierz Szafnagel (1858–1923). Szafnagel was the owner of Kuszlany manor in Oszmiana region (Belarus). He was interested in politics, agriculture, and botany, especially mosses (bryophytes). In 1908, he published a book "Zapiski bryologiczne" [Bryological notes], containing reports on his expeditions in 1882–1885, during which he collected mosses in different locations in the territories of the former Grand Duchy of Lithuania (Szafnagel 1908). The book contains a separate chapter on BPF. Szafnagel's study area covered the northeastern corner of the Forest, nowadays within Białowieża National Park in the Polish part of BPF (**Fig. 2.9**). At the start of his excursion, Szafnagel also visited the Eastern small part of the Forest, nowadays in Belarus. Szafnagel explained that the localities were chosen on the basis of tree species diversity demonstrating the general nature of the local flora. His expedition yielded 70 species of bryophytes that he added to the general description of BPF. These species are cited by Błoński, Drymmer and Ejsmond (1888), and at present are stored in Vilnius University Herbarium.

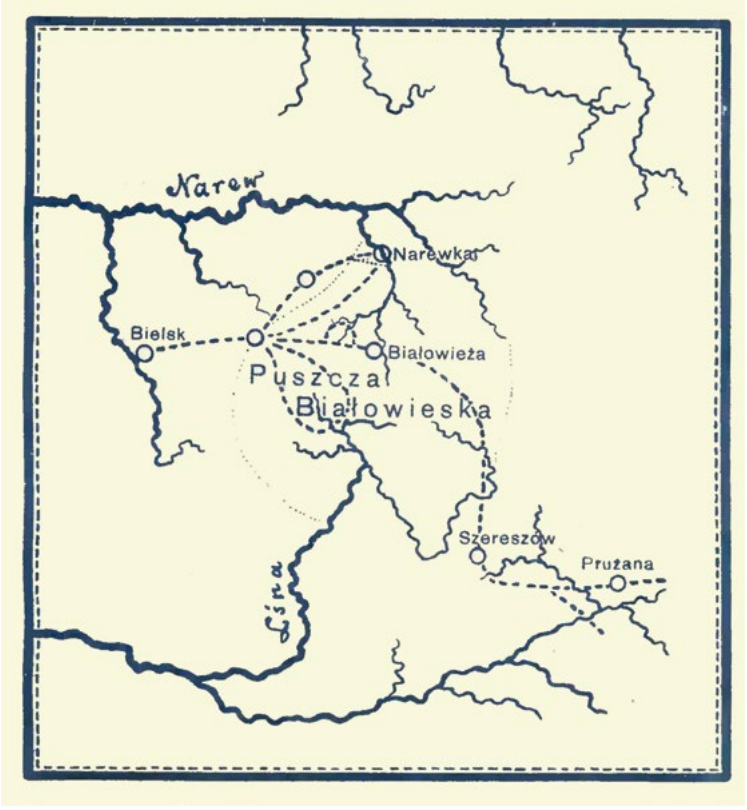


Fig. 2.9. Map of Kazimierz Szafnagel's botanical expedition to BPF in 1885 (Szafnagel 1908).

Polish botanist Józef Paczoski (1864–1942) undertook several visits to BPF in the 1890s, then returned to BPF in the 1920s to take up the position of a scientific director of Reserve Forest District (later Białowieża National Park). Inspired by traditional names and descriptions of different forest habitats deeply rooted in the regional history (names like *hrud*, *bór* or *gaj* are contained in historical documents, e.g. the inventory of royal forests from the 16th century; Revizya 1559), Paczoski included them in the new discipline of science–phytosociology. He himself recognized the legacy of past centuries: "A *certain notion about the types of plant cover existed for ages. Even the wild hunter tribes had to be aware of this as game, the basis of their existence, is connected with certain types of vegetation. The notion of bór, grud and oles dates back at least three hundred years in Białowieża*" (Paczoski 1927B). The new discipline, being a mixture of vegetation studies and plant geography, attracted the attention of a growing number of naturalists (Paczoski 1896, Maycock 1967, Daszkiewicz 2004). Paczoski produced a series of papers devoted to the phytosociology of BPF and wider geographical scope, and eventually published his opus magnum, the monograph "Lasy Białowieży" [Forests of Białowieża] (Paczoski 1930). In his book, Paczoski called BPF the least anthropogenically disturbed lowland forest of Europe, in which natural, "primeval" forest communities along with the natural dynamics of their development and succession were preserved (Paczoski 1930).

European bison fell into the scope of interest for naturalists, in connection with the grand discussion that occupied the attention of the natural sciences: are prehistoric species doomed to extinction and is there a way to preserve them from inevitable demise? Connected with that was the theory about species degeneration, which European bison was believed to suffer from. Presence of European bison in the scientific debate resulted in visits by naturalists and travellers to BPF with the purpose of seeing (and quite often also killing) these animals.

Sir Algernon Heber-Percy (1845–1911), a traveller and hunter, published a description of his travel to BPF and hunt organized there for him in 1879 (Heber Percy 1894). Both the text and drawings made by known illustrator Charles Whymper (1853–1941) (**Fig. 2.10**) that accompanied it, undoubtedly helped to popularize knowledge on European bison and BPF in Victorian England.

Edward North Buxton (1840–1924), known for his engagement in the Society for the Preservation of the Wild Fauna of the British Empire, visited BPF specifically to observe European bison and to obtain photographs of them. He left a description of his visit and the image of Forest at the end of the 19th century: "*With the exception of the meadows which border the latter, and a few clearances for cultivation round small villages, there are no open spaces: consequently although the timber, which consists mainly of oak, elm, birch, spruce, and fir, is very fine, the forest is tame and wanting in variety. This monotony is enhanced by the unfortunate practice of removing all wind falls, a most short-sighted policy, as I think, because nothing so assists the warmth, shelter, and sense of security of a forest, for wild animals, as fallen timber, through the branches of which a tangle of wild growth quickly penetrates and forms a natural screen*" (Buxton 1899).

Fig. 2.10. Charles Whymper's drawing of two European bison heads – trophies of Algernon Heber-Percy's hunt in BPF in 1879, published in 1894 (Heber Percy 1894).

Richard Lydekker (1849–1915), palaeozoologist and author of books on natural history, included descriptions of European bison in his book "The great and small game of Europe Western and northern Asia and America. Their distribution, habits and structure" (Lydekker 1901), and visited BPF himself in 1907 (Samojlik et al. 2020).

In 1905, Nikolai Mikhailovich Kulagin (1860–1941), a professor at the Moscow Agricultural Institute organized a scientific expedition to BPF for a comprehensive study of European bison. The team of researchers included professors from St. Petersburg and Moscow who made several shorter trips to the Forest and two researchers working in BPF permanently for two and a half years (1906–1908): an entomologist Alexander Mordvilko (1867–1938) and a veterinarian Konrad Wróblewski (1864–1945).

Fig. 2.11. The cover of Konrad Wróblewski's monograph of European bison, summarizing his work in BPF in 1906–1908, published in Polish in 1927 (Wróblewski 1927).

Reports on the progress of the expedition and its scientific achievements in the field of bison reproduction, sex and age structure, diet, influence on vegetation and competition with other ungulates, causes of death, parasites and diseases were published to the great interest of the scientific community (Kulagin 1919, 1928; Ognev 1926). Especially the works by Wróblewski (1908A, 1908B, 1912A, 1912B, 1927), the first specialist to professionally study European bison food preferences and causes of death including parasites, were important from the point of view of erasing "white spots" in the knowledge base on the species. One of the blood parasites he discovered was named after him – *Trypanosoma wrublewskii* (Kingston et al. 1992, Wróblewski 1908A, 1908B, 1909, 1912A). He demonstrated that the European bison diet was comprised mainly of grasses which confirmed little food competition with red deer, preferring shoots of trees and shrubs (Wróblewski 1912B). Wróblewski collected his findings in a monograph (Wróblewski 1927) that served as the most comprehensive source of knowledge on the biology and ecology of the European bison population before its extinction in BPF (**Fig. 2.11**); this work is still valid and relevant today (Krasińska & Krasiński 2013, Karbowiak et al. 2014). The general conclusion of Kulagin's expedition and Wróblewski's work refuted the prevailing notion of 19th-century science that European bison was doomed to extinction due to degeneration of the species. Members of the expedition were not able to find any signs of degeneration and ascribed the decline in its population to anthropogenic pressure and ecological reasons.

Before the outbreak of WWI, there were two more monographs published that played an important role in collecting information about BPF and communicating it to wider community, both scientific and general – yet only in Russian-language circles.

The first was "Kharakteristika Belovezhskoi Pushchi i istoricheskiya o nei dannya" [Description of Białowieża Forest and its history], published in 1902–1903 by Nestor Genko (1839–1904), author of forestry handbooks and the chief of the forestry taxation team that prepared the forest management plan for BPF in 1889. The book contains a summary of this and previous management plans and to this day remains an important source of knowledge on the past forest environment and its management (Genko 1903).

The second monograph, published in 1903, was entitled "Belovezhskaya Pushcha. Ee istoricheskii ocherk, sovremennoe okhotniche khozaistvo i vysochaishe okhoty v Pushche" [Białowieża Forest. Its historical description, contemporary game management and monarchical hunts in the forest] by Georgii Karcov (1861–1931). To this day, it remains the biggest (also in the meaning of size and weight) monograph of BPF (**Fig. 2.12**). It contains description of the history of BPF's management, information on its state at the turn of the 20th century, details on European bison population, including annual bison counts and amount of additional fodder delivered, and plethora of other particulars, for example on poaching, eradication of predators, bison enclosure inside the Forest, etc. (Karcov 1903). The monograph has many flaws, especially in the historical part, is burdened with ideological bias (e.g., in the assessment of the

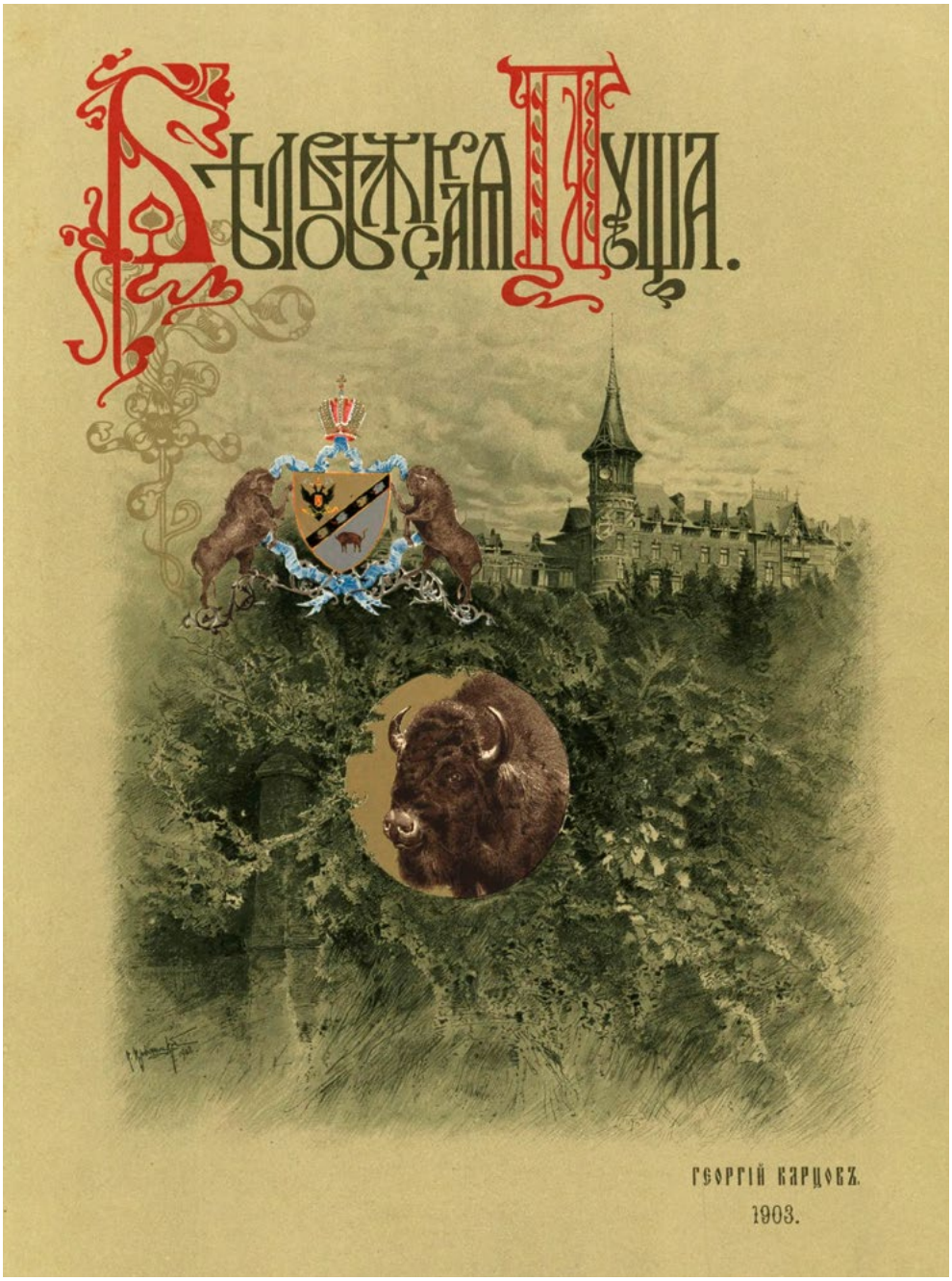


Fig. 2.12. The title page of Karcov's monograph "Białowieża Forest. Its historical description, contemporary game management and monarchical hunts in the forest" (Karcov 1903).

royal period in the history of BPF), and lacks any historical research methodology, despite using many archival documents. Despite that, it remains an important starting point in many studies on the history of the Forest and animal populations inhabiting it (e.g. Samojlik et al. 2019A, 2020).

The number of scientific publications devoted to European bison and BPF evidenced that both the Forest, which still enjoyed the fame of extraordinary wilderness and a place governed by nature rather than forestry, and its ancient dweller, bison, were topics of high interest to European naturalists. This was yet only one side of the coin – the other was an actual engagement of scientific circles in the action of European bison rescue. The outbreak of WWI was a crucial caesura for the entire continent and the Forest as well. The period of imperial hunting ground, relatively undisturbed by forestry, with European bison being protected and conserved as the most valuable asset, ended abruptly. The German occupation of the Forest from Summer 1915 led to rapid decline and eventual extermination of Białowieża's European bison population (in 1919) and introduced, for the first time in BPF's history, massive, industrial-scale, wasteful timber extraction. Information about the extinction of the last member of European megafauna reached scientific circles in Western Europe. After confirmation of the event, the International Society for the Protection of the European Bison was created in 1923 and an international initiative of bison restoration begun (Krasińska & Krasiński 2013, de Bont 2017).

Chapter 3.

The heritage of Białowieża Primeval Forest in European nature museums

The gradual rise of prominence of Białowieża Primeval Forest (BPF) as a place and object of scientific studies throughout the 18th and especially the 19th century was connected with another process: the growing value of animal and plant specimens originating from Białowieża in European natural collections. It was especially visible in the case of European bison, but can be traced also in examples of much less spectacular objects, for example herbariums.

3.1. European bison specimens in scientific collections and museums

The last remaining free-living population of lowland European bison was one of the strongest "magnets" attracting the attention of the scientific world to Białowieża Primeval Forest (BPF) already in the 18th century (see chapter 2 for more on this subject). Europe's largest land mammal was already, in the 15th-16th centuries, a natural curiosity and highly valued gift from the primeval forests of the Grand Duchy of Lithuania to western rulers. In 1416, a live bison was sent to Sigismund of Luxemburg, the Holy Roman Emperor, by Polish king and Lithuanian grand duke Władysław Jagiełło. This started a tradition that lasted for centuries. Pope Leo X asked for a stuffed bison from Lithuanian forests, and for this occasion Mikołaj Hussowski wrote a poem to describe the species and its habitat (Hussowski 1523). Unfortunately, the pope died in 1521, before the bison was sent. In 1568, Jagiełło's great-grandson, Zygmunt August, sent several live European bison to the Holy Roman Emperor Maximilian II (Samojlik & Jędrzejewska 2010). Prince Józef Poniatowski hunted bison in BPF in 1791, as the witness recalled, "*for royal gifts to some Swedish, Danish, Saxon, Bavarian and I don't remember which natural cabinets*" (Żarnowski 1927). With the

shrinkage of the species' range, such a gift became gradually more valuable. Legally protected as a member of *animalia superiora* group (in the Middle Ages, the game was split into two categories: *animalia parva* or *minuta*, smaller animals like hares or roe deer that were usually not under protection, and *animalia magna* or *superiora*, a group of big game – European bison, aurochs, bear, lynx, moose and red deer – reserved for royal or at least noble hunts (Pietruszka & Piekalski 2021) and arguably a regional symbol or icon, European bison survived the collapse of the Commonwealth of Both Nations in 1795. The chaotic period of pillaging newly annexed land by the Russian administration, which resulted in complete deforestation of one of the thirteen forest districts of BPF, could have led to the extinction of bison as well. Especially considering the fact that the level of knowledge about the natural treasures that fell into the hands of its new owners was extremely low: the correspondence between the administrator of the newly annexed provinces, Prince Nikolai Repnin, and Count Pyotr Rumyantsev, who received part of the forest referred to European bison as a "wild cow" (Hedemann 1939). The level of respect paid to the ancient forest itself was equally low: "*the clank of axes and reports of bison flushed out from there meander in the archival sources from the beginning of the 19th century*" (Hedemann 1939). Fortunately, the protection of European bison and the forest as its habitat was restored by two Tsar's decrees in 1802 and 1803 (Hedemann 1931) and the bison once again became the object of dreams – this time not of crowned heads but rather zoological collections, museums and universities.

In the beginning of the 19th century, naturalists were interested in European bison specimens for several reasons. Not only did the rarity of such showpieces make them so sought after, but especially the need to solve the mystery of the identity of European bison and aurochs (the ancestor of domestic cattle). The discussion, which carried on throughout nearly the entire 19th century, was based on confusion in the descriptions of those two bovines. The detailed study of European bison skeletons from Versailles and Schönbrunn by Georges Cuvier (Cuvier 1812) did not resolve all doubts and new studies were deemed much needed.

Soon, requests for permission to hunt the bison started to reach the Russian administration in Sankt Petersburg. One of the first came in 1803 from Vilnius General-Governor Beningsen, who wanted to obtain bison for research and show purposes for Vilnius University. Tsar Alexander I ordered to wait for the animal's natural death and then give the skeleton and pelt to the museum (Sławiński 1931). The Napoleonic wars happening in this period were also most probably used as an opportunity for obtaining Białowieża's bison. European conquests of Napoleon's army were accompanied by the confiscation of natural history collections in the occupied countries, and, for example, a skeleton of a European bison named Miska (Michka) from Vienna was acquired in this way (Daszkiewicz & Samojlik 2014). Among specimens assembled in the Museum of the Jardin des Plantes [popular name of the National Museum of Natural History in Paris] there is also a stuffed European bison listed in the inventory as "female from Lithuania. Emperor Napoleon" (**Fig. 3.1**). Given the fact that during Napoleonic times the last population of bison surviving in Lithuania was the one in

BPF, the bison had to be sent to the museum from Białowieża. A stay of Napoleon's army near the Forest during the 1812 campaign could have given naturalists accompanying the French army an occasion to obtain this specimen (Daszkiewicz & Samojlik 2014).

Fig. 3.1. European bison in the collection of the Muséum National d'Histoire Naturelle, Paris, described as "Female from Lithuania. Emperor Napoleon" (Photo by Piotr Daszkiewicz).

In 1819, Ludwig Bojanus, professor of Vilnius University, argued that it is essential to provide the university with bison specimens – his request was fulfilled and in 1821 a male and a female European bison were killed during a specially organized hunt. This resulted in a detailed study published by Bojanus in 1826, in which he described two species of extinct bovines: the aurochs, *Bos primigenius* Bojanus and the steppe bison, *Bison priscus* (Bojanus 1825). However, the bison-aurochs dispute continued until 1878, when August Wrześniowski finally proved the taxonomic distinctiveness of the two bovines (Wrześniowski 1878).

In 1823, three European bison were killed in BPF: two for the museum of Warsaw's Forestry School (Brincken 1826) and one for the Sankt Petersburg's Kunstkamera (Bajko 2004). After the death of Alexander I in 1825, the requests of universities and natural science museums for European bison skeletons, pelts, or entire animals started to receive even more positive response, and almost every application from

museums was satisfied (Samojlik et al. 2017, Fedotova et al. 2018). Nevertheless, obtaining a permit for a specimen was a complicated administrative task, requiring an extensive exchange of correspondence and sometimes a personal trip to BPF by interested naturalists, organizing a hunt, processing pelt and bones, and eventually transporting the massive package back to a museum. This was the case in 1826, when Feliks Jarocki hunted two bison for the Zoological Cabinet of the Royal University of Warsaw (Daszkiewicz et al. 2004).

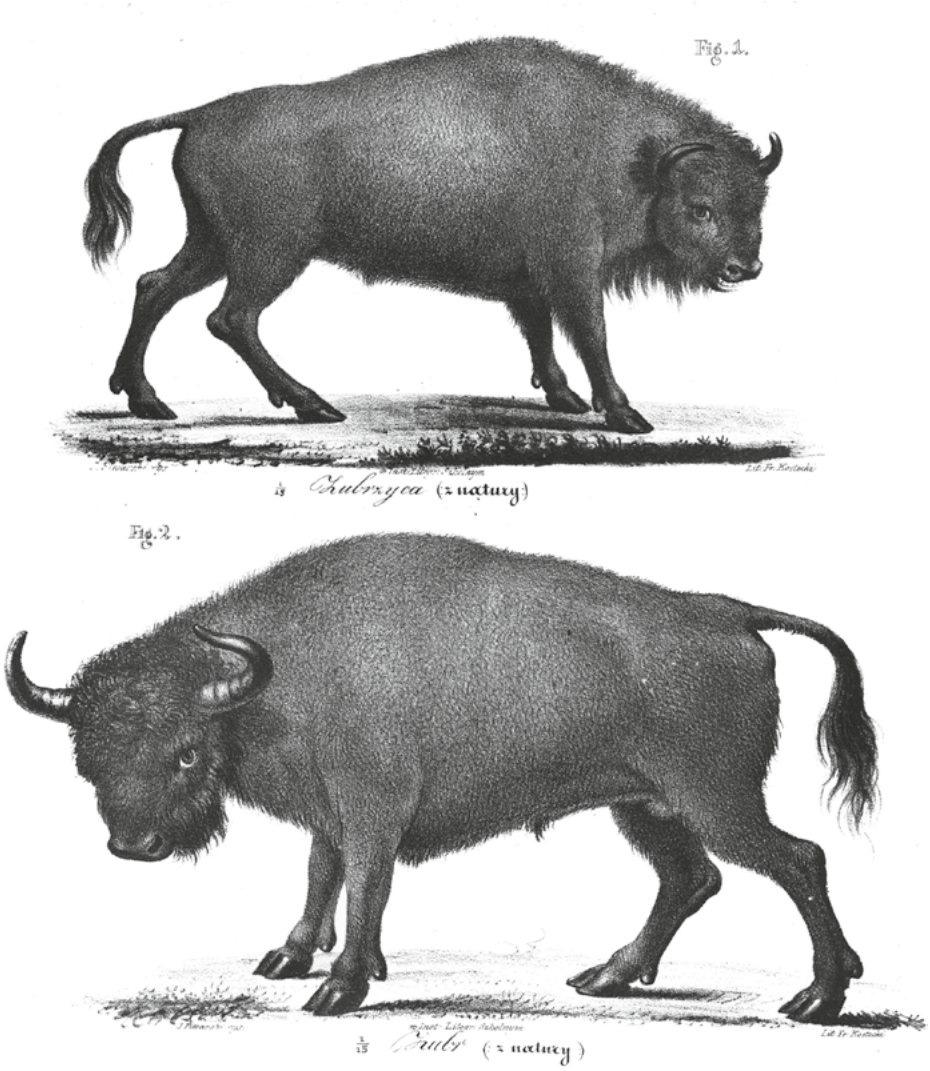


Fig. 3.2. Compilation of two drawings signed by Jan Feliks Piwarski: „European bison female (from nature)" and „European bison male (from nature)", both published in Jarocki's book (Jarocki 1830).

These bison were drawn by Jan Feliks Piwarski (1794–1859), a painter educated at the Imperial Drawing Cabinet in Vienna. There is no evidence that Piwarski visited Białowieża with Jarocki, it is therefore most likely that the artist drew the bison for Jarocki's book not from nature, but using stuffed specimens brought back to the Zoological Cabinet (**Fig. 3.2**).

Interestingly, an illustration published in 1869 in the popular Polish weekly "Tygodnik Ilustrowany" (Taczanowski 1869) provides an opportunity to witness how bison from Białowieża were displayed in the cabinet itself. They were located in the very centre of the main hall alongside red deer, wild boar, moose, possibly also lynx – all species present in BPF, with more exotic animals like a lion, big snakes, an elephant and two giraffes placed in less prominent parts of the hall (**Fig. 3.3**).

Fig. 3.3. European bison from Białowieża in the centre of an exhibition at the Zoological Cabinet of the Royal University of Warsaw. Drawing by Wojciech Gerson (Taczanowski 1869).

A detailed description of the process of acquiring two bison in 1830 by the Vilnius University indicates that the decision was made at the highest level of the Russian administration. The correspondence between the university and officials lasted several months and was made up in total of about 20 letters sent both ways (Sławiński 1931).

In 1847, the bureaucratic procedures for obtaining European bison specimens were formalized and streamlined: naturalists from Russia were to apply to the Ministry of Education, who then applied to the Forestry Department of the Ministry of State Domains (the ministry that supervised BPF). The Minister of State Domains was then obliged to file the request to the tsar. In case of a European university or museum, the procedure was different: these institutions had to apply to a respective ambassador in Sankt Petersburg first. The ambassador then wrote to the Minister of Foreign Affairs, who, in turn, filed the application to the Minister of State Domains, at which point the two paths met. In the case the tsar approved the request, the decision was sent down the same channels and, parallelly, the local governor and forest administration were informed. The latter was responsible for the organization of a usually complicated and expensive hunt, involving not only the forestry service but also hundreds of local people as beaters. Since the processing of the pelt and bones was a complicated task, every museum had to secure an experienced taxidermist to accompany the hunting party (Fedotova et al. 2018).

In 1847, a request for three bison was sent from the Zoological Museum of the Imperial Academy of Science in Sankt Petersburg. Obtaining a bison specimen was part of a plan to expand the collection of the museum devised by its head, Johann Brandt (1802–1879). One of the planned goals was adding native animals, which were poorly represented in the museum, to the collection. At least one bison for the museum was shot by one of the most prominent naturalists in the Russian Empire in the 19th century, Alexander von Middendorff (1815–1894) (Fedotova et al. 2018). Middendorff was a keen zoologist known for his expedition to Siberia (1843–1845) and observations of the effects of permafrost on the spread of animals and plants.

The first Tsar's hunt organized in BPF in October 1860 for Alexander II and his entourage served as an occasion to reinforce the diplomatic connections (based on family ties) with German princes. Since there were in total 28 bison killed, the hunt could have served as an opportunity to fulfil pending requests for European bison specimens from Western European museums. Such applications were filed from the museums in Jena, Giessen, Stockholm, Dresden, Waldau, Hannover and Strasbourg (Fedotova et al. 2018). Pamphil Ivanov, a taxidermist from the Zoological Museum in Sankt Petersburg, was sent to BPF two weeks prior to the event but eventually was overwhelmed with the amount of work and lack of preparation from the administration (e.g., some of the bison carcasses deteriorated as no proper cold storage was provided). The packages containing pelts and skeletons were addressed to the Zoological Museum of the Imperial Academy of Sciences, Russian universities (Moscow, Kharkov, Kiev, and Dorpat), the Russian Imperial Court, German princes, and additionally for Freiburg University, but, due to a mistake, all seven foreign packages were sent to Freiburg. It took over a year to untangle this situation and deliver the bison specimens to their proper destinations (Fedotova et al. 2018). Only the museum in Strasbourg, which ranked among the most important scientific collections in Europe in the 19th century, apparently did not receive the bison in due time – as indicated by the prolonged correspondence on this matter following the tsar's hunt

and lasting until 1864 (Samojlik et al. 2017). However, Karcov (1903) indicated that a bison was in fact shot for Strasbourg in 1865, yet did not reach its destination in France that year, maybe for strictly political reasons. The Polish January Uprising against Russian rule lasted until the autumn of 1864, and the subsequent wave of pro-Polish sympathies in France cooled political relations between Russia and France over the next few years. Interestingly, the personal communication from the museum confirmed that it possesses 19th-century European bison exhibits, yet is unable to trace their origin and date of arrival (Daszkiewicz, personal communication). It is therefore possible that the Strasbourg museum received its bison after the thawing of political relations.

Natural history cabinets and museums underwent a rapid development in the middle of the 19th century: progressing colonization and organization of numerous scientific expeditions provided them with a flood of new specimens, which also became an object of intensified worldwide trade. Growing collections were gradually better organized thanks to developments in systematics. The technical side of creating exhibits from dead animals also witnessed modernization, allowing presentations of animals in their lifelike forms. Furthermore, new museum buildings were planned to specifically address both scientific and public needs, which meant showing species in their natural habitats, surrounded with fitting plants and close to other species that inhabit the same environments. Usually, this also meant that new collections required more than one specimen of a given species. The full representation of the species requires an entire set, adult male and female, juvenile and elderly animals, preferably also aberrant ones. By the late 19th century, museums sought not only large impressive males, but all available specimens – especially in the case of animals so rare and carefully protected as Białowieża's European bison (Fedotova et al. 2018).

After the first tsar's hunt in BPF, such endeavours became one of the favourite leisure activities of the imperial family. Apart from the big numbers of bison shot during each monarchical hunt in BPF (e.g., 37 European bison killed during the tsar's hunt in 1897, 40 in 1900; Karcov 1903), since 1900 a practice of regular culling of animals considered "useless for reproduction" was introduced by the game administration. There were also animals dead from natural causes, quickly discovered by forest guards and other forestry workers. All the above meant that in the second half of the 19th and beginning of the 20th century, BPF administration was able to respond positively to every request for European bison specimens, even from smaller institutions like scientific cabinets of secondary schools (Fedotova et al. 2018). Another opportunity to provide specimens for scientific purposes, especially for Russian institutions, was the special research expedition led by Nikolay Kulagin in 1906–1908 (see Chapter 2). During their research, zoologists collected over 100 dead European bison, from which skeletons, skulls and pelts were sent to the Zoological Museum of the Imperial Academy of Sciences in Sankt Petersburg and Zoological Museum of Moscow University, contributing to the further progress of research on the species (Fedotova et al. 2018).

Since the 1890s, the administration of BPF made special efforts to satisfy museums' requests for bison pelts or skeletons, and in 1913, it was decided to immediately process suitable bison carcasses and "donate them to educational institutions", even without any formal requests. High-ranked hunts with political backgrounds also happened during this period, for example, the hunt of Albert I, the Prince of Monaco, in 1913. Albert I shot two bison in BPF – one of which was then offered by him to the Institute of Human Palaeontology (Institut de Paléontologie Humaine) in Paris, where it remained until WWII (**Fig. 3.4**). In 1941, it was moved to the National Museum of Natural History in Paris. The second bison was exhibited in the prince's private apartments, then in Albert I High School in Monaco, and is currently found in the Museum of Prehistoric Anthropology in Monaco.

Fig. 3.4. Stuffed European bison killed by Prince of Monaco Albert I in BPF in 1913, exhibited in the library of the Institute of Human Palaeontology in Paris between 1921–1941. The anonymous photograph was most probably taken in 1921/1922 (after Hurel & Dubourg 2007).

Eventually, before the outbreak of WWI, European bison was available for public viewing in all major European natural history museums and, thanks to the action of live-capturing and transporting animals to different parts of the continent, in zoological gardens too (Fedotova et al. 2018).

A compilation of known dates of European bison hunts in BPF in the period 1811–1914 yields a total number of 209 animals killed, of which 153 were hunted for "recreational" purposes (by the tsar, his family and high-ranking individuals who had received special permission) and 56 shot strictly for scientific purposes (Samojlik et al. 2017). Additionally, 72 bison were caught alive to be transported to zoos or breeding centres (or for experiments with cross-breeding with domestic cattle, as in the case of Walicki's efforts in the 1860s, see Daszkiewicz et al. 2012). The impact of this anthropogenic offtake of specimens on the European bison population was relatively small, especially considering the counteracting effect of supplementary feeding provided by the administration of BPF almost in the entire 19th and beginning of the 20th century (Samojlik et al. 2019A). The actual impact of this activity should however be considered in another way. The hunting and capturing of animals, resulting in the wide dispatch of European bison for exhibits and live specimens, made the species itself and the place of its occurrence, BPF, increasingly recognised not only by European naturalists, but also by the wider European public visiting museums, zoos and reading accounts of expeditions to Białowieża. This "familiarity" with European bison, especially among the public in Western European countries, may have played a role in their active participation in the species restoration campaign after extinction of bison in 1919 (de Bont 2017). Animals captured alive in BPF and transported to several zoological gardens and animal breeding centres throughout Europe became the source of hope for the species restitution, fulfilled when the European bison was restored in Białowieża in 1929 (Krasiński & Krasińska 2013).

3.2. Botanical specimens from BPF

The first scientific description of flora of BPF published in 1829 by Stanisław Batys Górski (Górski 1829), had a significant impact on the dissemination of knowledge about the Forest and its most famous inhabitant, the European bison. The critical evaluation of the plant species present in BPF based on field surveys allowed to reject a very popular hypothesis that European bison survived only in BPF because of some endemic plant that constitutes the major part of the bison's diet (see Chapter 2 for further details). But Górski's impact was connected also with the entire herbarium he brought from Białowieża, which was and still is held by the Herbarium of Vilnius University. The survey conducted by the authors (Ričkienė et al. 2021A) led to the discovery of 67 plant specimens from BPF dated 1823, 1824, 1826 and 1844, with the majority collected in 1826. Among the specimens collected by Górski, there were rare and currently protected species from BPF, including bellflower *Campanula lilifolia* L. (*Adenophora*), yew *Taxus baccata* L., silver fir *Abies alba* L. (indicated by Górski as *Pinus picea* Mill.). The latter was evaluated as a feature of primeval forest in BPF already by Paczoski (Paczoski 1930, Marozau et al. 2021). According to the information on specimen labels, all of them were from "*magna sylva Bialowiezka puscza*" (**Fig. 3.5** and **3.6**).

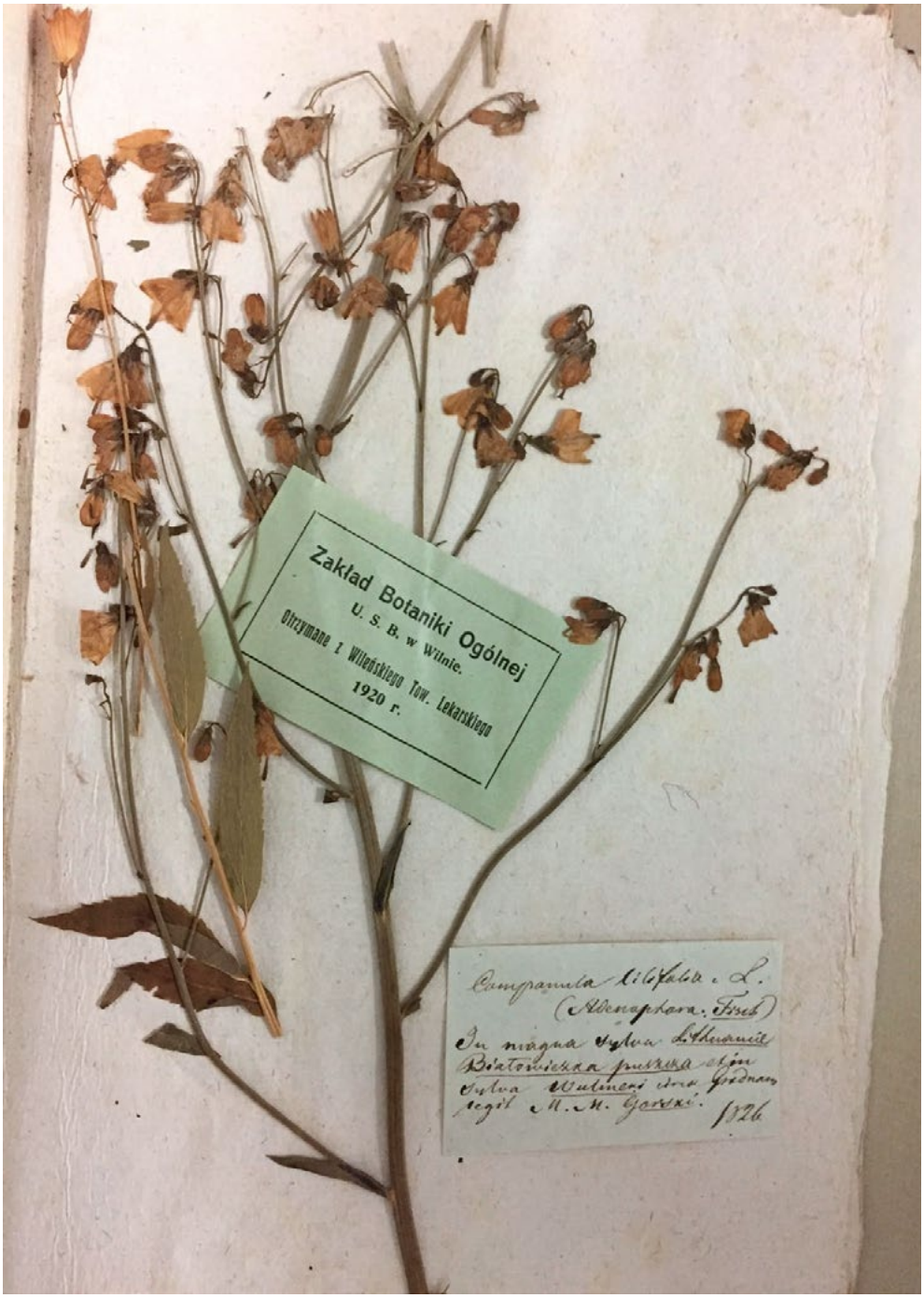


Fig. 3.5. Specimen of bellflower *Campanula lilifolia* L. (*Adenophora*) with Stanisław Batys Górski's name on the label, indicating the origin of the plant: „*In magna sylva Lithuaniae Białowieska puscza*" 1826. From the collection of Vilnius University Herbarium.

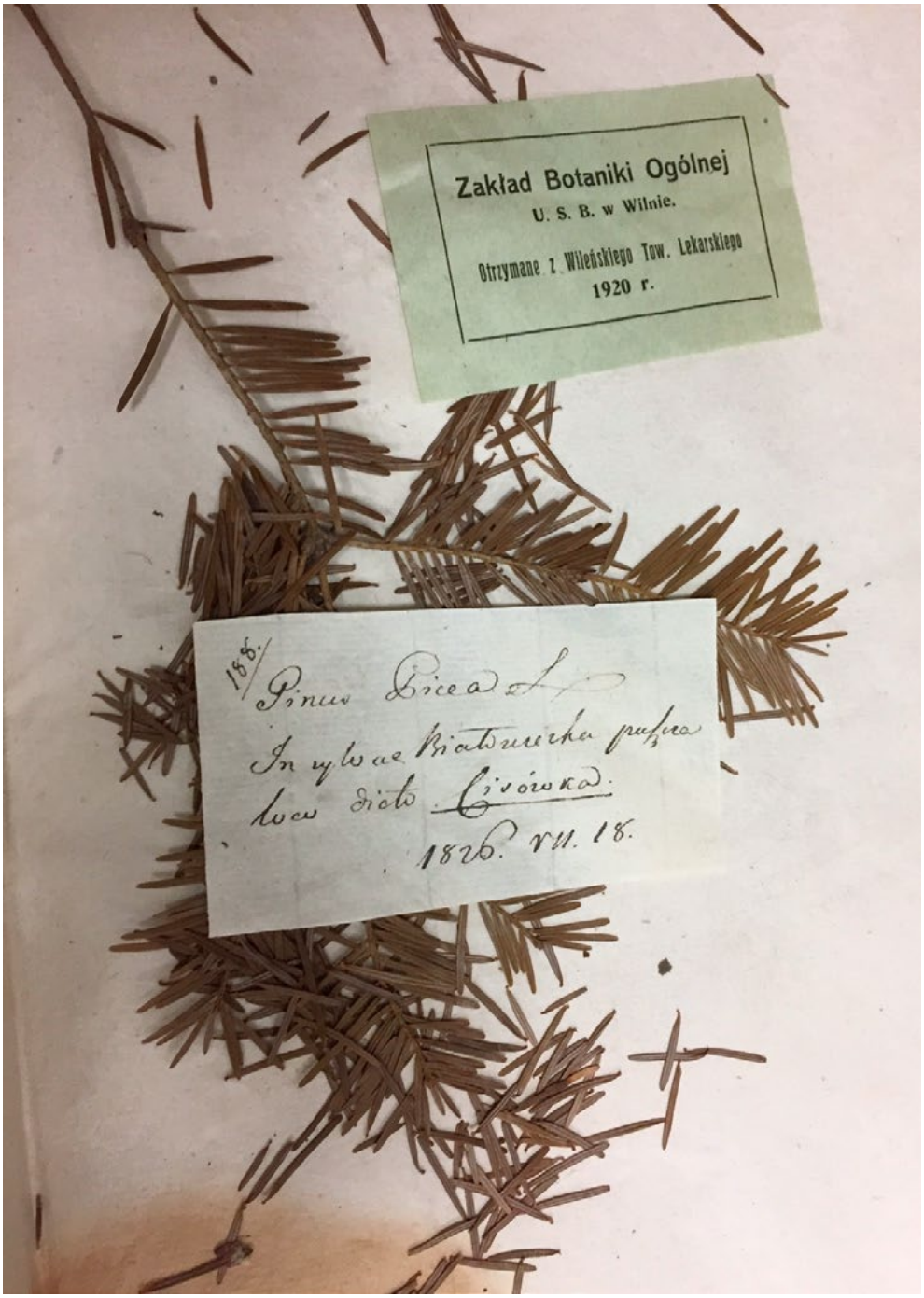


Fig. 3.6. Specimen of silver fir *Abies alba* L. *(Pinus picea)* with Stanisław Batys Górski's handwritten label, indicating the origin of the plant: „*In sylva Białowieska puscza dicto Cicówka*" and the date of collection – 18 July 1826. From the collection of Vilnius University Herbarium.

All 67 labels were written in black ink in Górski's handwriting style, compared to his manuscripts (see **Fig. 2.3**). Some of the labels even included the botanist's signature: "S. B. G." or "M. M. Gorski" (Ričkienė et al. 2021A). Górski's work in the field of botany was widely appreciated by botanists and historians of science (Błoński et al. 1888, Błoński and Drymmer 1889, Grębecka 1998, Galinis 1968A, 1968B, Hryniewiecki 1952, Mowszowicz 1957, 1973, Sławiński 1922). His herbarium, also stored in the Vilnius University Herbarium, is also a valuable milestone in the natural history and history of science and constitutes a heritage of the common Polish-Lithuanian history.

Vilnius University herbarium also holds K. Szafnagel's collection of bryophytes. The collection includes 17 specimens (11 species) of bryophytes from BPF collected in May 1885 (Jukonienė et al. 2022). Szafnagel's herbarium specimens greatly supplement the heritage of natural history of BPF as well.

Specimens originating from BPF that found their way to European natural history museums and collections in the course of the 19th century contributed not only to the dissemination of knowledge and rise of popularity of European bison and the Forest itself. With the development of research methods, these collections, especially containing European bison remains, from obscure to well-known ones, became the object of interest of science in the first decades of the 21st century. Samples of bones of European bison from collections across Europe were recently used to study environmental and dietary adaptations of the species based on stable carbon and nitrogen isotopic ratios (Hofman-Kamińska et al. 2018A, 2019). Molar teeth of European bison were scanned and their microwear was analysed to supplement our knowledge on foraging habitats of the species (Hofman-Kamińska et al. 2018B). Collagen extracted from bones from various collections was used for DNA analysis of population processes preceding the species extinction in the wild (Węcek et al. 1017). Also morphological studies were done based on European bison specimens scattered throughout Europe, for example, measurements of bison horns from historical collections and their comparison with modern population (Krasińska et al. 2013). Undoubtedly, the list of studies possible thanks to collections of specimens from BPF, with special emphasis on European bison, will grow.

Chapter 4.

How public perception of Białowieża Primeval Forest evolved in the 19th-early 20th century

Recognition of BPF as primeval forest among European naturalists, a rising number of scientific publications devoted to the Forest and European bison, and a flood of requests for bison specimens from European museums and zoological collections were only part of the process of building BPF's status. The other side of the coin was public reception of this rising prominence of BPF and European bison through popular writings like newspaper and journal articles and – following that – the general perception, knowledge and attitude towards the primeval forest and its ancient beast. We have surveyed Polish, French and Russian popular science, hunting and nature journals in search of descriptions of the Forest and mentions of European bison. We have also scrutinized newspaper and journals clippings, found at the Wroblewski Library of the Lithuanian Academy of Sciences, and devoted to BPF from the middle of the 19th to the beginning of the 20th century. This collection represents the general knowledge and perception of BPF in contemporary Lithuania.

4.1. BPF and European bison in Polish journals of the 19th-early 20th century

We surveyed archival issues of "Echa Leśne" [Echoes of the Forest], "Łowiec Polski" [Polish Hunter], "Ochrona Przyrody" [Nature Conservation], "Przegląd Myśliwski i Łowiectwo Polskie" [Hunter's Digest and Polish Venery], as well as other journals of a more general scope: "Biblioteka Warszawska" [Warsaw Library], "Głos" [The Voice], "Kłosy" [Ear of Grain], "Świat" [The World], "Tygodnik Ilustrowany" [Illustrated

Weekly], "Wszechświat" [The Universe], and "Ziemia" [The Earth]. Below, their short descriptions are presented in chronological order. Later in the chapter presentation of their content is split in two parts: firstly, "Echa Leśne", "Łowiec Polski", "Ochrona Przyrody" and "Przegląd Myśliwski i Łowiectwo Polskie" are discussed in more detail, then all other journals are grouped under "Other journals" header.

"**Łowiec Polski**" [Polish Hunter] is the oldest Polish hunting magazine, with the first issue published in 1899 with 1500 copies (later increasing to 5000 in 1914). The founder and first editor-in-chief of the magazine was Jan Sztolcman, a naturalist best known for his crucial role in saving the European bison after the species' extinction in 1919. The popularity and importance of the journal was determined by the rank of its contributors – among them were some of the best naturalists of the period: Janusz Domaniewski, Kazimierz Wodzicki, Jan Żabiński, Janusz Grochmalicki, Edward Lubicz Niezabitowski, Jan Karpiński, Kazimierz Szczerkowski or Wacław Roszkowski (Daszkiewicz et al. 2018). Fittingly, the subject matter undertaken in papers published in "Łowiec Polski" was much broader than just strictly hunting.

Established in 1920, "**Ochrona Przyrody**" [Nature Conservation] was the official press organ of the State Council for Nature Protection in Poland. It published texts of a very high professional standard. At the dawn of independence, Poland had some excellent naturalists, mainly from the former Austrian annexation which was not a surprise given the fact that unlike in lands annexed by Russia or Prussia, the Austrian partition allowed Polish academic centres to function relatively normally.

"**Przegląd Myśliwski i Łowiectwo Polskie**" [Hunter's Digest and Polish Venery] was published in Warsaw for only four years (1923–1926). Its founder and editor-in-chief was Julian Ejsmond, a writer, historian and hunter. Although the title of the journal associated it strictly with hunting, it was abundant with articles on nature conservation, as stated by the editor-in-chief: "*The most beautiful achievement of modern hunting is the understanding of the necessity of nature protection by all hunters*" (Ejsmond 1924B).

The first issue of "**Echa Leśne**" [Echoes of the Forest] was published in 1924 as „Popularne pismo Leśne. Miesięcznik wydawany przez Związek Zawodowy Leśników w Rzeczypospolitej Polskiej" [Popular Forestry Magazine, a journal published by the foresters union in the Republic of Poland]. As such, the journal was associated with state authorities and administration, yet it consistently published articles opposing the government's plans and decisions concerning the exploitation of Polish nature or persecution of nature conservationists like Władysław Szafer or Józef Paczoski. The journal was published until 1939, and in 1991 its publishing was resumed by State Forests.

"**Biblioteka Warszawska**" [Warsaw Library], published in Warsaw between 1841 and 1914, focused on literature and popular science, playing an important role in educating Polish society during the period of russification and destruction of Polish schooling.

"**Tygodnik Ilustrowany**" [Illustrated Weekly] was a Polish weekly published in Warsaw in the period 1859–1939 (the last issue was published three days after the

German invasion of Poland). It was one of the most widely read and popular magazines of the second half of the 19th century, touching on artistic, cultural, historical and social issues. The magazine was established by Józef Unger (1817–1874) and in 1909 reached a circulation of 2000 copies. The group of collaborators on the magazine included prominent Polish literary figures (Józef Ignacy Kraszewski, Eliza Orzeszkowa, Bolesław Prus, and Nobel Prize winners Władysław Reymont and Henryk Sienkiewicz). Among topics published, history of Poland and Polish literature were the most common, but the weekly also abounded in reports from travels and descriptions of the wonders of nature. The magazine was known for its high-quality woodcuts.

"**Kłosy**" [Ear of Grain], an illustrated weekly devoted to literature, science and art, was published in Warsaw between 1865–1890.

"**Głos**" [The Voice] was a scientific, literary, social and political weekly issued in Warsaw in the period 1886–1905.

"**Wszechświat**" [The Universe] is the oldest popular science magazine in Poland, founded in 1882 in Warsaw and published until today, with breaks connected with world wars in years 1914–1927 and 1939–1945. The editorial office was moved to Vilnius in 1934 and to Kraków in 1945.

"**Świat**" [The World], a weekly issued in Warsaw in the period 1906–1939 was famous as one of the first magazines publishing photo reports.

Finally, "**Ziemia**" [The Earth] was an illustrated weekly dedicated to the popularization of knowledge on the nature of Poland and has been published in Warsaw and Kraków since 1910.

Below, we describe how BPF and European bison featured in each of these periodicals.

"Łowiec Polski" (1899–1914, 1924–1939, 1945–)

From the very beginning, "Łowiec Polski" covered the subject of BPF and European bison. Judging from the number of articles and mentions devoted to these topics, they were of upmost interest to the journal's readers. Jan Sztolcman and his co-workers, and after 1928 his successors, reported on the condition of BPF and the European bison population, published historical curiosities related to it, and after the bison extinction in in the wild, documented actions taken to save and restore its population.

Several articles concerned the status of European bison and the risk of its extinction. As early as 1900, "Łowiec Polski" published a Polish translation of a work by Eugen Büchner on bison dying out in BPF (Büchner 1900), along with bison population statistics from 1832 onwards. In 1910 and 1911, much attention was paid to epizootics in BPF (Anonymous 1910A, 1910B), with different theories of their origins published.

BPF was often mentioned in articles devoted to old hunting traditions and historical hunts of Polish kings, as in a series on the history of Polish hunting spanning nine

issues (J. Z. 1909). Several articles quoted historical descriptions and depictions of European bison, like Herberstein's or Mikołaj Hussowski's (Ziembicki 1934, Birkenmayer 1933). In these articles, the former Grand Duchy of Lithuania and Poland appeared as a "promised land" of hunters, lost after partitions of the Commonwealth of Both Nations.

Nature conservation was also a topic often raised by "Łowiec Polski", and often the magazine represented a very progressive approach, advocating for the protection of small birds from hunting (Wodzicki 1938) or for the creation of nature reserves with prohibition of hunting (Domaniewski 1932). BPF was brought up in the context of the exploitation of valuable tree stands in the 1920s – the journal advocated for limiting tree cutting for timber to preserve areas with beautiful woods within BPF (Anonymous 1929).

Especially the campaign to save and reinstate European bison in BPF gained attention of the journal's editors and authors. "Łowiec Polski" was most probably the journal most carefully following and documenting the progress of the bison rescue programme, including an article detailing the circumstances surrounding the discovery of the last bison killed in BPF (Sztolcman 1926B). The discovery was made by Herman Knothe, sent by Polish authorities in March 1919 to find the last bison. The article testified to efforts made by authorities, prior to this discovery, to protect the remaining European bison. Among these efforts was an increase in the penalty for killing a bison, offering rewards to people helping to capture poachers, printing one thousand posters informing in Polish and Belarusian about the ban on killing bison and hunting in BPF. Additionally, a team of 25 guards on horseback was organized in the forest to fight marauders and poachers (Bark 1939). The latter information was accompanied by a description of the discovery of another poached bison, different from the one reported by Knothe: "*In March 1919, rumours reached me that a certain peasant from the Chwojnik area cottages, with his two sons, had killed the last bison still surviving by then. I immediately set off for the said settlement. The owner, as is usual in similar cases, at first denied everything, swearing on honour and on the health of his children that he knew nothing about anything. However, his entire behaviour seemed suspicious. I ordered a meticulous search. The entire settlement was shaken to its foundations, but to no avail. We were already about to leave when I realised that the peasant was showing a certain nervousness as the guards approached the shed, which was stacked to the ceiling with finely chopped pieces of wood. I decided to throw away the wood, which took a good hour of our time. Under the wood appeared: a barrel of meat, a fresh skin and the skull of the last bison in Białowieża. Sic transit gloria mundi*" (Bark 1939). After the last free-living bison in BPF were killed illegally, the gaze of the entire hunting society turned to Pszczyna, where bison from Białowieża were held in captivity. "Łowiec Polski" often reported on the Pszczyna herd, directly connected with hopes for saving the species (Anonymous 1927A, 1931).

The international action to save European bison inaugurated by Jan Sztolcman's speech at the International Congress for the Protection of Nature in Paris in 1923 was described in "Łowiec Polski" as one of the first, if not the first, Polish journals

(Sztolcman 1925). The author's appeal for a campaign to save the species recently extinct in the wild received support from, among others, the French organisers and the American delegation. The latter was led by William Hornaday, famous for his successful action of saving American bison from extinction. Although German conservationists were not invited to the congress in Paris, they soon joined the international bison rescue campaign. In 1925, the First Congress of the International Society for the Protection of European bison took place in Berlin, with the attendance of 32 participants representing Germany, the Netherlands, Austria, Sweden, Denmark, Hungary, Poland, and Russia. Soon after that event, "Łowiec Polski" published a proclamation to all hunters and nature lovers to support the Society (Anonymous 1926).

Fig. 4.1. Article on the necessity to issue a post stamp with European bison was illustrated with collection of examples of other countries' stamps with their iconic animals (from Kobylański 1934).

Restitution of the European bison population in BPF to its wild state was called, in one of the articles, "*a holy matter*" (Świderski 1928). In 1929, despite such expressed pessimism, Poland's position was strong in the ICZM, a programme for a Polish bison conservation programme was developed. In 1929, the Congress of the International Society for the Protection of European bison took place in Poznań, and in 1930 Polish members constituted the majority of the Society's participants. Interestingly, editors of "Łowiec Polski" devoted themselves to persuading the Polish Post to publish postage stamps with European bison (**Fig. 4.1**) "*with hopes that Poland will be the first country to issue a stamp with a bison on it*" (Kobylański 1934).

Interest in the progress of restitution went even further – "Łowiec Polski" devoted several texts both to search for surviving European bison in the whole of Europe and to the discussion on the role of American bison in the restitution. Among animals found in parks and zoos were American bison and hybrids of both species of bison, or even of European bison and Ukrainian steppe cattle. Given the fact, that obtaining hybrids was seen as easier than breeding pure European bison, leaders of the restitution action had a difficult choice to make. On one hand, the number of European bison available was very low and there was a high risk that it would not be enough to restore the free roaming population. On the other hand, a large number of both hybrids and American bison were available. There was therefore a strong temptation to use hybrids which eventually would eliminate the European bison as a species. Polish members of the International Society for the Protection of European bison, especially Jan Sztolcman, advocated the restoration of a population derived from the pure Białowieża bison line (Daszkiewicz & Samojlik 2005). "Łowiec Polski" reported on the development of discussion on this matter: decision to eliminate hybrids from the programme (Sztolcman 1926A), concerns with American bison brought to Poland (Domaniewski 1929), and Erna Mohr's remarks on her observations of the Białowieża herd (Mohr 1935).

The topic of plains American bison (originating from Wainwright, Alberta), donated by the Canadian Polish community to the President of the Republic of Poland, returned to the pages of "Łowiec Polski" several times (e.g. Kostryko 1935), eventually being treated as a "backup plan" in the case that the programme to breed the Białowieża line failed: "*On the other hand, the question of sentiment comes into play, and in Białowieża an animal reserve has already been established. For any nature lover, Białowieża without bison seems empty. This lack can be filled, and this is exactly what the Ministry of Agriculture has initiated. Namely, by setting up hybrids of European bison and American bison in the game preserve. For bison breeding, this material is of no value. These hybrids should be kept separate. As they are not hard to come by and one can always have a sufficient number of them, let them live in Białowieża and for the time being, until pure-blood European bison return, let them please our eyes and hearts. For the layman, moreover, for the general public visiting Białowieża, they will simply be bison*" (Domaniewski 1929).

"Łowiec Polski" served also as a platform for popularization of scientific knowledge about European bison. Monographs on European bison by Jan Sztolcman

(1926D) and Konrad Wróblewski (1927) were either published in full (the first), or in a form of a long treatment (the latter) in the journal. This coincided with articles concerning the idea of restoring the species itself. This programme was uncharted ground because the American experience of saving American bison could not be easily translated to Polish conditions. "Łowiec Polski" expressed the responsibility that Poland undertook with the campaign to save European bison: "*The moment Poland begins to gather more European bison and when it intends to carry out their breeding on a relatively large scale, it thereby takes on itself a great responsibility for the future of European bison. If, for any reason, these bison were to succumb, there would be an irreparable loss and Poland would be accused of contributing to a further decrease in the number of living European bison through negligence or recklessness*" (Domaniewski 1929). The matter was seen not only as a scientific and logistical challenge but also an important political symbol: "*The absence of European bison in the Forest was the reason for countless anti-Polish speeches at various international congresses, where Poland was accused of having allowed the extermination of this magnificent animal and of not giving it sufficient protection so far. Today these accusations will cease*" (Ejsmond 1929).

European bison and BPF appeared on the pages of "Łowiec Polski" also in the context of fighting with poachers (Bark 1934, 1937, Lindeman 1935), the return of a bison statue originally erected in BPF and evacuated to Russia in 1915 (the statue was displayed in Warsaw and then transported to Spała, where it remains until today; Anonymous 1925) and numerous descriptions of hunts in the Forest (e.g. Ejsmond 1927, 1928, Knothe 1936, Korsak 1935). A series of articles was devoted to the reintroduction of brown bear in BPF, including observations of unwanted behaviour of local dwellers: "the population of Białowieża villages treats bears with evident fondness and even feeds some of the more adventurous ones, which is by no means undesirable, as it defies the purpose of breeding completely wild bears in the forest" (W. L. 1938B). Similarly, "Łowiec Polski" reported on the reintroduction of moose in BPF (W. L. 1938A, Knothe 1938). An interesting, yet enigmatic thread were films made in Białowieża in the interwar period: "Łowiec Polski" mentioned documentaries shot by Włodzimierz Puchalski and Jan Karpiński (see below in the section "Polish audio-visual materials devoted to BPF and European bison from the 19th-beginning of the 20th century").

"Ochrona Przyrody" (1920–2001)

Authors of "Ochrona Przyrody" appreciated the importance of BPF: already in the first issue of "Ochrona Przyrody", attention was drawn to the uniqueness of the Forest and the need to give it a special place in Polish nature conservation policy. Władysław Szafer wrote: "*Of the vast, often almost untouched forest areas lying in the north and north-east of the former Russian partition of Poland, the most noteworthy is Białowieża Primeval Forest which has been a protected area for flora and fauna since*

time immemorial. Today, although destroyed by the war and almost devoid of its greatest peculiarity, i.e. the European bison, it is the only area that can become a Polish untouchable park of nature" (Szafer 1920). In the early 1920s, the administration of the Polish State was just getting organised. This also applied to nature protection. In the second issue of "Ochrona Przyrody" of 1921, a brochure by W. Szafer entitled "Plan for the establishment of a forest reserve in Białowieża Primeval Forest" was published. This marked the first initiative to create the Białowieża National Park (BNP) with a strict reserve. Noteworthy, the name "national park" itself was used by State Council for Nature Protection many years before BNP was officially established. Institutions were also created to bring about the protection of the Forest. In 1924, the formation of the Białowieża National Park League was announced, established by State Forestry with the purpose of promoting the national park (M.S. 1924).

"Ochrona Przyrody" often reported on the progress in the establishment of the national park in Białowieża, among others – about resolutions of the conference on reserves in BPF in December 1921, held at the Forestry Department of the Ministry of Agriculture and State Property. The conference participants decided to create three strict and two partial reserves, as well as to establish a beaver colony on the Narewka River, to preserve valuable tree specimens throughout the Forest (today we know them as "monument trees"), and to protect "*valuable forest fauna species*", i.e. moose, black storks and European bison "*both in the Forest and throughout the state*" (Anonymous 1923). Władysław Szafer, present at the conference, drew up a programme of scientific research in protected areas (Szafer 1922), emphasizing: "*In the planned observation of the processes of wilderness in the primeval forests of Białowieża, Pieniny and partially also in the Tatra Mountains and Czarna Hora, I see one of the most important scientific tasks that has to be accomplished by joint and planned efforts of botanists, zoologists and foresters. The inviolacy of the area of the nature reserve guaranteed infinitely will make the research independent of its duration, in a way, because the observations started by our generation will be carried out continuously by the following generations until they reach a relative end, i.e. the recognition of the image of a balance of life which will one day exist in the 'primeval forest' community as a result of the changes and transitional phases which this forest will experience during the long period of its wild state*" (Szafer 1922). It is worth stressing that scientific research occupied a very important place in Polish nature conservation policy and was one of the most important reasons for strict protection. In contrast, French nature protection was mainly motivated by "beauty" and aesthetic values of nature, as in the case of the first reserve in the Fontainebleau forest. In Soviet Russia, the sole purpose of creating protected areas was to make better use of their natural resources. Polish declarations of the importance of scientific research in nature reserves were quickly followed by actions: a scientific programme was developed for nature reserves and national parks, and already the first issue of "Ochrona Przyrody" reported on a planned scientific expedition to BPF: "*As soon as the noise of the battles and skirmishes fought victoriously by the Polish troops driving the Bolshevik troops out of the forest areas surrounding the famous Białowieża Primeval Forest in March 1919 had*

died down, the Ministry of Religious Affairs and Public Education in agreement with the Ministry of Agriculture and State Property and the command of the army operating towards the then Bolshevik-occupied Lida and Vilnius, sent a scientific expedition to check the extent of destruction of the Forest by the Germans, but above all to protect the remains of the king of Polish animals living in the Forest: European bison" (Anonymous 1920). In subsequent years, "Ochrona Przyrody" published a series of articles revolving around research conducted in BPF: Tadeusz Wiśniewski's paper on fir in the Forest (Wiśniewski 1924), on birch (Kobendza 1934), pioneering research on decaying wood, its fauna and flora (Hackiewicz- Dubrowska 1936). Also Józef Paczoski (see more on his scientific works in chapter 3) published an article in "Ochrona Przyrody" on research conducted in the Białowieża museum and nature reserve (Paczoski 1927A). Furthermore, work in Białowieża did not focus solely on inventories of either species or habitats but rather spread to wider ecological research, including mapping of soils in connection with types of tree stands, research on insects aiming, among others, at explaining the causes of bark beetle outbreaks, and meteorological studies on the Forest's microclimate (Karpiński 1933). All these ambitious programmes led to the concept of protection of not only species but also habitats, which is today a basis of EU nature protection policy, i.e. Natura 2000.

The bison rescue and reintroduction campaign was significantly reflected in the journal, incorporating several articles tracking the progress of, firstly, checking for possible remaining bison in BPF. A report prepared by Janusz Domaniewski stated unequivocally that the bison were no longer present in the Forest and that the only surviving bison on Polish lands were 16 animals in Pszczyna (Anonymous 1921A). As early as 1920, the State Council for Nature Protection prepared a Draft Law on the Protection of Particularly Rare Species of Animals and Plants (Anonymous 1921B), in which European bison is mentioned in numerous paragraphs, alongside mention of a prison sentence and hefty fine for any bison poacher. Apparently, in 1920, there was still a desire to believe that perhaps the bison had survived in the wild and should be placed under strict protection. "Ochrona Przyrody" informed about Jan Sztolcman's efforts to reconstruct the population on the basis of specimens scattered in various zoos and parks (Sztolcman 1926A, 1927, Sokołowski 1926) and followed them until the successful return of European bison to BPF in 1929 (**Fig. 4.2**). The release of the bison on 19 September 1929, regarded as a major success of Polish nature conservation policy, was described in an article by J. J. Karpiński (J. J. K. 1929).

"Ochrona Przyrody" brought information not only about efforts to reintroduce European bison but also about similar efforts focused on moose, brown bear and beaver (see chapter 5).

Another feature of articles in "Ochrona Przyrody" was the natural history museum in Białowieża. The first museum, created at the end of 1914 by the administrator of the forest, Mitrofan Golenko (1863–1943), had over 500 exhibits, representing the unique values and diversity of life of BPF. In August 1915, museum exhibits were evacuated to Moscow. The first natural history museum in Białowieża is known therefore only from historical sources (see Samojlik et al. 2020) and Mitrofan Golen-

Fig. 4.2. A fragment of the photograph taken by J. J. Karpiński accompanying the article on the return of bison to Białowieża (from J. J. K. 1929).

ko's paper (Golenko 1935). During WWI, German administrators started collecting exhibits for another museum (Bajko 2017, 2020), which was then captured by Poles. It was visited by Stanisław Miklaszewski in 1919, who expressed his impressions in an article in "Ochrona Przyrody": "*a small museum located on the first floor* [of the tsars' palace in Białowieża] *has by some miracle survived. It contains rare and interesting collections, such as: rare specimens of trees of various species, a rich collection of forest mosses, numerous skeletons, horns and skulls of bison, moose and deer; we admired here huge slices of trunks sawn from ancient oaks, some of them several metres in diameter. These valuable collections are in a state of complete neglect, and I think that the appropriate Polish authorities should register them as soon as possible and take good care of them*" (Mikaszewski 1919). In wartime, however, this postulate was not realised as a significant part of the collections was robbed during the Bolshevik invasion of Poland and the war in 1920. The next time "Ochrona Przyrody" mentioned

Białowieża's museum was in 1927, when the new collection experienced difficulties: no subsistence was received from the government and two members of the museum's staff, curator and preparator, resigned. "*From the above-mentioned figures, it can be seen that the Museum not only did not receive any monetary allowance last year, but moreover was deprived of its professional strength. Since the collections of the Museum without proper care are in danger of being destroyed very soon, and the Museum itself without professional staff cannot give the visitor what is required of it, I ask the Ministry to indicate whether the Museum can count on any subsidy in the current year, and whether an intelligent preparator who would at the same time act as curator be engaged. Should this not be possible, I would ask you to indicate how the museum collections can be saved from destruction, which is inevitable without constant professional supervision*" (Paczoski 1927A). The situation improved in the following years, and in 1930 Karpiński published an article in "Ochrona Przyrody" stating that "*great changes have taken place in the natural history museum of Białowieża Primeval Forest at the national park. Nine beautiful, huge glass cabinets were made, in which the exhibits of the animal world were placed. Prof. J. Paczoski's botanical collection was organised and systematised, and 60 tin boxes were made to store them in a huge wardrobe made especially for this purpose. This created a beautiful collection of wilderness plants, housed in a special botanical cabinet. At the entrance, there is an entomological cabinet, prepared throughout the year. The entire museum, housed in 8 rooms, was given spectacular electric lights inside cabinets. The number of exhibits has almost doubled*" (Karpiński 1930). Since then, the museum was growing rapidly, not only enriching its collection (Karpiński 1933) but also receiving new spaces for exhibitions (Kostryko 1936, Karpiński 1937B).

Although it was repeated many times in articles in "Ochrona Przyrody" that the main goal of BNP was to preserve the pristine nature of Białowieża woodland and provide a unique area for scientific research, the park was meant to be accessible to tourists. It was hoped that the development of tourism would not only be a source of financial resources but that it would spread the idea of nature conservation to the public (Szafer 1929A). The journal reported on new developments in that field: new oak gate to BNP designed by Henryk Jasieński, an architect from Kraków (Karpiński 1930), training of tourist guides needed to handle the number of tourists visiting BNP (Kostryko 1936), several new train connections to Białowieża launched, including the luxurious 'Dancing, Skiing, Bridge' train that had previously only travelled to Zakopane in the Tatra Mountains. The train had to be renamed to 'Dancing, European bison, Bridge' as it was difficult for Białowieża to compete with Zakopane in terms of skiing (J.J.K. 1933).

"Przegląd Myśliwski i Łowiectwo Polskie" (1923–1926)

The journal's interest in BPF covered both the historical heritage of hunts in the Forest and its current, interwar state. It was here that the first information on the return of European bison to Białowieża was reported, in an article describing a hunt in Białowieża (Ejsmond 1924B). Such important information was published in this popular journal much earlier than in more official „Ochrona Przyrody". European bison and BPF were also frequently used as motifs in illustrations inside the journal, as well as on its covers (**Fig. 4.3**).

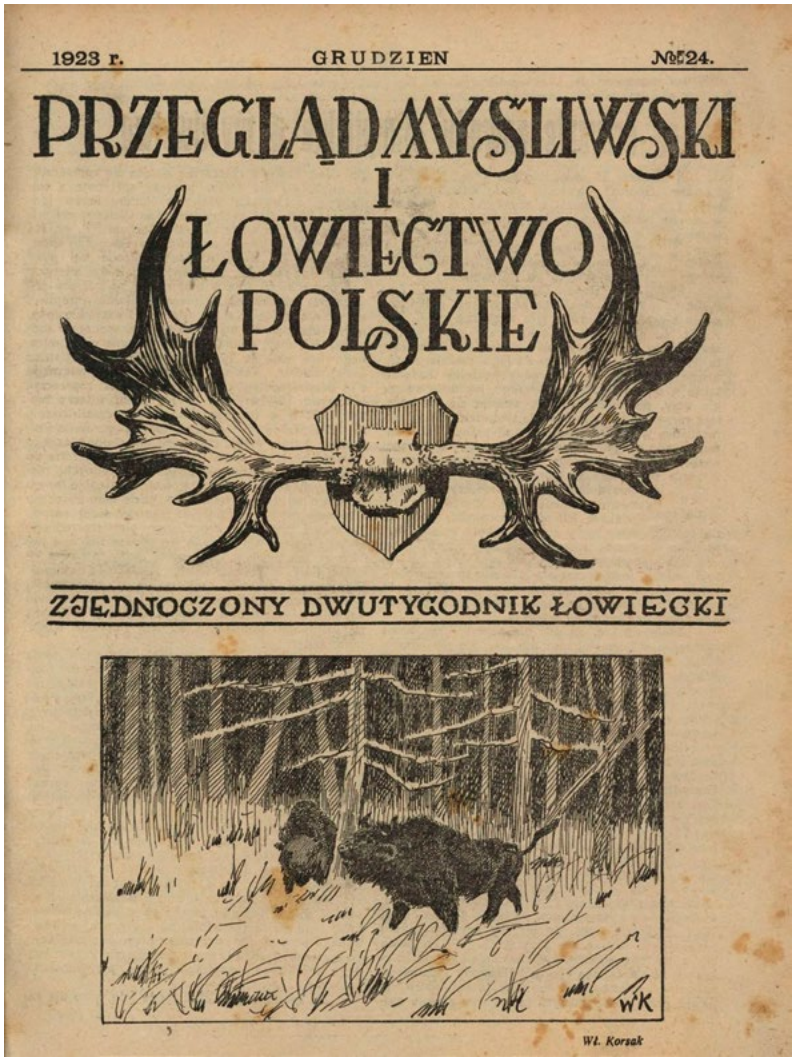


Fig. 4.3. Drawing of European bison by W. Korsak on the cover of "Przegląd Myśliwski i Łowiectwo Polskie" (No 24, December 1923).

The glorification of old hunting practices returned to the pages of "Przegląd" on many occasions, for example in the description of king Zygmunt August's hunt in BPF in 1546 (Bąkowski 1923A, 1923B). Sometimes historical articles, like deliberations on nature protection in the times of Władysław Jagiełło, i.e. the 14th-15th century, presented an occasion to publish commentaries that seem valid even nowadays: "*The fact that history has passed a death sentence on aurochs, wild horse, saiga, and partly on European bison, wolverine, and sable, has been due to thousands of causes, impossible to consider in this humble study, but among them climatic changes have played a significant role*" (Ejsmond 1923). Historical articles, poems and fables were published in "Przegląd" in the context of polemics on nature conservation and hunting issues. In one rhyming fable European bison and beaver persuade the ministry to issue a conservation law but the high-ranking official explains that treasury is the most important thing and the forest itself is more important than the animals. For the ministry, the bison and beaver are just "*ghosts from Białowieża*". The roaring bison responds: "*There will be forest, but there will be no us. Excellency, us!*" (Ejsmond 1924A).

"Przegląd" regularly published information on both the progress in the protection of BPF and the restitution of European bison, focusing especially on efforts made in Poznań Zoo. The economic crisis of the 1920s and the withdrawal of all German shareholders protesting against Poznan being part of independent Poland had put the Poznań Zoo on the brink of bankruptcy. Appeals for help were published, sometimes taking a peculiar form: "*Let's think how zoo would flourish and how many European bison would it have if every smoker denied himself 20 cigarettes a year and sent this one zloty back to Poznań. We would then have ten such zoos in Poland and we could buy the entire Hagenbeck* [famous German zoo]" (Kobylański 1926). A little-known episode in the history of European bison restitution was also described, connected with the transport of European bison from the zoo in Budapest to the forests in Vyšehrad, part of the failed programme of bison reintroduction in Hungary (Żarnowski 1924).

The journal also included detailed information on the protection of other species, especially beavers (Lenkiewicz 1924), as well as on the progress of the organisation of the future Białowieża National Park: "*Several reserves have been created, with the reserve in Białowieża Primeval Forest at the forefront. Białowieża Primeval Forest, covering the largest forest area in the lowlands of central Europe, was protected as an imperial hunting ground before the war. Undoubtedly, the biggest attraction of the forest was European bison. The storm of war also swept through the forest, damaged it badly and, above all, exterminated what was the greatest adornment of the Forest, i.e. European bison. Nevertheless, the preservation of at least part of the Forest in its primeval state was a priority for the Commission. Therefore, on 29 December 1921, in the Forestry Department of the Ministry of Agriculture and State Property, in the presence of representatives of the Ministry and the Commission, a protocol was signed, by virtue of which the following reserves in Białowieża Primeval Forest were created* [the article lists five reserves in BPF] (...). *Besides that, it was decided to establish a beaver colony on the Narewka River, closer to its source, in a place where there is no flooding; preserve valuable specimens of trees in the entire Forest, especially take close care of any*

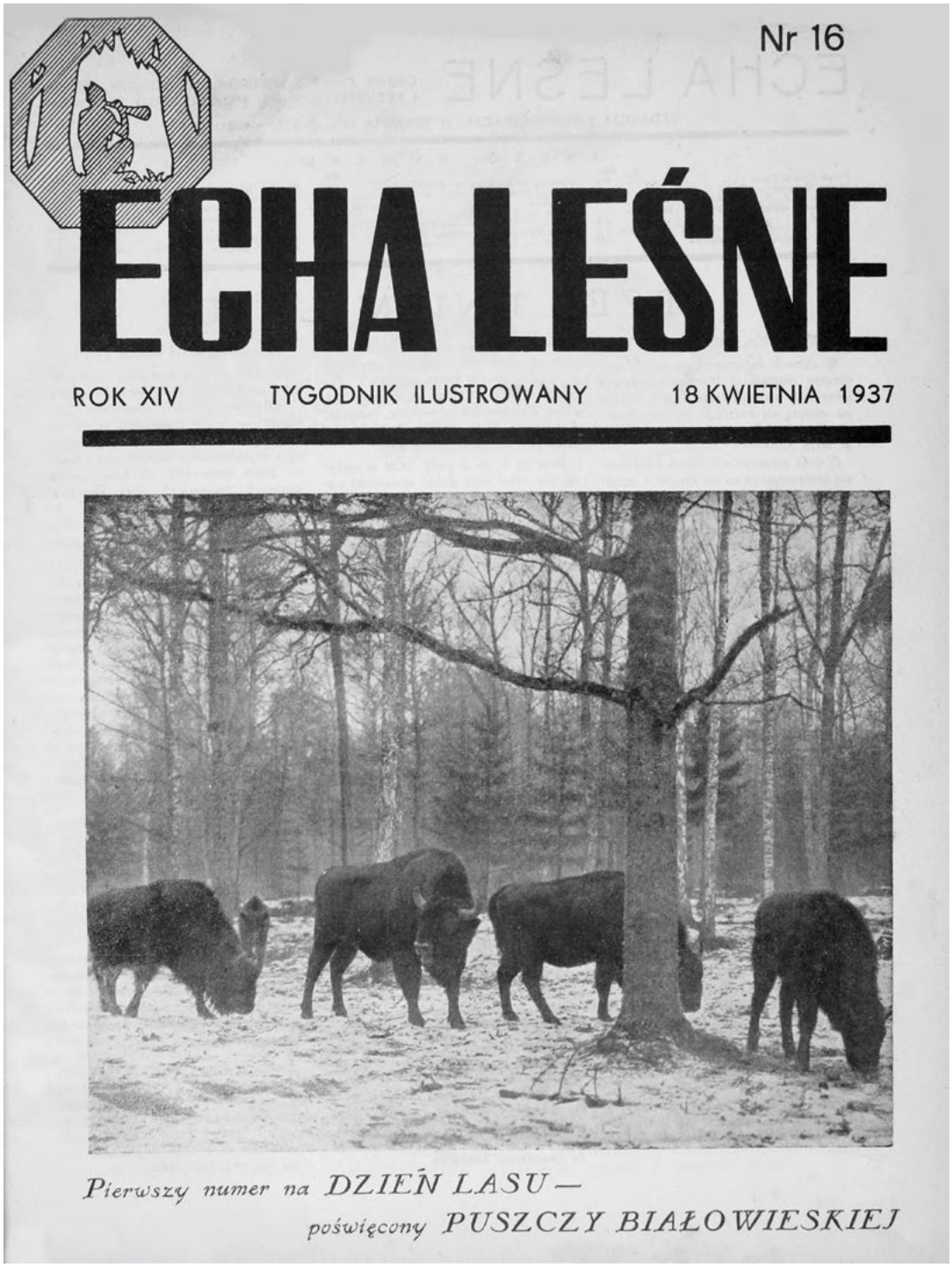


Fig. 4.4. The cover of the issue of "Echa Leśne" devoted exclusively to Białowieża Primeval Forest, published in April 1937.

yew trees that may be found; protect valuable species of forest fauna, as elk, black stork and European bison, both in the primeval forest and throughout the state. Strict reserves will be exempted from all management, in particular from the removal of fallen trees and dead wood, in partially protected reserves lying coniferous trees will be removed due to the danger of insects. While fallen deciduous trees may be removed, it is desirable that they are left on the ground, where they will form a habitat for certain species of flora and fauna. In this way, the first large reserve was created in our country, fully deserving the name of a Polish nature park" (Kołodziejczyk 1924).

"Echa Leśne" (1924–1939, 1991–)

In the interwar period, BPF was present in virtually every issue of the magazine, with one issue devoted exclusively to Białowieża (**Fig. 4.4**). Introduction to that issue stated: "*Białowieża Primeval Forest, and foremost its national park today, contain the mysterious beauty and story of virgin nature. Besides that, Białowieża Primeval Forest is, among our primeval forests and woods, as respectable for its history as Wawel is among other memorial buildings. The centuries-old patina of the Wawel Castle*, [here it] *is made up of centuries-old oaks, lime trees, elm trees, pines and spruces of the primeval forest. At their feet, Poland's history and great historical events have been scrolled through time*" (J. M. 1937). The special value of the Forest was emphasized especially in the context of independence regained in 1919, fragile and laboursome over the next several years: a manifest from 1919 calling out to protect the common good – woods (Anonymous 1937C), legendary visit of Marshal of Poland, Józef Piłsudski (Karpiński 1937A), and a secret mission of forester Bolesław Błażewicz to Białowieża just before independence was regained to instruct local people not to participate in occupants' last episode of robbery and exploitation of the Forest (Anonymous 1937A).

A topic of interest to readers of "Echa Leśne" was the estimation of the losses suffered by BPF during the German occupation in WWI and a question if the Forest could still be called ancient and primeval after three years of severe exploitation by German management: "*So what is left of the Forest today? – Is it only the remnants burdened by history, still called primeval forest* [Pushcha] *for the sake of memory? No, Białowieża Primeval Forest is still today the largest forested area in European lowlands, and its primeval character, in spite of the German devastation of such a large area, is still maintained within the limits of what is possible for rational management, not to mention its wild heart – the National Park*" (Karpiński 1937B). However, it was honestly admitted that besides plundering and destroying the Forest, it was during the German occupation when the first project to create a national park in Białowieża came to light: "*If we wanted to find that moment when the first idea of setting aside an area of Białowieża Primeval Forest for the present national park was born, we would have to go back to documents from the time of the German occupation. The State Council for Nature Conservation has in its possession the original German map, on which*

the area between the Narewka and Hwoźna Rivers, the Browska Road and the Białowieża Glade is clearly marked, and bears the inscription 'Naturschutzpark'. Historical truth dictates that the Park was designed at the beginning of 1918 by the occupational Forestry Board of Białowieża Primeval Forest, which separated an area of 30 km² from the Forest as an inviolable 'Nature Park'. Thanks to this, the occupants, who managed Białowieża Primeval Forest in a barbaric manner, did not carry out any cuttings in the designated area and did not drag the forest railway through it" (Anonymous 1937B).

"Echa Leśne" has also reported on efforts undertaken after regaining independence by the Polish government to reclaim items important for Białowieża: management maps returned by the Russians in 1921 and 1922, a shattered monument commemorating a Polish royal hunt in BPF in 1752 "*deliberately destroyed by the Russians*" and "an iron cast of a life-size European bison brought to the courtyard of the Royal Castle in Warsaw", originally erected in Białowieża after the hunt of tsar Alexander II (Anonymous 1924). This article in "Echa Leśne" ends with a sad statement, "*Today, only memories remain of this royal beast*", reflecting the overarching mood of reflections on BPF in this journal in the interwar period: the joy at the Forest's return to Poland on one hand, and deep concern over the state of BPF and the fate of European bison.

Other journals

The most important paper devoted to BPF published in the popular "Tygodnik Ilustrowany" was a recount of the visit to the Forest by Wacław Przybylski (1828–1872). Przybylski was a Polish naturalist, writer, participant of the Polish national uprising of 1863. He visited BPF in September 1856. Having spent two weeks there, he used his experience to prepare a lecture at the Archaeological Museum in Vilnius (Kieniewicz 1986), and to publish an article in "Tygodnik Ilustrowany". Przybylski first and foremost expressed his awe of the pristine nature he found in Białowieża: "*If it is your will, gracious reader, to take a closer acquaintance with nature, presenting itself in the shapes in which it came out of the hands of the Eternal, only with the stigma of centuries of solitude and traces of the past and fierce forces of nature: free spreading and storms, then you do not have to look as far as you might think. Do not think that we are urging you to wander far across the ocean; that would be too great a sacrifice. This journey is not far and will take no more than a few weeks* (...). *It is Białowieża Primeval Forest, which forms a kind of gloomy backdrop to the picture, in the midst of an almost forestless area, where you can see traces of human labour and careful tending to the land. As you go further along the road leading to the Forest, the landscape slowly changes its character: the hills disappear, the dark contours of the Forests become more and more prominent, and at last you can catch a glimpse of the entire majesty of what may be Europe's last refuge of wild nature, untouched by human hands, and where industry has not yet removed the mysterious veil behind which lies the mystery of the unfettered transformations of the plant world*" (Przybylski 1863). Przybylski described

the variety of trees and plant life found in the Forest, paying special attention to the amount and role of dead wood present in the Forest: "*Great variety also prevails in terms of the age and beauty of the trees. Huge pine trunks, scattered here and there, seem to threaten to fall, which will inevitably bring doom to the smaller vegetation, in tight rows shooting upwards. The entire area is covered with fallen and decaying trees, whose decomposition abundantly provides plant food for the juvenile trees* (...). *Small shrubs grow freely in the gaps between the larger trees*" (Przybylski 1863). The author described his own encounter with European bison (illustrated with an engraving by Juliusz Kossak, **Fig. 4.5**) and summarized the knowledge on both European and American bison (repeating some erroneous information, e.g. on the degeneration of European bison and domestication as the only way to save the species) and emphasized the value of BPF in preserving wildlife: "*Nowhere in the whole of Europe do we encounter such a variety of wildlife as in Białowieża Primeval Forest. A rich niche for zoological observations and discoveries, it has preserved almost all the features of pristine forests, and its vastness and the tranquillity that prevails here provide a safe refuge for animals*" (Przybylski 1863).

Fig. 4.5. „European bison fight" – illustration by Juliusz Kossak published with Przybylski's article in „Tygodnik Ilustrowany" (from Przybylski 1863).

Zygmunt Gloger (1845–1910), Polish historian, archaeologist, geographer and ethnographer, visited BPF in 1878 and then later in 1882, together with the Nobel Prize in Literature winner Henryk Sienkiewicz. Gloger's most known account of travel to Białowieża is the report from the latter visit (Gloger 1903), but earlier also recalled his experience in an article published in "Biblioteka Warszawska" (Gloger 1881). The article includes a description of the Forest itself, the history and current protection regime of European bison (which Gloger finds far below expectations), ending with a significant statement: "*Someone has rightly said that today, when the great forests have disappeared from our land, the famous primeval forests have fallen under the axe of speculation and disorder, as a reminder of the last ones, only Białowieża Primeval Forest remains, reminiscent of the old Polish primeval forests of Mazovia in their vastness*" (Gloger 1881).

"Kłosy" journal published a description of BPF by Walery Brochocki (1847–1923), a Polish landscape painter. In 1885, Brochocki visited BPF and made about 10 drawings (Fig. 4.6), which were later published in "Kłosy" (1885) and other periodicals. His extensive sketch devoted to BPF was interesting due to the author's artistic approach: "*Many huge pine trees stand completely withered; some of them are still green at the top, but many are stripped of their bark and completely riddled by woodpeckers looking for bugs. These naked, standing monuments of old age, dead and blackened by the rain, still stand strong, their crowns stripped of needles, proudly raising them above the other trees. They seem to be healthy, but dead giants, calmly waiting for their end, when, rotten and damaged by vermin, they will fall to the ground and slowly turn into dust. These trees are often so decayed and brittle that they fall apart from the impact of a stick, glowing with golden decay from inside. The fall of such a huge skeleton causes a lot of destruction: with its weight, it topples and breaks the trees next to it, as if to make them into a deathbed dressed in green. For this reason, you will often come across villages which are littered with broken trees; it seems as if an infernal orcano* [hurricane] *had burst into this retreat with all its fury and was on the prowl, breaking and wreaking havoc all around. In a word, it can be said that this forest, with its springtime smile of blossoms, greens and colours, and with all its horror and power of forms, will enchant the most demanding lover of nature; For wherever you step, you will see an unbelievable wealth of motifs, miraculously grouped together, which, with the most perfect shades of breaking light, produce a sight of a thousand varieties of the most varied tones, spreading incomparable charm all around*" (Brochocki 1885).

In September 1885, a popular science weekly "Wszechświat" published an article "Puszcza Białowieska" by Józef Wacław Siemiradzki (1858–1933), geologist and paleontologist known for his natural exploration of Central and Southern America. Siemiradzki described the Forest, paying more attention to its geological composition. As a palaeontologist, he was interested in the topic of species extinction in the context of the theory of inevitable extinction of European bison (which he opposed). He blamed poorly-managed forestry, not any natural causes or tendencies in the biology of the species for its decline in numbers. Describing bison, he wrote: „*To be in Białowieża and not see a bison is the same as to be in Rome and to not see the pope.*

Fig. 4.6. Walery Brochocki's drawing „In Białowieża Primeval Forest" published in „Kłosy", 1885, No 1055.

However, not everyone is so lucky: in the past, it was possible to see European bison in the zoo, i.e. in a huge area of the wildest backwoods, encompassing about 40 wlokas, fenced with a high fence, but today, this pleasure is not so easy achieved. We trudged knee-deep in the mud for several hours following the fresh tracks of the five remaining bearded animals, but encountered nothing but tracks. We had to content ourselves with

a magnificent bronze statue of an unknown author, erected to commemorate one of those slaughters, known as bison hunting, which effectively contributes to the extinction of the bison. Whether bison are really becoming extinct is a question which has not yet been solved, but with the present way of managing them, I do not doubt that they will quickly disappear from the face of this world" (Siemiradzki 1885).

The journal "Głos" published an anonymous paper entitled "Z Puszczy Białowieskiej" [From Białowieża Primeval Forest] in 1900. The author was probably Wacław Makowski (1880–1942), Polish lawyer, professor at the University of Warsaw. In 1902, Makowski published a poem „Baśń Puszczy Białowieskiej" [A fairy tale of Białowieża Primeval Forest] (Makowski 1902). Paper in "Głos" is written in similar poetic style, describing man's feelings in primeval forest and human unity with nature (Makowski 1900).

A completely different approach was taken in an anonymous article published in „Świat" in 1907, entitled "Samochodem do Białowieży" [To Białowieża with a car] (Anonymous 1907). The practical, down-to-earth guide on how to travel to BPF with an automobile includes comments on the quality of roads and guest houses, and possibility to fill the gas tank during sabbath and is full of funny remarks (e.g. while registering in the guest house, the travelling company gives names of the most famous Polish writers: „Mickiewicz, Słowacki, Krasiński"). Still, even in this text the awe for the primeval forest is included: „*It's the primeval forest... We drove through the white road right into the high forest, and out of all mouths came a plea to the chauffeur. -Slower! Slower! We are in Białowieża Primeval Forest, an eternal pristine forest, the only one in Europe. It constitutes a small, separate world, with its own fauna and flora. Conversation falls silent, jokes and laughter cease. This forest has an indefinable stateliness, a mysterious majesty that evokes awe and respect*" (Anonymous 1907).

An interesting account of a visit to BPF in 1919 was published in "Ziemia" journal. Its author, Stanisław Miklaszewski (1886–1944), Polish playwright, poet and translator, travelled to Białowieża in August 1919. He was enchanted with the Forest: "*I left Białowieża at sunset, dense mist and haze rose from the depths of the moist wood like smoke, waiving its white yarn around colossal tree branches; amidst slowly thickening darkness this enormous forest has just started to unveil its primeval nature, full of wonders and unspeakable secrets, to a curious traveller*" (Miklaszewski 1919), but also able to make quite down-to-earth observations, e.g. on the Forest in being in better state than "*it is heard in the wide circles of society*". Among such statements, he mentioned also European bison: "*And the bison? The reader will undoubtedly ask. A few of these last Mohicans are still wandering around today in the wildest parts of the Forest (their number is said to vary from 4–6)*" (Miklaszewski 1919). Although already in 1919 a government mission led by Herman Knothe (Daszkiewicz et al. 2020) reported on the extinction of the species, apparently rumours still circulated about single bison or even small herds seen in BPF. The Polish Hunting Association has even set a reward and printed placards (Daszkiewicz et al. 2020) to obtain any information about these surviving bison. As we know today – it was futile effort.

4.2. Polish audio-visual materials devoted to BPF and European bison from the 19th-beginning of the 20th century

Polish hunting and nature magazines from the late 19th and beginning of the 20th century quoted some audio-visual documents concerning BPF. These materials have most likely been lost or destroyed, nevertheless their potential value for the history of the Forest itself and the restitution of the bison population justifies the need to collect information about them.

Since 1896, Bolesław Matuszewski (1856–1943), one of the most important pioneers of cinema and documentary film and an associate of the Lumière brothers' company, was a photographer accompanying the tsar's family on their travels around Europe. In 1897, he filmed the tsar's hunt in Białowieża (Magidow 1999, Mazaraki 2004), but the fate of this film remains unknown. If found, it would make the oldest footage of Białowieża.

In 1913, a European bison hunt was organized in Pilawin, in Potockis' acclimatisation park. The "privilege" of the hunt fell to Walter Winans (1852–1920), a well-known American artist, sportsman and hunter. An anonymous author (probably Jan Sztolcman) described the motives behind his decision to kill the animal: "*This was a magnificent bull, acquired from Białowieża Primeval Forest in 1905, about 20 years old, in full development of strength and appearance, but so vicious that he was no longer suitable for breeding and for a long time had to be kept in a special enclosure, isolated from the rest of the herd. He did not tolerate any rival, and in the last few years he has killed as many as three younger bulls, as well as two American bison imported from Hagenbeck*" (Anonymous 1913). The article goes on to say that the American hunter brought a cameraman from London who captured the whole scene on film (Anonymous 1913). The fate of the film is unknown.

Since 1915, the German occupation of BPF started, along with colonial exploitation of the resources of the Forest. At the same time, German wartime propaganda promoted the idea of German "civilising" role able to transform the primeval forest into a forest of economic benefit, while teaching the local population "order and cleanliness" (Bohn et al. 2017). Georg Escherich (1870–1941), the official responsible for BPF management in the period of German occupation, produced the film "Der Urwald in Bialowies". The film was shown to kaiser Wilhelm II (Sunseri 2012), but beyond that its fate is unknown.

In the interwar period, BPF and European bison appeared many times on Polish Radio, which was established in 1925. The most prominent author of radio broadcasts on BPF was Otton Hedeman (1887–1937), historian and author of the most important monograph on the history of BPF (Hedemann 1939). Unfortunately, there are no traces of these broadcasts in the Polish Radio Archives, only a list of them is preserved in the "Vilnius depository" at the National Library in Warsaw (Dolatowski

et al. 2017). In 1927, Professor Adam Czartkowski (1881–1958), botanist and historian of science gave a twenty-five-minute lecture on the Polish Radio programme in Warsaw entitled "European bison and its future" (Anonymous 1927B). There was also film footage devoted to BPF made in this time, connected with important names involved in the campaign to save European bison and protect the Forest, such as Kazimierz Wodzicki (1900–1987) or Jan Jerzy Karpiński (1895–1965), as well as the pioneer of Polish nature filmography, Włodzimierz Puchalski (1909–1979).

In December 1938, two films showing BPF were screened in Warsaw: a film by W. Puchalski and another by J. J. Karpiński. The latter accompanied a talk on the history and fate of BPF by Karpiński (Z.W. 1938). The article describing these screenings included a short passage of the film's contents: "*the regeneration of European bison, of which we have 15 specimens in the pure Białowieża lineage out of the total number of 35 specimens present in the country (including Pszczyna), and the difficulties in re-acclimatising bison and moose were further parts of the talk, richly illustrated with interesting films, showing us both the Forest itself in its characteristic fragments and these (...) animal species in peculiar scenes of their life in the National Park, it is to be hoped that with appropriate efforts, which are being planned, the bison and moose will settle in Białowieża Primeval Forest forever. Dr. Karpiński's films were extremely interesting, and among them there were some fragments of beautiful colour images, with the only drawback being that the projected images were projected onto a screen that was too small, with the result that even in a room with a hundred spectators, it was difficult for the rest of the audience (especially those with poorer eyesight) to 'decipher' the image*" (Z.W. 1938). The fate of the films presented in 1938 remains unknown.

4.3. European bison and BPF in Russian hunting and forestry journals of the 19th-early 20th century

Russian hunting and forestry journals from the 19th and early 20th century were surveyed in search for information connected with BPF and European bison (Fedotova 2022). Among Russian forestry journals, "Gazeta lesovodstva i okhoty" [The Forestry and Hunting Gazette] (1855–1859), "Lesnoj zhurnal" [Forestry Journal] of the Society for the Encouragement of Rational Forestry (1833–1851), and "Lesnoj zhurnal" [Forestry Journal] (1871–1917) of the Forestry Society in St. Petersburg, as the most prominent and widespread ones, were selected. Despite the same titles, the latter two journals differed significantly. The first was created with the active role of the Ministry of Finance to educate landlords and forestry officers in the field of rational forestry. The second journal was made by a professional association of the forestry officers as a platform for professional discussions. During the time when the first of

the "Forestry Journals" was no longer published, and the second has not yet started, "The Forestry and Hunting Gazette" continued the traditions of the first of the journals.

The range of Russian hunting journals in this period was wider, as was their audience. The texts published ranged from fictional stories, anecdotes, poetry and brief correspondence from the distant provinces to a series of papers written by zoologists specifically for enthusiasts of hunting. The first Russian periodical with the word "hunting" in its title was "Zhurnal konnozavodstva i okhoty" [Journal of Horse Breeding and Hunting] (1842–1864), devoted mostly to horses and their breeding, without any interest in European bison or BPF. The same goes for "Zhurnal okhoty" [Journal of Hunting] (1858–1862) or "Okhotnik" [Hunter] (1887–1889), mentioning European bison and BPF only once and briefly.

"Lesnoy Zhurnal" of the Society for the Encouragement of Rational Forestry (1833–1851)

This journal published a paper about European bison and BPF in the first year of its existence. Already in 1833, the article "On the Buffalo" was published, compiling translations from the Polish journal Sylwan. European bison were described as "huge animals" that used to live in the gloomy forests of severe and sparsely populated lands, that used to be the object of hunting for legendary kings and heroes. It was indicated that even the people of neighbouring regions know almost nothing about the bison (Anonymous 1833).

In 1835, the journal published excerpts from Julius von Brincken's book (Brincken 1835), and in 1836 two articles by the senior forester of the Grodno province Andrey Kovalsky, briefly describing BPF and European bison (Kovalsky 1836A, 1836B). However, the most notable publications about BPF and the European bison in the "Lesnoy Zhurnal" and in the "Gazeta lesovodstva i okhoty", that came to replace it, were two series of articles by the Grodno provincial forestry officer Dmtiry Dolmatov (Dolmatov 1849A, 1855A), whose achievements were described in chapter 3.

In 1849, an anonymous series of articles "Information on the state and private forests in the Grodno province" was published, most probably based on reports to the imperial state administration. In addition to a general description of wooded areas it gave data on logging, other forest uses, transport routes, prices and markets. The article reported that the large-sized timber (suitable for foreign trade) was available for logging in BPF, but its rafting was very difficult, since all the BPF rivers are small, slow and required clearing. There were some tar and resin making in the BPF, but no other "wood industry" in the district (Anonymous 1849). In similar tone, the journal has reprinted excerpts from a paper written by geographer and statistician Konstantin Arseniev, a high-rank official, member of the St. Petersburg Academy of Sciences, and teacher of the future emperor Alexander II (Arseniev 1845A, 1845B). Arseniev described European bison he had seen himself and defined BPF as a pre-

cious peculiarity of the region. He also described government plans for the modernization of BPF similar to remarks made by Dolmatov.

In addition to the original articles, the journal published short notes and reprints, e.g. a note was about permission to kill one European bison for the Natural History Museum in Mainz in 1840 (Anonymous 1840). This specimen made its way to Mainz, survived two world wars and until recently it was on display in the museum (Anonymous 1989). Another type of notes published concerned alleged, never corroborated observations of European bison far from BPF: in the Nizhny Novgorod province (1500 km from BPF, Anonymous 1850), near Warsaw, or even in the Urals and Siberia (Anonymous 1869, Egorov 1897, Anonymous 1898).

"Gazeta lesovodstva i okhoty" (1855–1859)

In 1856, the periodical published a paper "On the influence of parasitic plants on forest trees" by forestry inspector Nikolay Malgin, who was sent to BPF to supervise the timber felling operation. Malgin stated that the best trees in BPF were damaged by insects due to mismanagement: excessively long and strict restrictions on logging. The recipe he proposed was obvious – cutting down large and, especially, "overmature" trees. Another author who described BPF in those years as an "undeveloped source of natural resources" was the editor of the journal, Nikolay Zobov. In 1859, he published a series of articles analysing data on state forestry districts in the European part of the Russian empire and proposing methods of increasing revenue from BPF: lifting some restrictions for the merchants, setting up sawmills, lowering state prices on dead wood and "overmature" trees, improving rafting routes in the Forest (Zobov1859).

The journal also published a paper on wild boar capturing in BPF, written by one of the BPF forestry officers, K.K. Strahlborn (Strahlborn 1858). According to the article, wild boars completely disappeared in BPF during the harsh winters of 1838 and 1839. They appeared again only in the late 1840s. A task of this type – to capture a few animals – has not been given to BPF administration since 1846, when several European bison were caught (Dolmatov 1855B). More than four hundred beaters made noise and drove animals to a fence, which led them into a trap-corridor. The operation continued for several days and nights, with bonfires preventing wild boars to escape at night. Strahlborn described this in romantic tone: "*The fire flared up along the entire chain and presented to the eye one of those amazingly majestic pictures, about which some metropolitan dandy who had never been in the forest at such a time has no idea. Excellent examples of works of art by the Flaman school, striking the eye with a sharp transition of light and shadows, the novels of Cooper and Sue, with descriptions of dark autumn nights, with groups of robbers and knights lit by the flames of bonfires, were resurrected in memory*" (Strahlborn 1858). In the result of the hunt, six wild boars were transported to St. Petersburg.

By the end of 1859, the Ministry of State Domains decided to cease printing "Gazeta lesovodstva i okhoty", moving the relevant problems to the "Zhurnal Ministerstva gosudarstvennykh imushchestv" [Journal of the Ministry of State Domains] (1841–1917; after 1864 it was published under the title "Agriculture and Forestry"). Big game hunting was not in the scope of this journal, but short pieces on BPF and European bison were printed there anyway, e.g. information on logging in BPF for the period from the late 1830s to the late 1850s (Anonymous 1861).

"Lesnoy Zhurnal" of the Forestry Society in St. Petersburg (1871–1918)

Articles about BPF that appeared in the *Forestry Journal* of the Forestry Society in St. Petersburg had a different character than in its predecessor. These were materials written by forestry officers with a special higher education and were addressed to their professional peers. They were more informative and reliable, but also less interested in hunting and zoological topics.

In the 1870s, "Lesnoy Zhurnal" published two papers about BPF by authors that worked in BPF as members the forestry inventory teams. Nikolai Kholshevnikov (Kholshevnikov 1873) and Victor Tutsevich (Tutsevich 1878) wrote on BPF management for the sake of bison, both borrowing a lot of data from existing literature. When describing European bison, Kholshevnikov cited mostly Alfred Brehm. Kholshevnikov, however, objected to the prevailing notion of European bison degenerating and being doomed to extinction – he accused the reforms in the management of state peasants in the 1860s, namely giving them meadows in the Forest, as the reason behind lack of food for bison and their decline in numbers. Tutsevich made the same argument a few years later. Both authors believed that the Ministry of State Domains had to move out at least some of the peasants from BPF for the sake of European bison. Kholshevnikov went even further and proposed to resume controlled burning, which was previously exercised by shepherds and beekeepers: this would improve the feeding conditions for the European bison and help pine in competition with spruce, the latter considered a less valuable tree (Kholshevnikov 1873).

What was interesting in Tutsevich's approach was that he basically defended the abandonment of "rational" forest management in the case of BPF for the sake of European bison. Tutsevich aimed at answering the question if "*proper forest exploitation of Białowieża Primeval Forest may have a negative impact on the population of European bison and what actions could favour the preservation and spreading of this species*?" (Tutsevich 1878). Observing that bison protection was so important for the administration that wood exploitation was drastically limited (no sale of raw material from 1859 to 1877), Tutsevich argued that the controlled and limited exploitation of the forest is not incompatible with the policy of bison protection: "*It should be noted that Białowieża's bison do not belong to cruel or extremely wild animals, which could be particularly disturbed by the close proximity of people. It is often ob-*

served that bison approach a herd of domestic cattle and graze with it. Therefore, it seems to me that the preservation of this species in the forest depends more on providing them with the basic needs, that is water and food, than on completely stopping the exploitation of forests solely to ensure peace of these animals" (Tutsevich 1878).

Furthermore, he noted that bison have ten resting places in BPF and further two in the adjacent Świsłocz Forest, therefore exploitation of the forest should be planned in a way that only one of those resting places is disturbed and the rest is left for the bison to stay in. However, "*only selective cutting should be employed, not to modify the character of tree stands to which the bison are accustomed to and which, most probably, are a necessary condition for their survival*" (Tutsevich 1878).

A short mention of BPF and European bison was included in 1897 article by the chairman of the Forest Society V.T. Sobichevsky in the context of the All-Russian Exhibition in Nizhny Novgorod in 1896: the pavilion presented by the Ministry of Imperial Court was decorated with "*bulky wood materials*" from BPF and stuffed European bison (Sobichevsky 1897).

In the same year, S.N. Arkhipov published a short compilation of information from various sources about logging in the BP before 1860 (Arkhipov 1897), mentioning also the projected railway through BPF, which was discussed in detail in the journal "Ekonomist" (Lund 1862).

In three issues of "Lesnoy Zhurnal" in 1902 and 1903 a monograph on BPF management by Nestor Genko, head of the forestry inventory team in BPF in 1889–1890, was published (Genko 1902–1903). It was also published as a book in 1903 (Genko 1903) (see chapter 3).

In 1909, the journal published a paper by Arthur Kründer, who visited BPF to coordinate insect pest control measures and evaluate their effectiveness. This pragmatic task did not daunt the author from including romantic digressions on the Forest: "*With reverence for the pictures that awaited us and anticipating that we would now see something extraordinary – we remained as if chained to the windows of the cars and did not take our eyes off the rapidly changing, like in a kaleidoscope, forest pictures for a minute. The mysterious silence of the Forest, shrouded in morning mist, majestic oaks, giant pines and firs, the light making its way through the spruce undergrowth, the variegated foliage of oak, maple and hornbeam, this is an impression that is difficult to convey with a pen. Every now and then it seemed to us that right now we would see a huge European bison among the oaks in grud* [deciduous forest], *a moose would rise from the bagna* [swamp], *a stag-deer would slip into the forest, a herd of wild boars would break out of the alder bog*" (Kründer 1909).

Since 1883, the Forestry Society in St. Petersburg had its branch in Moscow. Usually, the works of the members of the Moscow branch were published in the Forestry Journal (as well as the minutes of the meetings of the Moscow branch), but in 1890–1902 "Otchety Moskovskogo lesnogo obshchestva" [Annual reports of the Moscow Forestry Society] were published, and in 1907–1912 "Trudy Moskovskogo lesnogo obshchestva" [Proceedings of the Moscow Forestry Society]. In the "Annual Report" an article about BPF by the professor of forestry M.K. Tursky was published (Tursky

1894). Tursky argued for limiting logging – which actually turned out to be the type of management preferred by the tsar. In 1897, Nikolai II ordered to limit the logging in BPF even more to preserve the primeval appearance of the forest (Genko 1903, Karcov 1903).

"Zhurnal okhoty i konnozavodstva" (1869–1874)

"Zhurnal okhoty i konnozavodstva" [Journal of Hunting and Horse Breeding] was published in St. Petersburg from 1869 to 1874. In 1870, a translation of a Polish text was printed under the initials "G-v. P.", with the description of European bison hunting in BPF for zoological museums in December 1858 (G.P. 1870). Compared with archival sources, the article contained several errors (e.g. it stated that two "*huge European bison*" were killed for St. Petersburg and Berlin yet sources contain information on four animals killed in 1858, none of them intended for Berlin or St. Petersburg, see Fedotova et al. 2018). The appearance of the European bison was described in a manner very characteristic for the 19th century: this herbivore was represented as a beautiful, but dangerous animal: "*the majestic lion-like mane covers the entire neck with thick waves, curls scatter on the forehead between the horns, a beard under the muzzle, huge glossy horns, its gigantic size, its consciousness of own terrible power expressed in every movement – everything gives to a bison a formidable appearance, terrifying not only any other beast, but even the human being*" (G. P. 1870).

In 1873, an eminent zoologist and public figure Modest Bogdanov described game animals of the European part of the Russian empire in a series of articles. The second paper contained information about the European bison (Bogdanov 1873), all based on a book by Usov (see more in chaper 3). However, two aspects explained by Bogdanov were curious. Firstly, Bogdanov believed that at the beginning of the 1870s, there were about 1000 bison in BPF (official data listed 542 in 1870, Karcov 1903). Secondly, Bogdanov wrote that the Białowieża bison due to the prohibition of hunting became "*tame, trusting and not afraid of people*", and due to supplementary winter feeding they are "*not quite a wild animal anymore*", as they do not sustain themselves (Bogdanov 1873).

"Priroda i okhota" (1878–1912)

"Priroda i okhota" [Nature and Hunting] was one of the most prominent and voluminous hunting journals of the imperial time. Its first volumes were published under the title "Nature" since 1873 by Leonid Sabaneev (1844–1889), zoologist and former student of Sergei Usov. 1874, the Society for the Breeding of Game Animals and Rational Hunting started to publish the "Journal of Hunting" under the editorship of the same Sabaneev. By 1877 both journals were found to be unprofitable. Sabaneev combined the two publications into the journal "Nature and Hunting", focused on hunting

and various issues of natural history. After the death of Sabaneev in 1898, Nikolay Turkin (1858–1918), a specialist in hunting legislation, became its new editor. There were many professional naturalists among contributors to the journal, ensuring generally high quality of published texts. The first publication connected with BPF was a small article on European bison and hunting for them in Białowieża in the first issue of "Hunting Journal" (Anonymous 1874). However, these were just excerpts from the book on the first tsar's hunt in BPF (Fuchs & Zichy 1862). Quite a few small pieces about BPF were published in the sections "Chronicle" and "From newspapers and magazines": in 1879, it reprinted material from the "Novosti" [News] newspaper on the cost of maintenance of BPF and European bison, and published another note on the number of bison in BPF (Anonymous 1879B), stating that there were 800 of them in 1815 and that currently their number reaches two thousand (according to official data published by Karcov in 1815 there were no data available for 1815, in 1816 there were 483 bison, and in 1879 – 571; Karcov 1903). In the same year, an engraving "European bison family" was published (**Fig. 4.7**).

Fig. 4.7. European bison family – illustration from "Priroda i okhota" journal (Priroda i okhota 1879, No. 11).

In 1882, citing the St. Petersburg newspaper "Golos" [The Voice], journal reported that the number of European bison in the BPF rose to 600 (the same number was indicated by Karcov) and therefore the tsar allowed the killing of two animals (Anonymous 1882). In 1884, with reference to the newspaper "Novoye Vremya" [New Times], the journal informed about poachers killing bison despite the strict ban, and about bison's meat sometimes appearing in luxury Warsaw restaurants (Anonymous 1884).The only long article dedicated to BPF and European bison was published in the journal in 1885. The author, Yakov Baikov, reported that he had to meet the New Year "*in a wretched village on the border of Białowieża Primeval Forest*" (Baikov 1885). He described the forestry management exceptional, as firstly the Polish and later Russian authorities protected the Forest and the European bison "*from predatory instinct of men*". The author remarked on the "*variety of vegetation*" and trees of a "*strikingly fresh and healthy appearance*" and "*remarkably large sizes*". He also noted traces of fires, but considered them unharmful to large trees, as these were small controlled burns with which shepherds tried to improve forest pastures (Baikov 1885).

"Okhotnichya Gazeta" (1888–1912)

The weekly "Okhotnichya Gazeta" [Hunting Gazette] was printed in Moscow in 1888–1912 with the main emphasis on hunting legislation, cases of poaching and irrational game extermination. It included also numerous short pieces from correspondents in different provinces.

For a quarter of a century of its existence "Hunting Gazette" published 12 articles and brief notes devoted directly to BPF and bison as well as a number of illustrations of good quality (e.g. **Fig. 4.8**). In addition, European bison was discussed in articles devoted to other topics: e.g. in an article on tsars' hunting reserve Gatchina (Kuskov 1906). Also published was a note on alleged European bison observations in the Novgorod province (Shirinsky-Skikhmatov 1895) or even in the Urals (Samoilov 1898), on bison extermination in Central Europe (Anonymous 1890C). The European bison were also often mentioned in discussions on hunting legislation (Foltz 1897).

An interesting part of articles in the journal was devoted to European bison poaching. Written by the editor of the newspaper Nikolay Turkin and Sergei Foltz, a lawyer and hunting enthusiast from the Grodno province (Foltz 1894, Turkin 1896), they showed that convicting a poacher even for killing European bison was a difficult task. Attempts to eliminate poaching carried out by the BPF administration were met with little sympathy and assistance from the police and officials of the district or provincial administration. In 1891, Sergei Foltz published an article about a mortally wounded European bison who killed a poacher, presenting it as an act of justice and retribution. As in many other articles, poachers were described here not only as lawbreakers, but also cowards. Foltz, who conducted the investigation, stated that the poacher had a chance to survive but his two accomplices fled, leaving him to die in the forest (Foltz 1891).

Fig. 4.8. The Bison and the Lynx – illustration from "Hunting Gazette" 1895, No 1, page 5 (explanations on page 15). Explanation of this illustration in the journal reads: "*The lynx certainly cannot hurt such big animals as moose, red deer or European bison, but they can easily kill calves, if they get away from their mother, which is rare, of course.* (...) [The drawing shows] *the psychological moment of two opponents meeting – a female bison with a calf and a large lynx, neither of which can do the other any harm: the bison cannot reach the lynx with its horns, and the lynx, feeling safe, is afraid to lunge at the mighty beast*".

In addition to "Priroda i okhota" and "Okhotnichya Gazeta" Nikolay Turkin was, for two years (1901–1902), an editor of a journal "Okhotniche delo" [Hunting]. It published two materials about BPF: the memoirs about the tsar's hunt in BPF in 1900 (Protopopov 1901) and a note about the trip of Georgy Karcov to BPF (Anonymous 1902).

"Okhotnichiy vestnik" (1901–1918)

"Okhotnichiy vestnik" [Hunting Herald] was published in Moscow from 1901 to 1918, in collaboration with hunting experts and enthusiasts but also with professional zoologists. The most prominent figure among the latter was professor of zoology at Moscow University and theoretician of the nature conservation Grigory Kozhevnikov (1866–1933). The journal featured drawings and photographs of European bison and BPF, yet often without any explanation or context (**Fig. 4.9**).

The first publication about BPF in this journal was the review of Georgy Karcov's monograph (Karcov 1903), beginning with the statement: "*Every learned hunter has heard about Białowieża Primeval Forest but knows about it hardly more than that it is a large forest, where the European bison lives*" (Segner 1903). Author of the review briefly outlined the contents of the book and emphasized that European bison were not dying out, as Karcov proves with statistical data.

In 1907, during a research expedition to Białowieża led by N. M. Kulagin (see chapter 3), "Okhotnichiy vestnik" published a note by the youngest members of the expedition – Sergey Ognev, a student at Moscow University. In his view "extraordinary mixture of various trees" produced here a "stately calm" impression (**Fig. 4.10**).

He was similarly impressed with local inhabitants: "As a result of alienation from the outside world, these people have retained more customs and traditions of antiquity than the population of villages and cities. (...) They passionately love their forest. Several years ago, the BPF administration tried to move them out from the forest, offering three times as much land in return. Some of them agreed, but a week later they returned to their forest again, so it seemed to them unsightly and bare compared to the wild beauty of their native forest" (Ognev 1907).

Fig. 4.9. Illustration showing two European bison from "Okhotnichi Vestnik" 1904, No 2, page 2.

Типичный видъ пущи.

(Фотографія съ натуры нашего сотрудника).

Fig. 4.10. Photograph „A typical view of the Forest" accompanying the paper by Ognev in a 1907 issue of „Okhotnichiy vestnik" (Ognev 1907).

In 1913, an article by V.R. Dits about European bison in Gatchina imperial hunting park was published, informing readers on the number of bison, hunts for them and their translocation to different places in Europe (Dits 1913).

Grigory Kozhevnikov (1866–1933), professor of zoology at Moscow University, was the first and most prominent supporter of the idea of state-organized nature conservation in the form of nature reserves excluding any human activity (Weiner 1988). Kozhevnikov motivated the need to protect nature for the sake of the future of science and future generations and in his articles in "Okhotnichiy vestnik" he drew attention to BPF and European bison several times.

In 1907, Kozhevnikov published the article on Kulagin's expedition, explaining that its aim is to answer the question "Why are the Białowieża bison dying out? Maybe their living conditions are not as good for them as they seem at first glance, maybe they have diseases that their bodies are unable to cope with, perhaps the species has outlived its energy or has grown decrepit" (Kozhevnikov 1907). In 1909, Kozhevnikov shared his impressions of the Second All-Russian Congress of Hunters in Moscow, where, among other things, European bison and BPF were discussed. In his presentation, Kozhevnikov raised the question of what exactly should be considered a nature reserve? "The idea of a nature reserve in its strict and true sense completely excludes human intervention in the daily routine of nature" (Kozhevnikov 1909). Kozhevnikov noted also his response to Konrad Wróblewski's presentation, supporting his opinion that preserving "the primeval forest as intact as possible" is as important as preserving the bison itself. Wróblewski proposed that at least a part of the BPF should be "untouchable" and that a biological station should be established there.

In 1914, continuing the topic started by V.R. Dits about the European bison in Gatchina (Dits 1913) Kozhevennikov published a note in which he opposed the notion of European bison degeneration and inevitable extinction. Furthermore, he proposed to spread both Białowieża and Caucasian bison to other forests, not mixing them, as perhaps they were different species (Kozhevennikov 1914). Three years later Kozhevnikov returned to the issue of bison in an article recounting rumours about the state of BPF and European bison during WWI. He saw the danger looming over the Forest and bison as "*measures taken by the Germans to protect the bison are doubtful, since at the same time, as they say, they built a number of sawmills*". Kozhevnikov stated "*it is necessary to take all measures to protect them from senseless extermination, it is necessary to ensure that the surrounding population is conscious that European bison is a national treasure that must be protected in every possible way*" (Kozhevennikov 1917A). In the next article, Kozhevnikov cited Hugo Conwentz's note that the BPF inhabitants had killed almost every European bison, and wondered why Conwentz blamed the local population and not the German troops. He again noted "*European bison is such an animal, each specimen of which is now the greatest treasure*" (Kozhevennikov 1917B).

Kozhevnikov was not the only one who, during WWI, retold on the pages of "Okhotnichiy vestnik" disturbing rumours about the extermination of the Białowieża

bison by German troops and poachers or about massive exploitation of the Forest. Another author, Dianov, stationed with an army ambulance train for nearly a month in Hajnówka on the border of the Forest in March and April of 1915, where he "*had the opportunity to wander through the virgin forest of this wonderful piece of Grodno province*" (Dianov 1916). In his description of the Forest, he separates the woods near roads and villages, where all deadwood is cleared and where only few fallen trees or branches can be seen, and remote places, where everything remains untouched and surrendered to the hands of nature itself: "in such places *trees that have fallen from decay form large rubble along which it was sometimes possible to wade only with great difficulty*; *dead giants overgrown with fluffy moss decay there. They crumble and disappear forever*, *giving their fellows – some*, *as decrepit as themselves*, *places for a grave*, *and others*, *young – for a freer life*" (Dianov 1916). Part of the article is devoted to descriptions of animals in the forest, especially European bison, which the author observed at feeding points. Dianov visited the village of Białowieża, where he bought three pairs of red deer antlers at a low price, visited the natural history museum (for more on Białowieża's first museum see Daszkiewicz et al. 2006 and Samojlik et al. 2020), and the tsars' palace where he saw stuffed European bison "*of exceptional size and a large collection of horns*".

Встрѣча съ зубромъ в

Dianov recounted his impressions from the forest: "*amidst virgin nature*, *I could not even think that in a few months all this serene kingdom would be echoed by the hellish rumble of cannon fire*, *and then it would into the power of new people*, *who*, *perhaps*, *for the sake of their own goals*, *will begin brutal destruction*" – mentioning the events that unfolded during the German occupation of the Forest (Dianov 1916).

Author using the pseudonym "Lesnik" [Forester] recounted his reflections of his life in the vicinity of Białowieża, painting a picture of significant human intervention in the life of the ancient forest: "*some of the rivers are cleared and straightened to serve as rafting routes*" and European bison "*has become accustomed to people*, *almost domesticated*, *with the exception of dairy farming which is not exercised*" (Lesnik 1918).

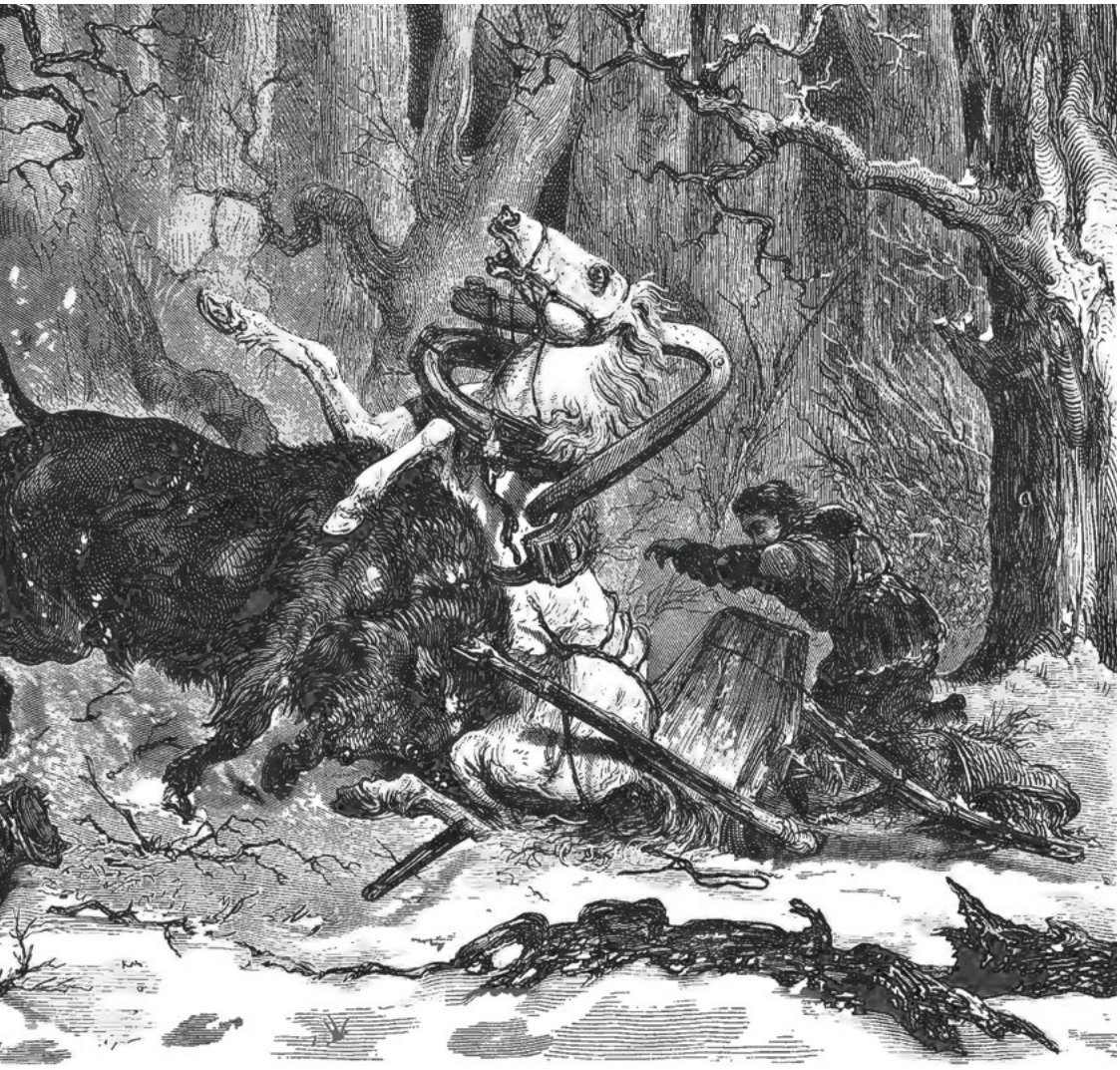


Fig. 4.11. Illustration „Meeting with European bison in Białowieża Primeval Forest“ from the journal „Niva“, 1872, No 46, page 725.

Nevertheless, the Forest was in his eyes still impressive and made him "*feel like a bug*", and the administration made a lot of effort to preserve the forest in its "*picturesque*" and "*pristine*" form (Lesnik 1918). The article was published in the time of German occupation of Białowieża and the fate of European bison was still unknown: "*it is a calm animal, massive and beautiful, and it will be a pity if the Germans destroyed this endangered beast*" (Lesnik 1918).

Other journals

In other Russian-language journals, European bison and BPF appeared either seldomly, usually in a form of reprints from other periodicals. In hunting journals, natural history was a rare subject, as these journals focused more on guns, dogs, and other practical issues. The journal "Russkiy okhotnik" [Russian hunter] published in Moscow from 1890 to 1895, never included any original papers about European bison or BPF. Nevertheless, there were at least 8 short notes – reprints from other periodicals – on changes in the forestry and game management of BPF (Anonymous 1890A, 1892), about the number of big game (Anonymous 1890B), culling an old vicious bison (Anonymous 1894A), about sending a stuffed bison to an exhibition (Anonympus 1894B), etc.

Although the journal "Psovaya i ruzheynaya okhota" [Dog and Rifle Hunting], published from 1894 to 1906, had no articles specifically devoted to European bison of BPF, both topics were mentioned, either in the form of images or text by Georgy Karcov about a red deer with 28 end horns (points branching off the "palm"), killed in BPF in September 1903 (Karcov 1904). The author considered BPF very suitable for red deer, since such a stag was found there only after 15 years of the species' reintroduction to the Forest. Karcov published also a photo of the killed deer, a drawing of his horns, as well as a table with detailed measurements of the latter.

The journal "Okhota" [Hunting] was published from 1902 to 1906 as a supplement of "Dog and Rifle Hunting". It included only one article connected with BPF – a review of Karcov's book (B.S.N. 1904). Most likely it was written by the ornithologist Sergey Buturlin. The reviewer compared BPF to Yellowstone National Park stating that BPF "*is a secure storage of the riches and beauties of the primeval nature of the European continent*" (B.S.N. 1904). BPF is interesting, he wrote, "not *only for a naturalist and hunter, but also for any nature lover, especially for an artist. The picturesque and majestic views of the forest, with a changeable relief and a wealth of different tree species, are in an endless variety*" (B.S.N. 1904).

European bison and BPF appeared regularly in the form of illustrations, often without any accompanying texts, in journals like "Niva" (**Fig. 4.11**),

4.4. Interest in BPF and European bison in French, Spanish and other international journals

The French popular science magazine "La Nature" [Nature] was published for almost a century, between 1873 and 1972. The founder and long-time editor of "La Nature" was Gaston Tissandier (1843–1899), chemist, physicist and a pilot. "La Nature" has become one of the most important European popular science magazines, whose reach and influence transcended the borders of France. European bison and BPF returned to the pages of the journal several times (**Fig. 4.12**), the first being on the occasion of the Exposition Universelle of 1900, held in Paris. The Russian hall was then decorated by a stuffed "magnificent bison", as the journal reported (Anonymous 1900). In 1906, the magazine published an article by V. Forbin on the slow extinction of bison in Białowieża, Caucasian and Pszczyna populations and about the peculiarities of the protection of BPF, incorporating the practice of leaving dead trees in the forest contrary to the forestry guidelines of that era (Forbin 1906). A year later, "La Nature" published an extensive article on Caucasian bison by A. Yermoloff, the former Russian Minister of Agriculture. The author supported the idea of Białowieża and Caucasian bison being the same species (Yermoloff 1907).

In the summer of 1915, BPF was captured by German troops, raising an international alarm over the fate of the Forest and its population of European bison. Echoes of this concern were visible in journals throughout Europe. In September 1915, Spanish magazine "Alrededor del Mundo" published an alarming article on the war threatening the existence of European bison: "*When the war reaches a terrible size, as now, it not only destroys works of art or cathedrals, but also threatens nature and can lead to the extinction of entire species. Probably this applies to one of the most interesting species of European fauna, bison* (...). *With the highest probability it can be said that the European war will lead to the destruction of European bison, today a species as rare as related American bison, known for colourful stories from the wild West*" (Anonymous 1915A). In the same time, Russian "Bulletin of the Kharkov Society of Nature Admirers" published two notes about European bison. The first was a fantastic story about bison fending off German soldiers: "*with bloodshot eyes, dishevelled hair, bison rushed swiftly at the bewildered Germans. German bayonets broke under the onslaught of the broad foreheads of bison, and indiscriminate shots aroused the frantic rage of the forest monsters even more, jumping and trampling on the Germans, they tore and tossed everything until it fell into pieces*" (Anonymous 1915C). The second note reported on European bison captured during the war in Białowieża and sold to Stockholm Zoo by Hagenbeck – rising another concern on the depletion of the size of the bison population in BPF (Anonymous 1915C). A very similar story about European bison fending off occupants was published in November 1915 in a French newspaper: "*Exceptionally unexpected allies fought for us in* (...) *the famous Białowieża Forest, the only forest that*

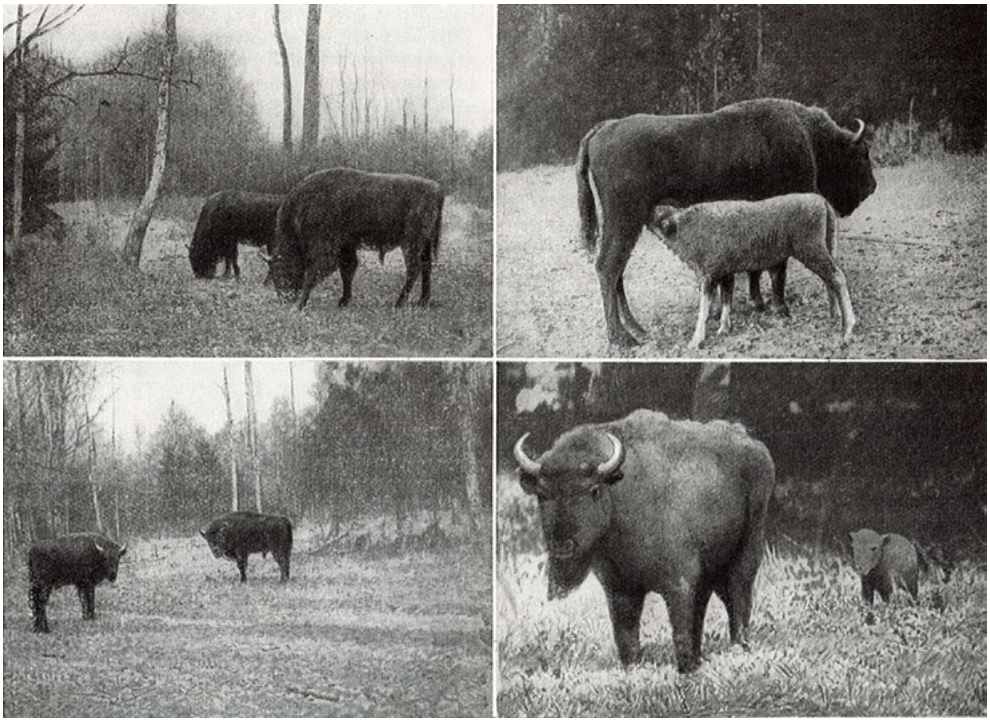


Fig. 4.12. European bison in an illustration in magazine "La Nature". Captions to photographs in the magazine read: top left – European bison from Białowieża, top right – young four-month-old suckling mother's milk, bottom left – European bison in animal park in Springe, bottom right – newborn European bison, 4 hours old, following its mother (from Kazeeff 1936).

has free-living bison, a species almost extinct and currently counting only 653 animals (…). It is said that one of the troops stood eye to eye with a herd of bison. Germans, who have never seen bison, stopped surprised and terrified. Bison seemed to be equally surprised. But a shot was fired and the herd burst into anger, throwing itself at soldiers. A terrible fight ensued, bayonets spattered against the skulls of angry animals, and many Germans were crushed under bisons' hooves" (Anonymous 1915B). Among these alarming voices, Hugo Conwentz published his account of the state of the European bison population and his impressions from BPF in "Die Woche" in 1916. *Conwentz (1855–1922) was a palaeobotanist and pioneer of nature conservation in Europe, supporter of the idea of national parks* (Vogel 1957). *Thanks to his effort the heart of BPF was never embraced by the German forest management, i.e. massive timber felling (Wajrak 2013). His text about his visit in BPF* started with an explanation that European bison once roamed in Germany, but now its range is restricted to BPF and the Caucasus Mountains. Even before Białowieża was captured by German troops, the State Office for the Preservation of Natural Monuments in Berlin asked the army to observe the need to protect European bison, which later resulted in prince Leopold's

Fig. 4.13. Photograph of a European bison at the feeding rack in BPF accompanying Hugo Conwentz's text (Conwentz 1916).

order prohibiting shooting bison in BPF to "*preserve the population of European bison as far as possible, in order to save a unique natural monument of its kind*" (Conwentz 1916). The author devotes several paragraphs to praising the German administration of BPF and the care taken of bison and the Forest itself. In Conwentz's text there is no doubt that bison and the Forest, as changed as they are, find themselves in good hands: "*On the whole, the Forest gives the impression of being pristine, but one cannot exactly speak of a primeval forest* (...). *Often one can see feeding places in the Forest where the bison are fed in winter with hay which the farmers in the villages were obliged to provide. The general impression is that animals are no longer in a wild state, but in a semi-tame condition and are hardly shy of humans. I was able to observe an animal lying on the ground at close, without it being disturbed in its rest. I also photographed an animal at a distance of* 5 *metres. It can hardly be attractive for a hunter who would like to stalk such game. Even if one has to admit that the bison are no longer in their original condition, the preservation of the population is very desirable*" (Conwentz 1916; **Fig 4.13**). The author sees only two threats for Białowieża's bison: poaching and lack of fodder, completely ignoring the German timber exploitation, which he calls very moderate: "*for the time being, there is no danger that the forest landscape as a whole will be altered and significantly impaired* (...). *Many parts of the Forest are not felled at all, and some large areas are still unknown to German foresters*" (Conwentz 1916). The latter, we might add, formed the reserve created in the centre of the Forest (Wajrak 2013).

Before the extinction of European bison was officially confirmed, an anonymous note was published in the bulletin of the French Geographical Society. It presented the history of the species, with a simplified and erroneous explanation of bison population decline caused by the degeneration of the species and summarized the current situation: "*Unfortunately, war treated bison with extreme cruelty. Areas, where these animals live, passed between sides of the conflict many times. We have virtually no clue as for the fate of bison in Caucasus. Regrettably, all evidence indicates that the three herds living in Poland and Lithuania were destroyed, forever*" (Anonymous 1918).

Another batch of articles in the French "La Nature" summarized the sad reality in which European bison were eradicated in the wild. In 1925, another article presented the history of the Forest and the decline of the bison population until their post-war extinction (Remy 1925). A similar topic constituted the core of a 1930 article by W. Kazeeff, with the analysis of the reasons for the extinction of the species characteristic for this era: "*Although we have said that the last wild bison of Europe were victims of the last war and the Russian Revolution, the statistics of Białowieża Primeval Forest show that from 1857 onwards their number, which for that year was 1898, was in decline (...). One must have the courage to admit that the reduction in the number of bison in Białowieża was due to poor management. It rested in the hands of courtiers skilful in intrigues, but completely ignorant in the field of natural history*" (Kazeeff 1930). The author's critique of the administration of BPF in the last century went even further, listing "*cardinal mistakes*" made, like introduction of industrial enterprises into the Forest, culling of bison individuals not focused on old males and infertile females, creating competition for the bison by introducing red deer and roe deer to the Forest, lack of sufficient grazing areas inside the Forest.

4.5. Perception of popular writings on BPF and European bison – Ludwik Abramowicz's collection of press clippings

A collection of clippings from periodicals and books from the middle of the 19th – beginning 20th century about BPF assembled by Polish journalist connected with Vilnius, bibliographer and editor Ludwik Abramowicz (1879–1939), found at the Wroblewski Library of the Lithuanian Academy of Sciences, gives a unique opportunity to trace the dissemination and perception of topics connected with BPF and European bison in this period (for more on this topic see Ričkienė et al. 2021B). Scientific publications of this era (see chapter 3) reached a selected and rather narrow audience of naturalists, foresters and game managers, whereas more popular journals and periodicals had a chance to be read by a much wider and diverse group of peers. Articles published in such journals not only informed about the existence, history and current state of the primeval forest of Białowieża and its European bison population but also shaped attitudes towards methods of nature protection, value of BPF,

and the significance of conserving the primeval species of bison. These popular works formed the perception of primeval forest and its prehistoric dweller among the general public in Europe, at least the literary part of it. Ludwik Abramowicz serves as a perfect example of an educated recipient of popular writings on these subjects. His collection of clippings from periodicals and books published in Warsaw, Berlin and Vilnius covers the period 1863–1916. Clippings themselves were cut from periodicals of wide cultural scope and cover a broad set of topics: geography, climate, plants, animals, and life of local people. The group of periodicals incorporated, among others, titles like "Kłosy" [Ear of Grain], "Tygodnik Ilustrowany" [Illustrated Weekly], "*Biblioteka Warszawska*" [Warsaw Library], "Wszechświat" [The Universe], "Głos" [The Voice], "Świat" [The World], "Ziemia" [The Earth], "*Życie Ilustrowane: dwutygodnik Kuriera Litewskiego*" *[Illustrated Life: biweekly of Lithuanian Courier]*, "Wielka encyklopedia powszechna ilustrowana" [The great general illustrated encyclopedia], "Die Woche" [The Week]. Apart from that, clippings included pages from books, encyclopaedias and illustrations.

All clippings presented information about BPF that differed in their substantive content: a significant part of them presented a very popular, romantic vision of the Forest but there were also papers prepared by established and reliable authors with a high level of accuracy (e.g. Gloger, Przybylski). What is common for almost all clippings is the awe their authors feel when faced with the actual Forest and European bison. Their personal impressions introduce readers to BPF as magic, legendary, enormous and mysterious. Several articles presented geographical information on the location of BPF and the ways to get there, some going as far as recommending travel routes by car (Anonymous 1907). Almost all papers present information about plants of BPF but the major part in descriptions is reserved for European bison. The species is described in all papers as the most unique feature and pride of BPF, not to be seen anywhere else in the wild. Several clippings contain information about European bison numbers and express concern about the decline of the population. Abramowicz's collection included also pictures that accompanied all papers and publications that the clippings originated from. This graphical material covered an entire variety of topics, from local dwellers, to animals, most prominently European bison, to the forest itself, and to historical monuments.

Most probably Ludwik Abramowicz was not the only one to collect clippings devoted to BPF and European bison, topics undoubtfully interesting and well represented in popular and more specialized periodicals. The fact that his collection survived in Wroblewski Library of Lithuanian Academy of Sciences was a great opportunity to get a glimpse into the mindset and level of general knowledge on topics of primeval forest, bison and Białowieża at the turns of the 19th and 20th centuries. Despite different informational value, the overall level of collected clippings allowed for the formation of a solid base of knowledge on geography, history, ethnography, a general biology of the forest but also more specialized topics like animal behaviour, conservation or features of a primeval forest. Even papers that repeat old and outdated information could have played a role in building a public image of primeval

forest thanks to personal remarks and impressions about the Forest and meetings with European bison. The fact that clippings included illustrations and photographs shows that the general public was acquainted with the look of European bison and the Forest itself.

Abramowicz's set can be treated as a model example of what information on BPF and European bison a curious person of that period could obtain from periodicals of various kinds. Such a collection of popular writings accompanied with pictures and photographs most probably had a crucial influence on the formation of public perception of BPF as pristine, natural and primeval, contributing to the Forest's special status as a historical and natural monument, worth studying and preserving. Such a collection of popular papers based, in majority, on reliable sources and publications, was hence an efficient tool used to communicate the value and importance of BPF and the bison – and their interdependence – to a wide audience (see more detailed analysis of Abramowicz's collection in Ričkienė et al. 2021B).

Chapter 5.

Animal reintroductions as an attempt to recreate the fauna of a primeval forest

The First World War wreaked havoc in the forests of Poland. Plundering of forests by the occupying forces, chaos of wartime, and the dire material situation of the Polish population led to enormous losses both to forests and to forest fauna. Hunger and relatively easy access to weapons drove mass poaching. The newly created administration of the Republic of Poland that was attempting to organise and normalise forestry policy found itself in a very difficult situation. The most basic working tools such as forest maps were often missing (Pączewski 1924).

One of the most important tasks was the restoration of the animal population of Polish forests. The action to save European bison is undoubtedly one of the greatest successes of Polish forestry policy. However, other successes of this policy are also worth remembering. The reintroduction of bears in BPF and the action to save beavers are also successes on a global scale. It is worth noting, however, that the reintroductions of the inter-war period were not only restorations of animal populations, dictated by natural or hunting interests, but also very much a restoration of historical memory: giving back Białowieża's woodland the species that dwelled there in the time of the Polish-Lithuanian Commonwealth. This approach was well characterized by Otton Hedemann, historian of BPF: "So *the collapsing Commonwealth handed over to the tsarist government quite a sizable population. However, they were unable not only to increase their numbers, but also to maintain them – the beaver population was shrinking fast, and the last beaver in Białowieża Primeval Forest was said to have been seen in 1836, a century ago. This centenary should be remembered. The beaver habitats mentioned above are obviously indicated by nature itself. Perhaps our forestry authorities could establish a new beaver colony in one of these habitats, thus initiating, under the protection of the laws of the Republic of Poland, the renewed development and possibilities for the royal beaver's genealogical buildings. It would really be worth considering, as the beavers which still live and vegetate somewhere in Polesie with such difficulty and in constant danger of extinction would have ideal con-*

ditions for splendid development here, increasing even more the seriousness and attractiveness of the pearl of our forests" (Hedemann 1935).

Action to rescue and reintroduce European bison

When BPF became a part of the Second Polish Republic, one of the most important questions was whether European bison managed to survive the period of German occupation and revolutionary chaos. Although already in 1919 a government mission led by Herman Knothe (Daszkiewicz et al. 2020) reported on the extinction of the species, rumours about bison still present in BPF and surrounding areas still circulated (Miklaszewski 1919). The report prepared by Janusz Domaniewski, a delegate of the State Council for Nature Protection, left no doubt that there were no more bison in the Forest, confirming the earlier findings of the commission led by Władysław Szafer (Szafer 1919). The only surviving European bison in the Polish lands were 16 animals in the Pszczyna forests in Upper Silesia (Anonymous 1921A). Still, the State Council for Nature Protection prepared a Draft Act on the Protection of Particularly Rare Species of Animals and Plants in 1920, which included European bison and penalties for killing one: prison sentence and a fine, not less than 200 thousand Polish marks (Anonymous 1921A). This act evidenced very strict measures taken to protect animal and plant species in the reborn Poland, but also related to the fact that in 1920 it was still believed that perhaps at least part of the European bison population survived.

Faced with the extinction of Białowieża bison, Jan Sztolcman proposed to rebuild the population from individuals scattered in various zoos and parks and to reintroduce the species into BPF. As most of the bison were outside Poland, it was necessary to internationalise this action. Jan Sztolcman reported in "Ochrona Przyrody" on the First Congress of the International Society for the Protection of the European Bison in Berlin (27 and 28 September 1925), in which he took part as an official delegate of the Polish Republic. He recalled that he was the first to propose the creation of a similar society at the Paris Congress: "*Let me remind you that in May 1923, at the International Congress of Nature Conservation in Paris, I was the first to raise the idea of founding a similar Society based on the model of the American Bison Society, thanks to which the remains of the American bison, which counted only 885 heads in January 1899, were saved from extinction and today their number reaches 15 or perhaps 16 thousand. The idea of founding a similar society was evidently a timely one, as a group of German scholars took it up at the same time as I did, and when the chairman of the zoological section of the Paris Congress, P. Delacour, during his stay in London, proposed to the Zoological Society there that it should take the initiative in founding a League for the Protection of the Bison, he was told that the Germans had already made efforts to do so. On 25 and 26 August 1923, a group of people met in Berlin and founded the International Association for the Protection of Bison (Internationale Gesellschaft zur Erhaltung des Wisents)*" (Sztolcman 1926C).

The first stage of the bison rescue campaign was, of course, to find and inventory them. Particular attention was paid to the Pszczyna bison, a few of which managed to survive the war disaster. In 1923, in a note published in "Ochrona Przyrody" it was reported that out of 100 animals living there in 1911, only five remained, 70 were killed by German Grenzschutz soldiers and 32 bison fell victim to poachers during the Third Silesian Uprising (W.S. 1923). It was also hoped that the Pszczyna bison would contribute to the restoration of the Białowieża population: "*On the issue of bison protection, a broader discussion developed. J. Sztolcman was asked to communicate personally with the Duke of Pszczyna on the reduction of the area of the Pszczyna game preserve for easier supervision. Prof. Dr. Grochmalicki reported that the bison in Poznań were doing well and that a new arrival was expected. Negotiations were also undertaken to bring in a cow*" (Szafer 1926).

There was also a search for European bison in other places. In 1924, it was reported that in response to an enquiry about bison from Jaworzyna Spiska, the management of the estate of Prince Hohenloe replied in a letter dated 19 June 1923 that "*the bison became extinct during the great snowfall. Only a three-year-old cow is left*" (J.Z. 1924). It is also interesting to note that in the Tatra Mountains, in the same estate, there were attempts to acclimatise Caucasian bison (J.Z. 1924).

Apart from Białowieża bison, hybrids with Caucasian and American bison, and domestic cattle were also found. The question therefore arose whether and how to use these hybrids in the campaign to save the species. On the one hand, the desire to rebuild a "pure" Białowieża population was obvious, while on the other hand, the small number of individuals and the memory of the recent war catastrophe made each individual, even a hybrid, extremely valuable. There was also a prevalent thought that a contingency plan is needed in case the restitution of the Białowieża line fails. The second important issue was the question of ownership – most of the bison were in private hands and their transfer to an international organisation or sale depended on the decision of their owner. A postulate of Konrad Wróblewski that the bison, as a "general heritage of mankind" should not be allowed to be privately owned, and that, by means of an international agreement, all pure-blooded bison should be gathered in different places, in several groups similar in age and consisting of several cows and a male (Grochmalicki 1932) unfortunately remained in the realm of wishful thinking. The Polish authorities purchased, whenever possible, European bison as well as hybrids. Białowieża was meant to be a breeding site and then a refuge for European bison of Białowieża origin, while hybrids were to be located elsewhere. European-American bison hybrids were a serious problem in the programme of restoration, especially since the Germans started to promote their breeding and then the crossbreeding of hybrids with European bison.

Already in 1928, it was pointed out at the Congress of the International League for Nature Conservation that the policy of crossbreeding European with American bison and increasing the number of hybrids could lead to the extinction of the pure Białowieża bison line (W.K. 1928). This threat was discussed several times on the pages of "Ochrona Przyrody" (Grochmalicki 1930), and Konrad Wróblewski even called for

a ban on the use of female bison for the "creation of hybrids" and postulated that all crossbreeding of the European bison with other species should be allowed only for scientific purposes (Grochmalicki 1932). The issue of subspecies in the restoration action was also a topic of hot discussion: Wróblewski argued that the Białowieża, Caucasian and Pszczyna lines should not be separated as they were the same species – European bison – whereas Roman Kuntze strongly opposed that view. It was eventually the Kuntze's view that prevailed, as scientifically more sound, and the decision to maintain only the pure Białowieża line in BPF was made (Kuntze 1935).

In 1929, the convention of the Bison Conservation Society took place in Poznań, parallel to the General National Exhibition. Celebration of the decade of Polish independence gave it special significance. The convention was chaired by Kurt Priemel, in memoriam of Jan Sztolcman, who died in 1928. In the background, there was a Polish-German dispute over the distribution of finances and the priority in the campaign to save the European bison.

Efforts were made to institutionalise the bison rescue campaign, recognising its natural and political importance. A special commission was set up with the participation of scientists, representatives of the Ministries of Education and Foreign Affairs and the State Council for Nature Protection (Szafer 1929B). In 1930, a convention of the Society took place in Leipzig (Grochmalicki 1930). It was reported that "*the present population of pure-blooded European bison is admittedly not numerous*,

Fig. 5.1. The moment of release of the first European bison in the Zwierzyniec reserve in BPF in September 1929 – a photograph by J. J. Karpiński published in "Ochrona Przyrody" 1929.

as it amounted to 59 specimens at the end of 1929, including 32 females and 27 males, i.e. as many as at the end of 1928. It should be noted, however, that what is most important for the forecasts of the European bison reproduction and which is the main concern of the International League for its conservation, is the fact that this animal, as a species, does not show any degeneration, can be easily bred and the young are born healthy, so that even though the previous year was marked by a considerable loss of older animals or those that died as a result of accidents, the arrival of newborns compensated completely for these exceptional losses. By adding to the previous year's numbers the animals born up to the spring of this year, today we have 62 pure European bison in zoos and game parks. This number of animals is broken down by country as follows: England has 19 specimens, Germany 18, Poland 13, Sweden 5, Russia 3, Austria 2, the Netherlands and Denmark 1 specimen each. In Poland, the largest number of bison (8) is in the Prince of Pszczyna's zoo in Upper Silesia, 2 specimens each in the Zoological Gardens in Poznań and Warsaw, and 1 specimen of a pure breed is in Białowieża (Grochmalicki 1930).

The transition to the second stage of the European bison rescue action, i.e. the release of animals into the wild, was followed with great attention. An important question was whether the bison should immediately return to BPF or whether another place should be found for them. In the case of Białowieża, the danger of parasites and poaching was emphasised (Szafer 1929A). The memory of the Bolshevik invasion and subsequent occupation of Białowieża was also very fresh. It was also argued that bison had better breeding conditions in Pszczyna, where they could be more closely watched in safer environment (Grochmalicki 1932). Opponents of the return of the bison to Białowieża included Janusz Domaniewski. Konrad Wróblewski proposed to erect a special breeding farm as the next stage of the campaign: "As *far as the breeding of European bison is concerned, in the opinion of the expert, it would be suitable to keep them in Białowieża, although the present park area of 22 hectares is unconditionally too small. In order to provide them with normal breeding conditions, it would also be necessary to set up separate plots with pens for each cow, thus creating a kind of matriarchy in the herds. The same plots with pens should be arranged for young and solitary animals, but young males should be eliminated from the herds at an early stage, and unnecessary bulls (sic!) and bastards should be given to zoos*" (Grochmalicki 1932).

The decision to choose BPF had also its political aspect. The campaign to save the European bison was a field of Polish-German competition. In a very unfair way, Poland was repeatedly attributed responsibility for the extinction of the species in the Forest. Therefore, the authorities of the Second Polish Republic were anxious for the success of the action and the triumphant return of European bison to Białowieża. The transport and release of the first animals in the reserve in Zwierzyniec on 19 September 1929, was therefore rightly regarded as a major success of Polish conservation policy. The return of the bison, together with its history, was described by Jan Karpiński in "Ochrona Przyrody", accompanied by his photographs (**Fig. 5.1**) (J.J.K. 1929).

In the last pre-war issue of "Ochrona Przyrody", a report from 1937 informed about the birth of two European bison: "bison females Biserta (after Borus) and Biskaja (after Plisch) gave birth to a litter: a bull 'Pulchny' and a heifer 'Polka'. The number of bison is currently 13, exclusively pure-blooded" (Doubrawski 1937).

Reintroduction of brown bear, beavers, moose, and Polish horse

The issues of "Ochrona Przyrody" and other forestry and hunting journals all share the common view that the aim of the policy of reintroduction and "strengthening" the population was to restore the mammal fauna of the forests of the former Commonwealth of Both Nations, not unlike "rewilding" today (Ledger et al. 2022). Therefore, not only European bison but also other large mammals were incorporated into the conservation policy. Especially, the brown bear reintroduction experiment in BPF serves as an example of a change in thinking about nature conservation and forestry. Persecuted as a pest by Russian authorities and eventually exterminated in the 1870s (see more on this subject in Samojlik et al. 2018), the species was set to return to BPF. This example, the world's first reintroduction of a large carnivore motivated by conservation and not purely hunting goals, shows that the ecological role of carnivores was well understood in Poland during the interwar period. Not only were they not treated as pests but they were rather considered a necessary component of natural ecosystems. The release of bears was preceded by many years of preparation and discussion on the origins of the individuals, their selection (Kuntze 1935) and the method of release (Daszkiewicz et al. 2020): "*Discussed for several years, the project of introducing the bear into Białowieża Primeval Forest, where the animal was exterminated in 1880, was put on a real basis in 1936. By virtue of an agreement between the Directorate of State Forest and the Warsaw Zoological Garden, the State Forest Administration would receive in the summer of 1937 three young bears (2+1) of Western Russian origin in exchange for the hybrid bison given to the Garden in November 1936. The young bears will be placed in a special facility on the periphery of the National Park, where they will be kept in closed breeding for the first period and then gradually accustomed to freedom. In this way, in 1937, BPF will celebrate the return of the third animal species* [besides the European bison and the beaver] *earlier exterminated by man*" (Kostyrko 1936). "Ochrona Przyrody" published photographs of bears in BPF (**Fig. 5.2**) and reported on the progress of reintroduction.

"An iron cage and a guards' lodge (temporal constructions) were built deep inside the National Park. At both compartments of the cage, there are wooden dark boxes built for barrows. In one compartment, the cage contains a female bear expecting cubs at the beginning of 1938, and in the other compartment bear cubs, imported from Russia, were placed. Bear cubs, both bought as well as born in the cage, will be free to leave the cage. As they grow, they will lose more and more contact with the cage and artificial feeding, assimilating permanently into the wilderness. Then both the female bear and the structures built there will be removed" (Doubrawski 1937).

Fig. 5.2. Brown bear female Lola in a cage in Białowieża National Park. Photograph by J. J. Karpiński published in "Ochrona Przyrody" in 1937 (Doubrawski 1937)

The reintroduction of beavers was also regularly reported. When Poland regained its independence, the species was almost extirpated. Thanks to the activity of foresters, and also the work of Julian Ejsmond, not only were the last populations conserved, but also a very successful beaver reintroduction campaign was carried out (Daszkiewicz et al. 2021). Interestingly, when the reintroduction of beavers was combined with restitution of European bison (Kostyrko 1936), this combination had already had a long tradition. In 1885, Antoni Wałecki published an article in "Pamiętnik Fizjograficzny" entitled "European bison and the beaver", in which he wrote: "*These two species of animals, already extremely rare and ultimately threatened with extinction, still find a refuge in our fauna; this circumstance awakens sympathy for them on one hand, and on the other raises the scientific significance of these species in relation to the rest of Europe*" (Wałecki 1885). Similar juxtaposition of the two species was the basis of a popular science book "Obrazki z życia zwierząt. Bóbr. Żubr" [Pictures from the life of animals. Beaver. European bison] published in Kraków in 1876 (**Fig. 5.3**) (Janota & Anczyc 1876).

Fig. 5.3. Illustration of beavers from the book "Obrazki z życia zwierząt. Bóbr. Żubr" [Pictures from the life of animals. Beaver. European bison] (Janota & Anczyc 1876).

The chance of conducting scientific research was an additional reason for the beaver reintroduction campaign. In the very first decision concerning the establishment of the nature reserve in BPF during a conference on reserves in Białowieża in December 1921, the establishment of a beaver colony on the Narewka River was one of the main points (Anonymous 1923). Władysław Szafer, one of the signatories of the minutes of this conference, drew up a programme of scientific research, which he believed should be carried out in protected areas, with research on beaver ecology being one of the programme's crucial points (Szafer 1922). Presenting the story of the rescue of the last German beaver population, Szafer emphasised: "German science has thus the beaver colony on the middle Elbe, which has been rescued from extinction, as an extremely valuable object for research, which it will undoubtedly exploit for itself with the characteristic German strictness and meticulousness" (W.S. 1923).

There were also plans to prepare a monograph on the beaver on Polish soil. However, this work required many years of field observations. The tragic death of Juljan Ejsmond in a car accident in 1930 prevented him from completing the book he was preparing, then the outbreak of WWII interrupted many years of research on beavers conducted by Edward Schechtel (Daszkiewicz et al. 2021). World War II and the occupation of Poland stopped the entire beaver reintroduction campaign. All the populations present in the Second Polish Republic and protected with great care found themselves outside the country after 1945. Today's Polish beaver populations originate from post-war reintroductions of the animals mainly from the USSR and partly from spontaneous border migrations.

What is important to stress is that the reintroduction programme relied on interdisciplinary cooperation. Discussing and planning the reintroduction of beavers, the Directorate of State Forests used the work and expertise of Otton Hedemann, historian of BPF, who identified the location of former beaver lodges on the Narewka River (another example of such fruitful collaboration between this eminent historian and forestry administration was the inventory of traditional names of BPF's backwoods; see Kostyrko 1936). This is a rare example of a forest management administration referring to the work of historians in order to carry out an up-to-date conservation campaign.

In the Second Polish Republic, actions were also carried out over the years to increase the number of moose in BPF. Three young moose were bought from the estate of Karol Radziwiłł in Dawidgródek in 1937, but during transport two of them died. One female moose was eventually brought to Białowieża, to the fenced game reserve (**Fig. 5.4**) (Doubrawski 1937). Further plans of translocating moose to Białowieża were unfortunately disrupted by war.

"Ochrona przyrody" also reported on the progress of the breeding of the Polish horse led by prof. Tadeusz Vetulani, who wished to obtain a horse as close as possible to the tarpan and to restore the wild horses in BPF. In 1936, the first horses were brought into the Forest (Kostyrko 1936), and a year later a 22-hectare horse reserve was established near the Hajnówka-Białowieża road (Doubrawski 1937).

Fig. 5.4. Moose in the game reserve in BPF in 1937, a photograph by J. J. Karpiński from "Ochrona Przyrody" (Doubrawski 1937).

Looking from the perspective of the years at the action of reintroduction of the fauna of primeval forest in the Second Polish Republic, its effectiveness should be emphasised – even if a significant part of achievements was lost due to war and the partitioning of Poland by Germans and Soviets. After the Second World War, all the protected beaver habitats found themselves outside Poland, Białowieża's bears did not survive the division of the Forest and Polish horses were stolen during the German occupation under the supervision of Lutz Heck, negating the effects of prof. Vetulani's experiments. However, the pioneering and historically important reintroduction experiments, motivated by conservation goals and aimed at reconstructing the fauna of the primeval forest, remain a legacy and contribution to science.

Chapter 6.

Building an iconic status of European bison through art

European bison was at the brink of total extinction after being eradicated in Białowieża Primeval Forest (BPF) in 1919, and was restored by an international effort. The success story of European bison rescue remains interesting until today, especially in the context of the global nature decline and biodiversity loss at rates unprecedented in human history: since the 1970s, vertebrate populations have declined by an average of 60% (Turvey & Crees 2019), and the remaining mammalian biomass has undergone drastic homogenization, with 96% now comprised of livestock and humans and only 4% of wild mammal species (Bar-On et al. 2018). An estimated one million plant and animal species are threatened with extinction (IPBES 2019, Tollefson 2019), in large part due to anthropogenic factors: overexploitation, habitat destruction, introduction of non-native species, human-induced climate change. This process has earned its own, gloomy name: The Sixth Mass Extinction, and deservedly so – the number of species lost in the last century would have been reached in 800 to 10,000 years without human-induced and human-accelerated processes (Ceballos et al. 2015). Slowing down these processes requires global systemic changes on economic, social, political and technological levels, which will not be possible without wide-reaching involvement in conservation (IPBES 2019). Focusing on the latter, it is crucial to develop mechanisms which would not only inform the general public about conservation goals but also convince societies to advocate conservation actions and support them with necessary resources. Therefore, the example of European bison — the largest surviving land animal in Europe, one of the most charismatic and iconic species of European mammals, successfully rescued after extinction in the wild over 100 years ago – might be useful nowadays to re-ignite the interest of the public. Of course, the threat of extinction affects a much wider suite of species, most of which not only do not have iconic status, but are almost completely overlooked by broader audiences.

The process of building a species' iconic status requires not only the scientific component (see chapters 2 and 3 for details of this process concerning European bison) and popularization in periodicals, journals and other means of communication (see chapter 4) but also a strong presence in visual media. These have always been one of the most important channels of human comprehension of information about the world, and in the modern age their role is even more crucial. It is through visual means that political, social and ecological communicates are most readily absorbed, and moreover – research shows that visual communication tends to be observed as a more objective and unmediated capturing of reality (Branthwaite 2002). Scientific illustration is particularly important in this respect, as it is expected to represent an "objective" vision of a given problem. According to Pyle (2000), an illustrator needs to understand the subject depicted which makes communicating the message easier. Apart from direct experience, the natural world is comprehended in the simplest way with the help of visual media, and conversely – all kinds of depictions of nature can affect the way humans perceive, engage in and support conservation efforts. Photographs play an important role in environmental and conservation discourses, as they "give biodiversity a face", concretize concerns about extinction of species and provide opportunities for affective involvement, which then potentially translates into engagement in wildlife conservation. As authors who analyse environmental discourse observe, it is easier to bypass text than photographs, so images help to capture the attention of the reader/observer (Seppänen & Väliverronen 2003).

Visual representation of species described in narrative texts strengthens the knowledge acquisition and positively impacts readers' attitudes (Flemming et al. 2018). It proves effective in the case of flagship, umbrella and keystone species, where a flagship species acts as a symbol for the protection of a particular habitat, an umbrella species is the one whose protection translates into conservation of other species or habitats, and keystone species is the one playing such an important ecological role that its loss would impact the entire structure of a community and ecosystem (Lindenmayer & Westgate 2020). Exposure to depictions of these relates to conservation intentions and, eventually, engagement in conservation actions (Smith & Sutton 2008). In this respect, concepts such as charismatic or appealing species are crucial for understanding the role of animal imagery in communicating conservation efforts. Charisma of a species is not easily defined (Monsarrat & Kerley 2018), and usually is described in traits that charismatic species possess (e.g. beautiful, impressive, endangered; see Albert et al. 2018). Similarly, aesthetic appeal is also expressed in traits, for example large body size, warm and bright colours, anthropomorphic traits and forward-facing eyes (Lundberg et al. 2019). Both of these categories are highly subjective and flexible, nevertheless their importance in conservation has been observed (Lorimer 2007; Clucas et al. 2008; Smith et al. 2012; Verissimo et al. 2017; Albert et al. 2018). Several studies analysed factors influencing public interest in different species and willingness to donate or engage in any form of conservation (Silk et al. 2017, Lundberg et al. 2019, Fukano et al. 2020), in general finding

connections between public involvement and appealing images. Such images were found effective as promotional tools, not necessarily connected with biodiversity conservation (Feldhamer et al. 2002; Home et al. 2009). It seems conclusive that animal imagery has the potential to become the dominant tool for raising social awareness and, consequently, receiving support for conservation campaigns. It falls in line with the strategies of conservation marketing that uses methods developed for the commercial sector for the benefit of conservation and is proposed as a fundamental component of the modern conservation toolbox (Wright et al. 2015, Macdonald et al. 2017).

Almost all published studies on the impact of animal imagery on perception, attitudes, and actual engagement in conservation actions embrace only the last decade or two, which makes it difficult to assess the long-term effectiveness of visualization strategies and techniques. An analysis of a case study that is set in the past and which gives an example of an effective action aimed at saving the species from the brink of extinction, could provide a valuable lesson for current species conservation. The mechanism of building the image of the species (understood as an overall representation, a vision containing both the physical representation and popular knowledge) that requires conservation effort is relatively fast thanks to mass media and social media, wide access to the Internet, and very fast circulation of information (Papworth et al. 2015, Wu et al. 2018, Nanni et al. 2020). It is possible that a similar mechanism also functioned in the past, only within a much longer time scale and different communication channels, with circulation of information restricted to much smaller groups, lower level of knowledge about bison anatomy among recipients of the information, etc. Many works now explore the relationship between an image of a given species created in various media and the public interest in its status (Lorimer 2007, Clucas et al. 2008, Silk et al. 2017, Albert et al. 2018, Wu et al. 2018, Fukano et al. 2020), the emotions it evokes in non-specialists (Joffe 2008, Kalof et al. 2016) and finally the willingness to spend funds on its protection (Smith et al. 2012, Colléony et al. 2017, Verissimo et al. 2017) – but all of them focus on recent patterns in a relatively short period of time: from years to a decade.

Studying this process in the case of European bison opens an opportunity to demonstrate that conservation communication has also been used in the past, except with different channels and over much longer timeframes: between 1500 and 1900. The first date is connected with the first known printed images of European bison. The year 1900 was chosen as a boundary date. For the international conservation effort, which started in 1919, to be effective, the process of building an image of European bison likely was completed around this time, especially in the world of slow information circulation. In the 20th century, the role of nature illustrations was gradually taken over by photography, in some aspects considered superior to artistic depiction and more realistic than even the most accurate drawings or paintings (Dunaway 2000). It is hard to precisely determine when the first photograph of European bison was taken – most probably during tsars' hunts in 1894, 1897 or 1900 in BPF. The latter is mentioned in the context of visit of photographer Karasik in the

Forest (Chestnykh & Kettering 2010). Photographs taken in 1900 were later published in Karcov's book (Karcov 1903). It is then safe to assume that such photographs entered wider circulation in the beginning of the 20th century.

The current esteem of the species is most probably the result of a centuries-old process of building the image of European bison as a charismatic, iconic animal. Furthermore, the successful restoration of the species after its extinction in 1919 was in all likelihood influenced by this long-lasting process. In this process, imagery played an important role. European bison images were, in the focal period of 1500–1900, mostly prepared as book illustrations but they often functioned alone, as prints, leaflets, irrespective of the original book in which they were published.

6.1. Analysis of archival imagery of European bison

By tracing the graphic representations of European bison from 1500 until 1900 we attempt to recreate the evolution of the perception of European bison over the centuries. The question is: did this evolution reflect the development of knowledge about the species, the understanding of its uniqueness and gradual rise of awareness of its possible extinction (particularly in the light of the 19th-century theories of degeneration and inevitable extinction of the species considered as primitive; Viennot 1862)? If so, depictions of European bison should become more and more accurate in the course of time between 1500 and 1900, and the public reception (especially in the context of conservation efforts) of these images should be linked with their accuracy.

Images for this analysis were collected during archival and literature surveys. Historical art collections in Europe were searched for European bison images using online search tools (europeana.eu, polona.pl, artsandculture.google.com, museums.eu), collections' and museums' websites, and via direct e-mail inquiries (the latter method was used especially in the case of Polish and Russian collections). The bias of this survey is connected with the level of digitization of collections' catalogues. Since it is gradually growing, more results should be expected if such enquiry would be repeated in future. The literature search was based on a bibliography of several hundred previously identified publications connected with European bison, BPF and forests of the Grand Duchy of Lithuania published until 1900 in Polish, Russian, English, German and French (see Samojlik et al. 2020).

In total, around 80 graphical representations of European bison from the period 1500–1900 were found. Thirty-eight of them were selected for further analysis: images showing only a small silhouette of the animal were discarded, as well as images that were a clear reprint of previously existing ones (without any added details) and images that, despite the accompanying description, depicted other species. Analysis of the evolution of graphical depictions of European bison was supplemented by

information about the development of knowledge about the species collected from various sources. When considering the knowledge of European bison, the evolution of the methodology of naturalists and their illustrators should be observed. Until the mid-18th century and the generation of Linnaeus, observation of animals as the research method in the field of natural history was rare. In general, scientific observations for the purposes of production of scientific illustrations, especially observation of animals *ad vivum*, from life, was rarely practiced (Swan 1995).

Initially, 38 archival images were ascribed to 50-year time intervals appropriate to their creation or first publication. Depictions were then analysed for their anatomical correctness. This was done to test the hypothesis that an increasing level of general knowledge about bison should result in more accurate depictions of the species. The anatomical accuracy (AA) was assessed using seven key features (Kobryńczuk 2008; Krasińska & Krasiński 2013) of species' appearance (identified on a photo from "European bison" entry in Wikipedia, see **Fig. 6.1**): (I) presence of the hump, gently rising from the neck; (II) body evenly covered with thick fur; (III) horns twisted inwards; (IV) large head set on a strong neck; (V) long hair on chin, throat and front of the body, forming a visible "beard"; (VI) long tail reaching the heel and (VII) overall silhouette: bulky, relatively short, with correct proportions and much heavier front (**Fig. 6.1**).

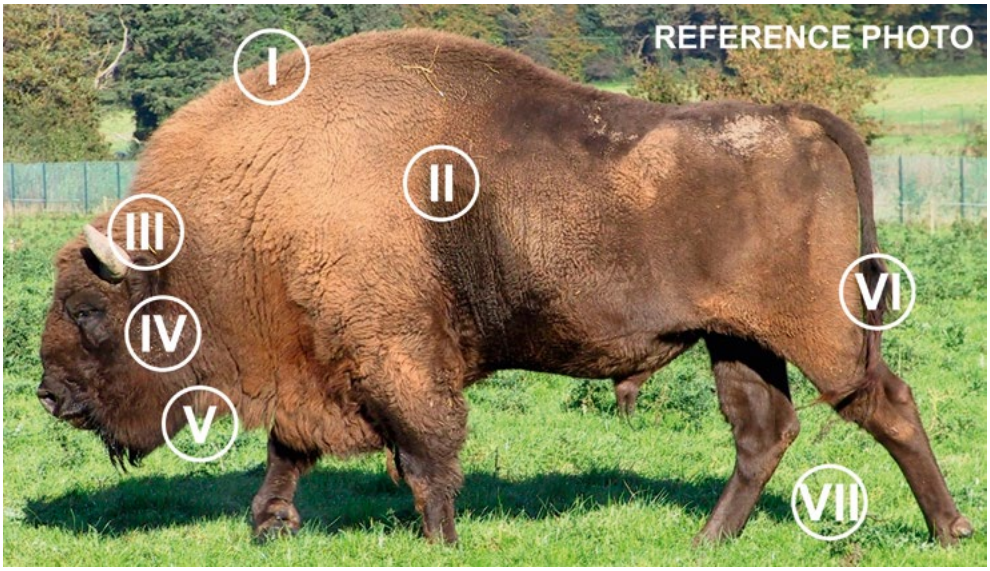


Fig. 6.1. "Side view of a European bison bull" – photograph from Wikipedia entry on European bison (https://en.wikipedia.org/wiki/European_bison) with key features of species' appearance marked: (I) hump, (II) thick fur, (III) inward-twisting horns, (IV) large head, strong neck, (V) beard, (VI) long tail reaching heel, (VII) front-heavy, bulky, relatively short silhouette.

The thirty-eight historical images (a selection of which are shown and described below) were reviewed by five European bison specialists: prof. dr hab. Małgorzata Krasińska and dr hab. Rafał Kowalczyk from the Mammal Research Institute, Polish Academy of Sciences in Białowieża, dr Katarzyna Daleszczyk and dr Zbigniew Krasiński from the Białowieża National Park, and doctor of veterinary medicine Jarosław Tomana from Pszczyna, who gave each image scores based on the presence and correct representation of each of these features. Scores (range 0–5) were attributed to each of the seven criteria, and then an average for the entire picture was calculated (max score was 35 for a max average of 5). This approach was selected as different European bison features were presented on drawings with varying degrees of accuracy. The average score for AA of images from a given interval was calculated (the number of images in one interval ranged from one to fourteen). Additionally, the average score was calculated for the entire century (given interval and an interval before). The reasoning for that is the assumption that due to slow dissemination of published information in the centuries analysed, both the new images and the ones published in the preceding interval could have equally impacted public perception of European bison.

The second step was to check the perception of historical depictions of European bison, especially to examine if the increasing level of knowledge about European bison resulted in more accurate depictions of the species and was this translated to more positive attitudes toward conservation efforts by the general public. Since we have no information about how these images were perceived in the time of their creation and distribution, we decided to test the modern public's evaluation of historical depictions in the context of possible involvement in the conservation of species shown. For this purpose, one image for each interval was selected using the following criteria: (1) images that entered circulation (hand drawn sketches, depictions in manuscripts and paintings that were neither reproduced nor widely known were removed from the pool of images analysed); (2) original compositions; and (3) depictions of a single bison in similar poses, from the side, with horns clearly visible (so that all images presented in the survey were comparable in terms of composition). The resulting pool of eight images was used to construct a survey containing two questions. The first question was designed to test how viewers assessed the accuracy of the representation in comparison with the reference photo (the same as in experts' evaluation) with the question: "How accurately does this image depict the European bison (compared to the photograph)?". The second question was designed to test how the perception of these images would translate to viewers' involvement in conservation actions. To avoid response bias that could result from asking about willingness to pay, the question focused on the potential of using the given depiction to advocate for species protection: "Would you recommend this image for a poster promoting European bison conservation?". The order of images for the social survey was randomized to remove any chronological effects.

The survey was distributed online as an anonymous Google form. Information about the survey was posted on social media channels of the Mammal Research In-

stitute, Polish Academy of Sciences, as well as distributed via e-mail using authors' personal contacts. The survey was active online for a period of one month. In total, 145 responses were registered. To check the strength of statistical relationships between answers to the first and second questions (time of creation and AA assessed by experts, AA evaluated by experts and survey respondents, AA of European bison images and their conservation potential assessed by survey respondents, conservation potential of European bison images in corresponding intervals assessed by survey respondents) a Pearson correlation test was conducted.

Several circumstances should be considered in discussing the development of knowledge about European bison. First, the gradual contraction of the geographical range of European bison since early mediaeval times made it difficult for naturalists to observe the animal at all, all the more in its natural habitat. The European bison was often confused with another bovine – aurochs *Bos primigenius* (Wrześniowski 1878, Łukaszewicz 1952). Taxonomic debates about whether European bison and aurochs were separate or the same species lasted until the 19th century. It was understandable, given the low level of knowledge about aurochs – its last surviving population went extinct in 1627 in Jaktorów in east-central Poland, where aurochs were protected by Polish kings (Rokosz 1995). The species was not widely known to Western European naturalists. What is more, in the mid-18th century even the possibility that European bison belonged to the Scottish cattle breeds was considered. The confusion further increased with the first reports about American bison *Bison bison* written by travellers in the 16th century (Sehm 1991).

The development of scientific knowledge about European bison could be traced to a series of books (Daszkiewicz et al. 2004, 2012; Samojlik et al. 2020), but the local, traditional knowledge about the species in the period concerned remains largely unknown. The only glimpse of traditional knowledge we have is through descriptions of customs from the Grand Duchy of Lithuania (in forests of which European bison survived the longest). In 1582, Maciej Stryjkowski noted that Lithuanians used European bison pelts to build boats (Stryjkowski 1582). In 1781, Jean Emmanuel Gilibert observed that it was an old Lithuanian custom to use pieces of fur from a bison's forehead as the remedy for difficult births (Gilibert 1781). In 1846, Ludwik Jucewicz wrote about another "magical" meaning ascribed to bison: amulets and shields made out of bison pelts (Jucewicz 1846).

6.2. Images of European bison 1500–1600

In general, the main source of knowledge about European bison were the works of ancient scholars, mainly Aristotle and Pliny, and sometimes travel accounts. The interval 1500–1550 was an exception because of two drawings by a German painter, printmaker, and theorist of the German Renaissance, known for his high-quality woodcut prints, Albrecht Dürer (1471–1528) (**Fig. 6.2** and **6.3**). The first illustration was accompanied by a description confirming that the artist had seen the depicted animal.

Fig. 6.2. Albrecht Dürer's illustration of European bison dated circa 1501–1504 done in pen and black ink. The British Museum, SL,5261.1 to 167. © The Trustees of the British Museum (www.britishmuseum.org/collection/object/P_SL-5261-101). AA = 3.18.

Fig. 6.3. Albrecht Dürer's European bison dated before 1528. Sheet with a Bison. Lombard album (ca 1550 – ca 1570), RP-T-1952-351, Rijksmuseum (http://hdl.handle.net/10934/RM0001.COLLECT.29680). AA = 3.68.

The AA of both pictures was highly evaluated by modern experts: 3.18 and 3.68 in the scale from 0 to 5.

Another exception was the account by Sigismund von Herberstein, a diplomat of the Holy Roman Empire, who saw both European bison and aurochs in the Polish-Lithuanian Commonwealth, and published illustrations of both species in "Rerum Moscoviticarum Commentarii" printed in 1549 (Herberstein 1549; side note: Herberstein's strict statement concerning the distinction between European bison and aurochs was widely disregarded by the taxonomic debate mentioned above). Despite Herberstein's personal observations of the species, the anonymous artist of the woodcut used for his book most probably relied only on the common knowledge of the European bison, as it was rather far from the actual likeness (**Fig. 6.4**). It was the widely known works of Herberstein that was much more influential than the unknown drawings by Dürer – it was translated, reprinted numerous times and cited (e.g., Gessner 1554). This illustration's AA was evaluated at 2.21, and the average AA for all three images originating in this interval was assessed at 3.0.

Only two illustrations were found for the period 1551–1600. Despite the fact that one of these was obviously based on the woodcut from Herberstein (Gessner 1554; **Fig. 6.5**), it included enough new details (beards, different depiction of fur on the animal's body) to include it in the analysis. Its AA was evaluated as 2.21.

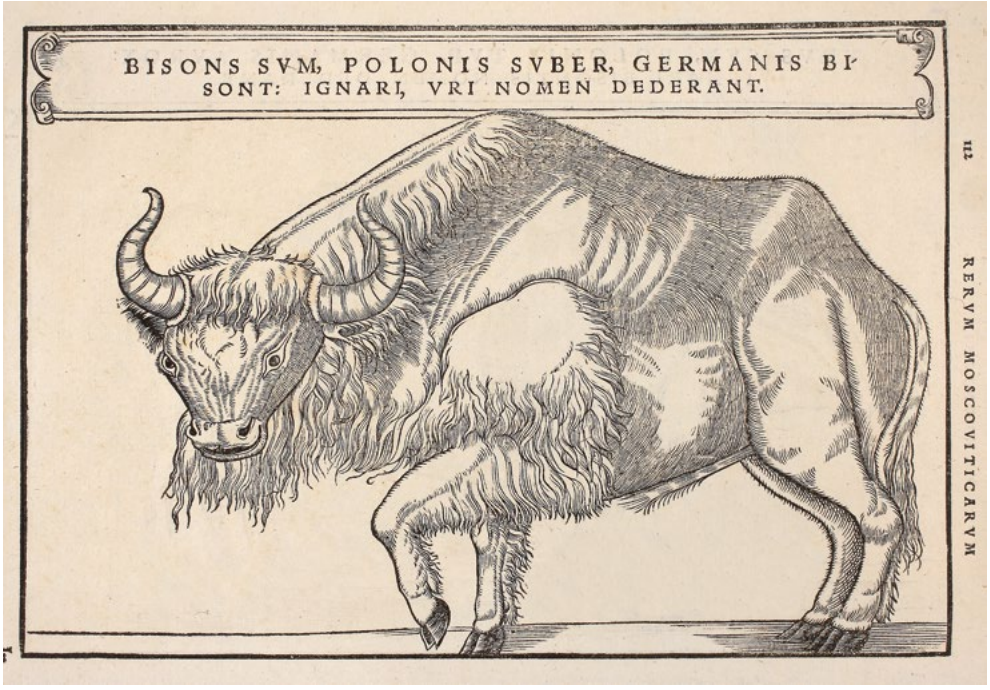


Fig. 6.4. Illustration of European bison from Siegmund von Herberstein's "Rerum Moscoviticarum Commentarii", Wien 1549 (https://dbc.wroc.pl/dlibra/publication/6046/edition/5639?language=en). AA = 2.21.

Fig. 6.5. Illustration from Conrad Gessner's "Historiæ animalivm", Zurich 1554 (https://www.biodiversitylibrary.org/bibliography/125499). AA = 2.21.

It was a common practice to reuse the same illustration in different publications, especially in the case of animals as rare as European bison. Preparation of illustrations for printing was a time consuming and costly process, therefore older printing plates were resold and reused many times (Feiman 2012). Even at the end of the 18th century, a famous French naturalist Jean-Emmanuel Gilibert illustrated his work on the European pond turtle in Lithuania with an almost two-century-old copperplate depicting a tortoiseshell turtle caught near Montpellier (Daszkiewicz & Bauer 2010). The second bison illustration is an anonymous woodcut printed as a leaflet between 1566 and 1572, depicting a European bison caught in Lithuanian woods in 1566 and given to Augustus, Elector of Saxony (1526–1586) for his animal enclosure (**Fig. 6.6**). The AA of this image was assessed at 3.04. An average AA of both illustrations for this interval was 2.6, and the accumulative AA average for the century was 2.8.

Fig. 6.6. Anonymous print dated 1566–1572 "Diß ist deß Wilden Awerochsen Contrafactur". Zentralbibliothek Zürich, Graphische Sammlung und Fotoarchiv: Aus der Sammlung von Johann Jakob Wick (Shelf Mark: PAS II 9/2; dx.doi.org/10.7891/e-manuscripta-92207). AA = 3.04.

6.3. Images of European bison 1601–1700

In the interval 1601–1650, two depictions of European bison entered circulation: a watercolour by a Flemish humanist, naturalist and illustrator of natural history books Anselmus Boëtius de Boodt (1550–1632). His "Wisent" illustration was part of an album with drawings of quadrupeds commissioned by Emperor Rudolf II around 1600 (**Fig. 6.7**).

Despite the fact that the official description attributes its creation to the period 1596–1610, we believe it was made closer to 1608 because of the second image of European bison from this time period, titled "Fabel van de bizon en de andere dieren" created by Flemish engraver Aegidius Sadeler (1570–1629) in 1608 for his collection of woodprints illustrating fables and tales "Theatrum morum; artliche Gesprach der Thier mit wahren Historien den Menschen zur Lehr" (**Fig. 6.8**). The picture shows the bison surrounded by other animals like camel, dog or goat. Its purpose was to illus-

Fig. 6.7. "Wisent" by Anselmus Boëtius de Boodt (1596–1610/around 1608). RP-T-BR-2017-1-2-15, Rijksmuseum (http://hdl.handle.net/10934/RM0001.COLLECT.673390). AA = 3.6.

trate a simple moral: surrounding oneself with bad company carries significant consequences. The drawing of bison is directly based on de Boodt's painting, yet flipped horizontally and with some details changed (muzzle proportions, eye positioning; copying other authors was apparently Sadeler's regular practice, see: Germ 2017) justifying treating it as a separate object for analysis. Both images' AA was evaluated at 3.6, and the average AA for the century was 3.1.

There was only one image discovered for the interval 1651–1700: "Bison Iubatus" from Jan Jonston's "Historiae naturalis de quadrupetibus libri" published in 1655 (Fig. 6.9). The author of the print is not known. The positioning of the bison's head and legs indicates that the image is clearly based on a century-old woodprint from Herberstein's work, again with some minor but significant alterations (shape of horns and nasal part of the head, beard, position of the tail). Its AA was assessed at 1.6, and the average AA for the century at 2.6.

Fig. 6.8. Illustration by "Fabel van de bizon en de andere dieren" from Sadeler's "Theatrum morum; artliche Gesprach der Thier mit wahren Historien den Menschen zur Lehr", 1608, RP-P-OB-5210, Rijksmuseum (http://hdl.handle.net/10934/RM0001.COLLECT.168100). AA = 3.6.

Fig. 6.9. "Bison Iubatus" from Jan Jonston's "Historiae naturalis de quadrupetibus libri", Amsterdam, 1655 (https://polona.pl/item/historiae-naturalis-de-quadrupedibus-libri-cum-aeneis-figuris,MTg1NDM1NDg/80). AA = 1.6.

6.4. Images of European bison 1701–1800

Similarly, only one image was ascribed to the interval 1701–1750. Made by Dutch engraver and printmaker Cornelis Huyberts (1669–1712), the plate showing European bison was published in a 1712 edition of Julius Ceasar's works (Fig. 6.10). Its AA was assessed at 2.5, and the average AA for the century was calculated at 2.1.

There were three images found for the second part of the 18th century, two of which were apparently based on actual observations of live animals. Drawing by Johann Heinrich Müntz (1727–1798) from around 1780 shows a female European bison kept by naturalist Jean-Emmanuel Gilibert in his mansion in Grodno, near Białowieża Primeval Forest (**Fig. 6.11**). Müntz – painter, architect, engineer and cosmopolitan – made several journeys around Poland, mainly to its eastern regions, each resulting in a collection of drawings and accompanying descriptions. At least twice he had a chance to visit BPF, 1780 and in 1783. His image of European bison was not free of errors: lack of hump, unnatural stiffness, excessively split hooves, therefore its AA was assessed at 2.79 by experts. This image was published in Gilibert's "Indagatores naturae in Lithuania" in 1781, the work constituting a major breakthrough in the development of knowledge about European bison, and later, in 1805, the same image was made widely popular by Gilibert's "Abrégé du Système de la nature de Linné". Gilibert received the bison captured in Białowieża Primeval Forest from the Polish king, Stanisław August Poniatowski, along with several other wild animals. For the naturalist, it was an occasion to conduct observations on the behaviour and feeding preferences of bison, to prepare its detailed morphological and anatomical description, and lastly – attempt cross-breeding with domestic cattle (which turned out unsuccessful). For more information on Gilibert's research, see chapter 2.

Fig. 6.10. Cornelis Huyberts' "Bizon" dated 1712. Rijksmuseum RP-P-OB-67.749 (http://hdl.handle.net/10934/RM0001.COLLECT.336499). AA = 2.5.

Fig. 6.11. Drawing by Johann Heinrich Müntz (c. 1780) of a female European bison kept by Jean-Emmanuel Gilibert, from: Gilibert 1781B and Gilibert 1805. AA = 2.79.

Fig. 6.12. Jan Potocki's watercolour "Żubr narysowany z natury w Łazienkach Warszawskich" from 1792 [European bison drawn from nature in Łazienki Park in Warsaw]. Department of Drawings of Warsaw University Library, Royal Collection, Inw. zb. d. 10206. AA = 3.82.

The second image based on observation of a live animal is Jan Potocki's watercolour "European bison drawn from nature in Łazienki Park in Warsaw" dated 1792 (**Fig. 6.12**). The author is most probably count Jan Potocki (1761–1815), Polish nobleman, ethnologist, linguist, traveller and author of a picaresque novel "The Manuscript Found in Saragossa". The watercolour was a part of Polish king Stanisław August Poniatowski's private collection and was not widely known. The AA of the depicted bison was assessed at 3.82.

The third image from the second part of the 18th century was F. J. Bertuch's depiction of European bison published in 1800 in a series of picture books for children (**Fig. 6.13**). The AA of the image was assessed at 1.54, with the average AA for this 50-year interval calculated at 2.7, and for the century at 2.6.

Fig. 6.13. F. J. Bertuch's "Vierfüßige Tiere, Taffel XXVII" from Bertuch 1800 (https://doi.org/10.11588/diglit.2630). AA = 1.54.

6.5. Images of European bison 1801–1900

Between 1801–1850, another milestone for the knowledge on European bison (after Gilibert's work) was published: Ludwig Heinrich Bojanus' "De uro nostrato ejusque sceleto commentatio, *Bovis primigenii* sceleto aucta" (Bojanus 1825; for the discussion about the date of publication see: Daszkiewicz & Samojlik 2019) left a detailed description of the anatomy of European bison, and was also the first to describe the aurochs and the steppe bison. Thanks to the precision of description and illustrations (as they showed mainly the skeleton of European bison, they were not included in this analysis), his work made it possible to learn about the bison's anatomy and became one of the most important sources of knowledge about this species. Based on actual observations of animals, rather than ancient descriptions or fragments of pelts or bones, both Gilibert's and Bojanus' works can be considered starting points of modern research on European bison. Nevertheless, the general level of knowledge about European bison in the beginning of the 19th century was still limited: publications describing the species were still based on ancient authors rather than on modern observations (e.g. Brincken 1826) and despite evidence that bison and aurochs were separate species, the vigorous debate arguing that they are the same species lasted until the second half of the century.

Fig. 6.14. Illustration from Buffon 1807 (https://doi.org/10.5962/bhl.title.36928). AA = 2.93.

The number of publications describing or at least mentioning European bison rapidly rose, and the images of the species became more available. There were fourteen images of European bison selected for analysis for the interval 1801–1850. An image of an attacking European bison published in 1807 in Georges-Louis Buffon's "Natural history..." (**Fig. 6.14**) in London was an echo of the breakthrough in knowledge about European bison from the second half of the 18th century, connected with the birth and popularization of Linnaean taxonomy, the work of the French science school, and the creation of "Histoire naturelle...", the first natural history encyclopaedia. Several illustrations based either on observation of live animals or on specimens from Białowieża Primeval Forest were sent to almost all major universities and zoological collections in Europe (for more on this subject see Fedotova *et al.* 2018). The AA of the image from Buffon's book was assessed at 2.93.

There were still publications containing images far removed from the species' real appearance, as the one by Karl Heinrich Hagen, illustrated by Friedrich Guimpel (1774–1839), German engraver and botanical illustrator (**Fig. 6.15**). This is one of the most curious depictions of bison's muzzle as a face (to add insult to injury, with the tongue sticking out), which AA was assessed at 2.36. Similarly, popular publication by Karl Philip Funke contained an image by a German illustrator and engraver Gustav Georg Endner (1754–1824), quite far from realism (**Fig. 6.16**), with AA of depicted bison valuated at 1.75.

Fig. 6. 15. Friedrich Guimpel's European bison from Hagen 1819 (https://dlibra.bibliotekaelblaska.pl/dlibra/publication/48096/edition/45288). AA = 2.36.

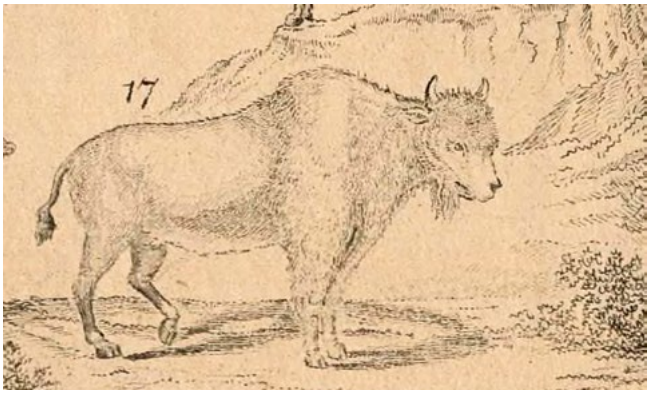


Fig. 6.16. Gustav Georg Endner's illustration depicting European bison from Funke 1820 (www.sbc.org.pl/dlibra/publication/93016/edition/87770/content). AA = 1.75.

Franciszek Kostecki's (an obscure Polish artist, active in years 1819–1831) depiction of female European bison dated 1820–1829 (**Fig. 6.17**) was probably not widely circulated, yet it obviously influenced an illustration published under the name Jan Piwarski in 1830, in the book by Feliks Jarocki (Jarocki 1830B, more on this book in chapter 2). In Piwarski's version, the illustration was most probably quite popular. Since Kostecki's drawing is dated earlier than the published version, we used his depiction for analysis – its AA scored 3.18.

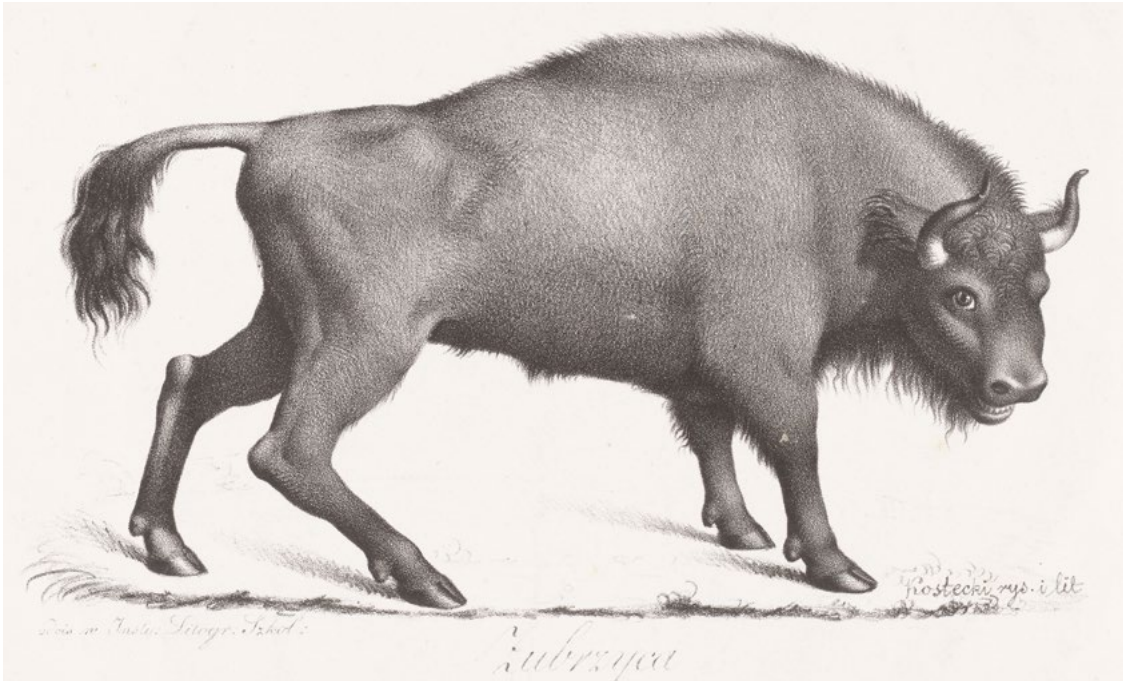


Fig. 6.17. Franciszek Kostecki's drawing „Żubrzyca" [Female European bison] dated 1820–1829, Biblioteka Narodowa, Magazyn Ikonografii G.11325/II (https://polona.pl/item/zubrzyca,MTE5MTU2Mzkz). AA = 3.18.

Jakub Sokołowski (1784–1837), an artist based in Warsaw, visited BPF together with Julius Brincken in 1821 (see chapter 2). Sokołowski's drawings, among them the depiction of European bison, were published in a widely circulated monograph by Brincken, "Memoire descriptif sur la foret Imperiale de Białowieża" (Brincken 1826). Despite the fact that the book suggests Sokołowski had a chance to observe the Forest and its animals, the drawing of European bison is based only partly on actual experience, whereas some elements are pure *licentia poetica* (**Fig. 6.18**). Experts evaluated the AA of Sokołowski's vision at 2.79.

Karl Joseph Brodtmann (1787–1862), a Swiss artist and lithographer, made a drawing of European bison in 1825, which was later published in "Naturhistorische Skizze von Lithauen, Volhynien und Podolien" by Karl Edward von Eichwald (Eichwald 1830) and thus entered and gained a place in academic circulation (**Fig. 6.19**). The AA of this depiction was assessed at 3.29.

Fig. 6.18. Jakub Sokołowski's „Żubr" [European bison], drawing made in 1821, from Brincken 1826 (www.biodiversitylibrary.org/bibliography/70897). AA = 2.79.

Fig. 6.19. Karl Joseph Brodtmann's European bison drawing made in 1825, from Eichwald 1830 (https://books.google.pl/books?id=_3VNAAAAcAAJ). AA = 3.29.

Jan Feliks Piwarski (1794–1859), painter, lithographer and educator, most probably did not visit BPF and used the stuffed specimens brought by Jarocki from Białowieża to the Zoological Cabinet of the University of Warsaw to prepare his prints of European bison for the book "O Puszczy Białowieskiej i o celniejszych w niej zwierzętach" (Jarocki 1830B). At least one of them, depicting female European bison, was heavily influenced by an earlier drawing by Franciszek Kostecki. The drawing of male bison, signed by Piwarski and published in Jarocki's book (**Fig. 6.20**), was evaluated as having an AA of 3.21 by experts.

Thomas Landseer (1793–1880), a British artist and engraver, known from his satirical etchings and the book "Characteristic Sketches of Animals", published an image of European bison in the latter, written by John Henry Barlow (Barlow 1832). His depiction of the species (**Fig. 6.21**), although described as European bison, resembles more an American bison, therefore its AA was evaluated at 0.68.

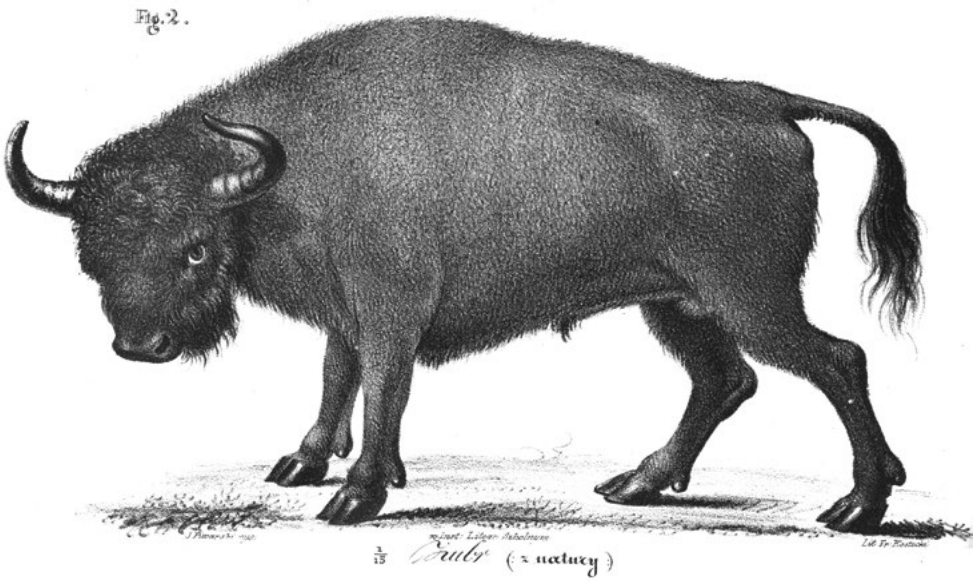


Fig. 6.20. Jan Feliks Piwarski's "Żubr z natury" [European bison from nature] published in Jarocki 1830 (https://rcin.org.pl/dlibra/publication/156546). AA = 3.21.

Fig. 6.21. Thomas Landseer's depiction of European bison (Barlow 1832) (https://books.google.pl/books?id=__heAAAAcAAJ). AA = 0.68.

LE BŒUF SAUVAGE

Ordre des Ruminants. *Genre* Bœu

Fig. 6.22. Illustration from Cuvier's "Oeuvres complètes de Buffon" (Cuvier 1835) (www.biodiversitylibrary.org/item/198514). AA = 3.29.

Illustration from Cuvier's "Oeuvres complètes de Buffon" (**Fig. 6.22**) published in 1835 (Cuvier 1835) showed European bison surrounded by tropical-looking foliage, yet its AA was assessed at 3.29.

Illustration from the book "La Pologne historique, littéraire, monumentale et pittoresque, ou scènes" by Chodźko (**Fig. 6.23**), published in 1835–1836, shows European bison and aurochs, with the former based rather on American bison – its AA was assessed at 1.14.

Kanutas Ruseckas (Kanuty Rusiecki, 1800–1860) was a Polish painter connected with Lithuania and Vilnius. His painting "Dogs attacking a European bison" from 1843 (**Fig. 6.24**) was most probably not widely circulated, as no prints or engravings based on it are known. The AA of the European bison depicted in his painting was evaluated by experts at 3.96.

An illustration of European bison (**Fig. 6.25**) from a supplement to a book by a German naturalist Johann Christian Daniel von Schreber (1739–1810) was published in 1844. Its AA was evaluated at 2.50.

An anonymous picture accompanying an article in "Illustrated London News" from 1845 entitled "European bison. At the British Museum" shows a curious take on the species' silhouette, with small head and unnaturally bended horns. This might be due to the fact that the illustration was based on a stuffed bison sent to London from Białowieża (**Fig. 6.26**). The AA of this depiction was assessed at 1.71.

Fig. 6.23. Illustration "La Forêt de Bialowieze – Le Bison, L'Urus" from Chodźko (1835–1836) (https://books.google.pl/books?id=8kkrAAAAYAAJ). AA = 1.14.

Fig. 6.24. Kanutas Ruseckas' painting "Dogs attacking an European bison" from 1843. Lithuanian National Museum of Art T-1498. AA = 3.96.

Fig. 6.25. European bison illustration published in 1844 (Schreber 1844) (https://digi.ub.uni-heidelberg.de/diglit/schreber1844tafelbd2/0272/image). AA=2.50.

Fig. 6.26. An anonymous illustration of European bison on the display at the British Museum in London. Illustrated London News 1845, No 180(7): 237 (https://books.google.pl/books?id=7q5LAAAAcAAJ). AA = 1.71.

An illustration accompanying Dolmatov's article published in the 1849 issue of "The Annals and Magazine of Natural History" (Fig. 6.27) was highly evaluated by experts for its AA, at 4.18. It was the second highest score given by experts reviewing the anatomy of depicted specimens (the first was awarded to an illustration from the last time interval, 1851–1900).

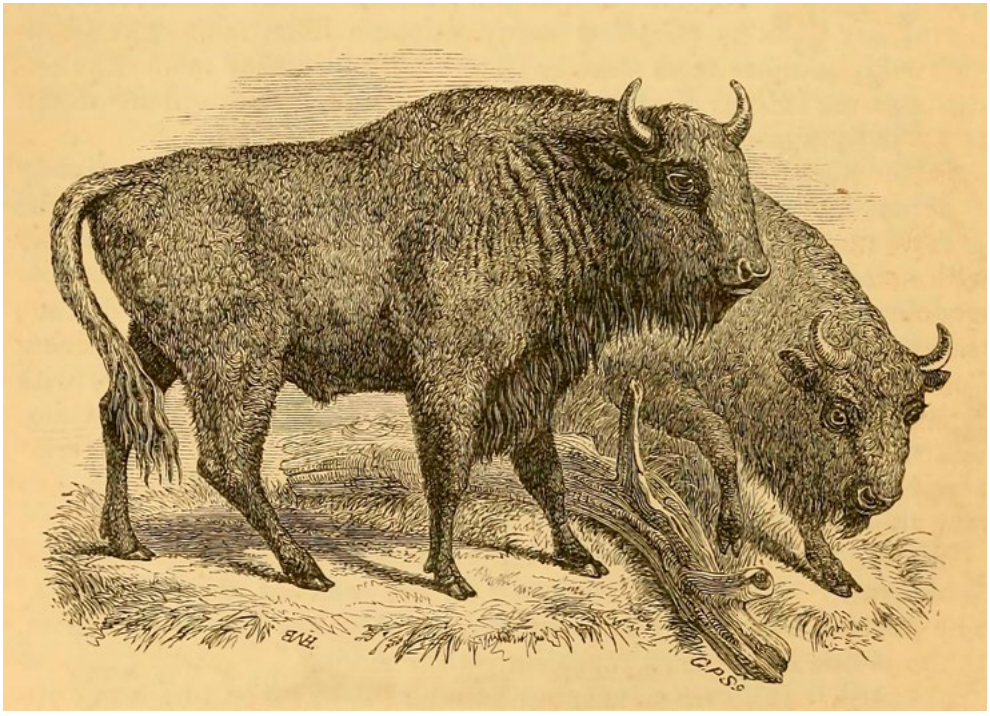


Fig. 6.27. Illustration of two European bison from Dolmatov's article (Dolmatov 1849B) (www.biodiversitylibrary.org/item/54554#page/161/mode/1up). AA = 4.18.

Overall, the average AA for the fourteen images from the interval 1801–1850 was assessed at 2.6, and the average AA for the century at 2.7.

The last interval analysed, 1851–1900, was abundant in publications popularizing knowledge on European bison, especially connected with several live animals and specimens sent to several destinations throughout Europe (see Samojlik et al. 2017, Fedotova et al. 2019, chapter 3 of this book). The idea of degeneration of the species and its inevitable extinction was publicized (Viennot 1862), while others stressed the threatened status of the species (Tutsevich 1878, Siemiradzki 1885). Also in this interval, several original and highly accurate, in terms of anatomical correctness, depictions of European bison were published.

Although George Vasey's book from 1857 was proudly entitled "A monograph of the genus Bos. The natural history of bulls, bisons, and buffaloes" the illustration depicting European bison (**Fig. 6.28**) made by the author himself was based not on observation of a live animal but on a stuffed bison from the British Museum, the same that served as a model for illustration for Fig. 6.26. The apparent failed taxidermy explains, at least to some extent, the low AA score of this depiction – 2.11.

Fig. 6.28. Image by George Vasey from his book published in 1857 (Vasey 1857) (https://books.google.com.om/books?id=BQ8AAAAAQAAJ). AA = 2.11.

Illustration from Dmochowski's book "Father's tales on the natural history, geography" from 1859 (Dmochowski 1859) is signed in a way that does not allow to identify its author. The depiction itself, described as "Żubr z Puszczy Białowieskiej" [European bison from Białowieża Primeval Forest] resembles more an American bison, and its AA was assessed at 2.04 (**Fig. 6.29**).

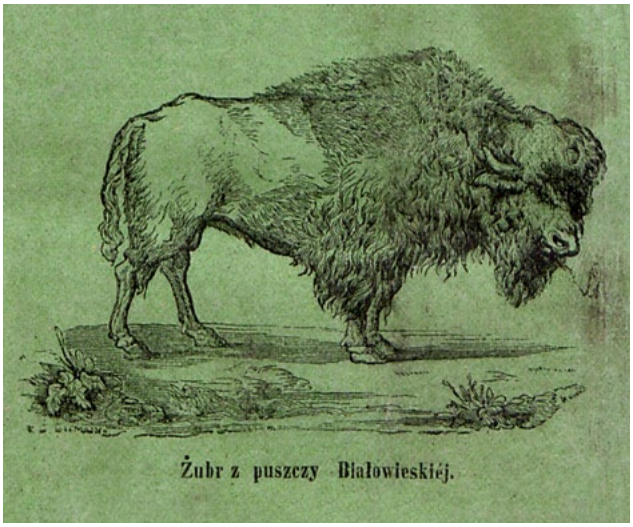


Fig. 6.29. An anonymous illustration from Dmochowski's book published in 1859 (Dmochowski 1859) (https://polona.pl/item/opowiadania-ojca-obejmujace-historya-naturalna-jeografia-historya-polska-i-starozytna,MTA3MTY2NA). AA = 2.04.

Fig. 6.30. Michaly Zichy's watercolour "Zubr" [European bison] from Fuchs & Zichy 1862. AA = 3.75.

Michaly von Zichy (1827–1906), a Hungarian Romantic painter was one of the most prominent painters at the Russian court, accompanying tsar Alexander II during his hunt in BPF in 1860 (which turned out to be a milestone in BPF's management, see Samojlik et al. 2020). After the hunt, in 1861, a prestigious book was published to commemorate the tsar's hunt under the title "Okhota v Belovezhskoi Pushche" [The hunt in Białowieża Primeval Forest] with illustrations by Zichy (Fuchs & Zichy 1861). Among the series of watercolours depicting the tsar's arrival to Białowieża, animals shot from hunting stations and tsar's entourage after the hunt, there was an illustration with European bison chased by wolves (**Fig. 6.30**). The AA of the illustration was evaluated at 3.75 by experts.

Juliusz Kossak (1824–1899), Polish painter specialising in historical themes and depictions of horses, was the head of the art department of the widely popular "Tygodnik Ilustrowany". It was in this journal, where Kossak's depiction of European bison was published, illustrating Wacaław Przybylski's article (see chapter 4 for more details). Although Kossak most probably did not visit Białowieża himself, his depiction of European bison is mostly accurate, with AA assessed at 3.64.

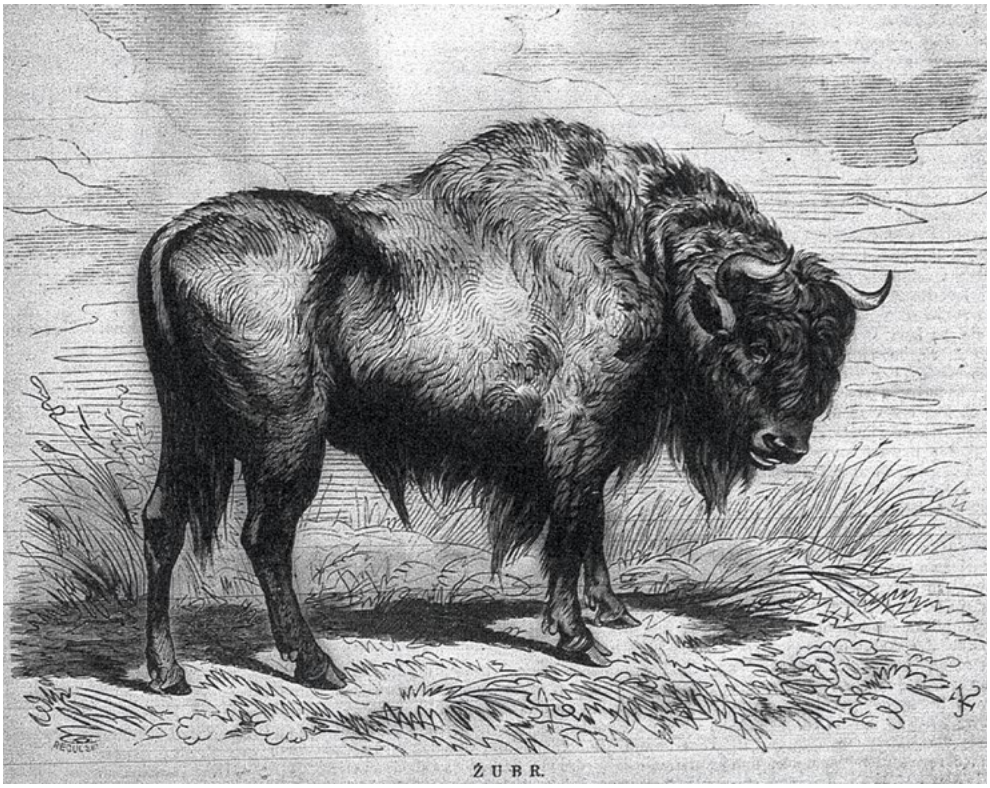


Fig. 6.31. Juliusz Kossak's illustration „Żubr" [European bison] accompanying Wacław Przybylski's article published in 1863 (Przybylski 1863) (https://bcul.lib.uni.lodz.pl/dlibra/publication/1512/edition/1174). AA = 3.64.

Gerardus Johannes Hengeveld (1814–1894), Dutch veterinarian, published a book on cattle species, breeding and health. In the first volume, European bison was also described and depicted by an unknown artist (**Fig. 6.32**). Its AA was evaluated at 3.18.

Gustav Ludwig Heinrich Mützel (1839–1893) a German artist, was mostly known for his mammal and bird paintings, including illustrations for Richard Lydekker's "The Royal Natural History" and Alfred Edmund Brehm's "Thierleben". It is the latter that published Mützel's depiction of European bison in 1875 (Brehm 1875) (**Fig. 6.33**). The depicted European bison scored 3.89 in the AA evaluation by experts.

Fig. 6.32. European bison from the book published by Hengeveld in 1865 (Hengeveld 1865) (https://books.google.pl/books?id=H1NVAAAcAAJ). AA = 3.18.

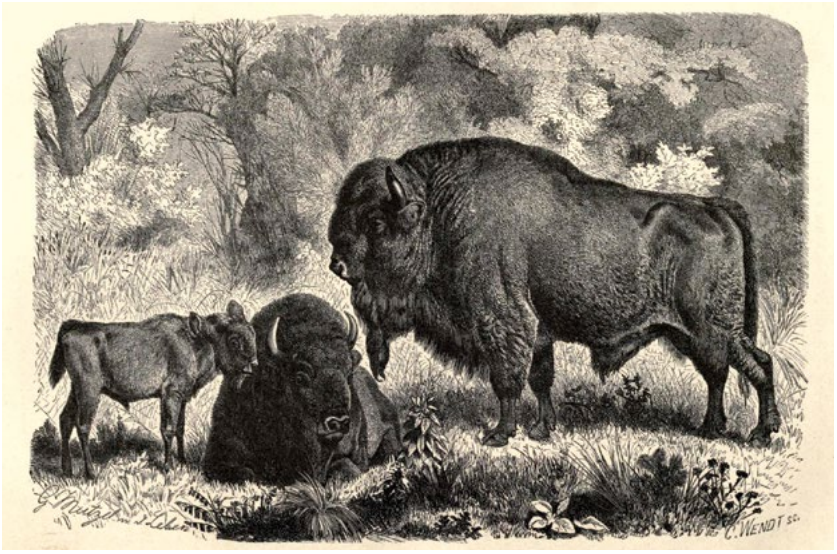


Fig. 6.33. Gustav Ludwig Heinrich Mützel's "Wisent" [European bison" published in Brehm's book in 1875 (Brehm 1875) (www.biodiversitylibrary.org/item/16032#page/424/mode/1up). AA = 3.89.

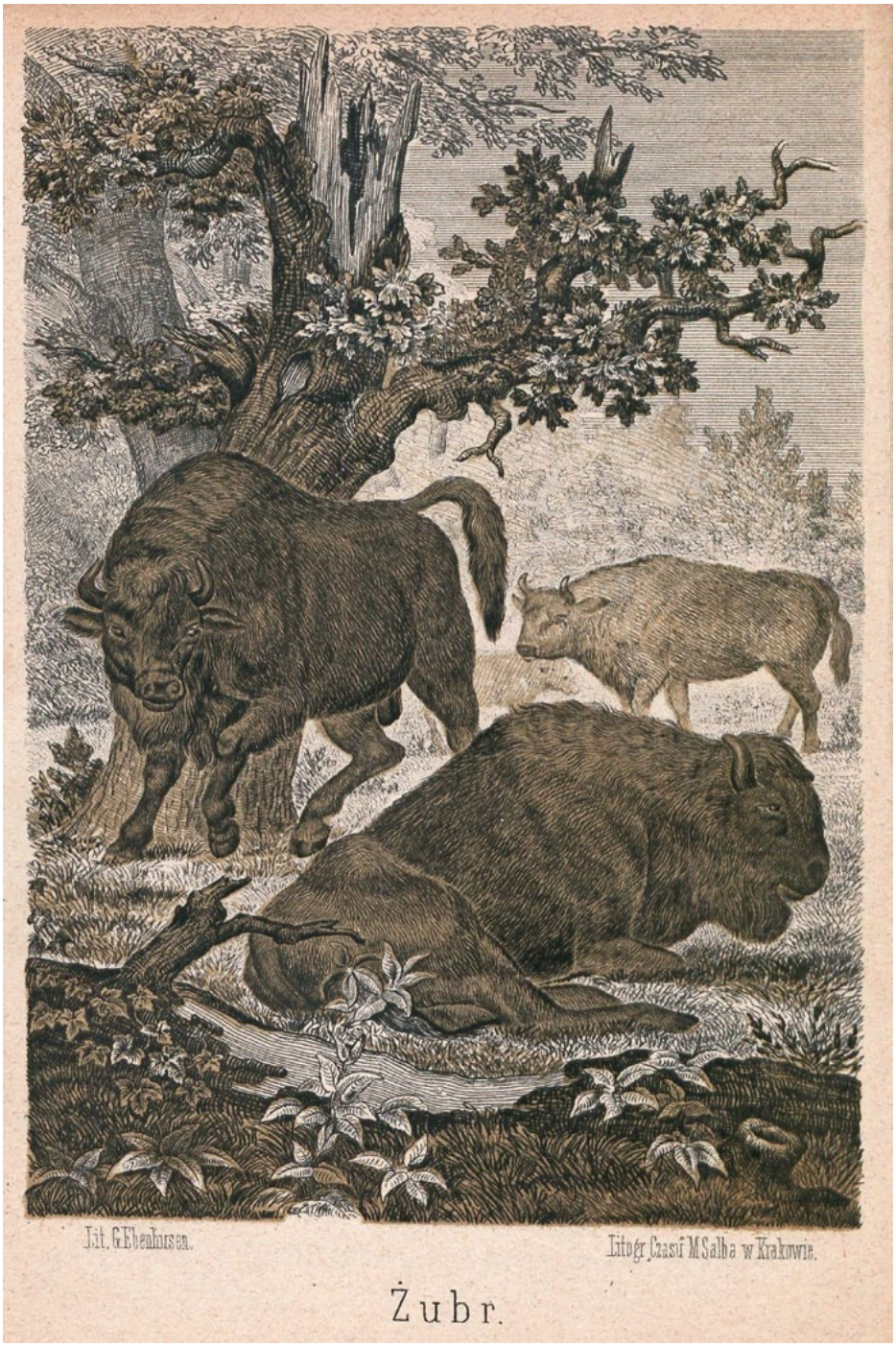


Fig. 6.34. Lithograph signed G. Ebenhusen from the book published in 1876 (Janota & Anczyc 1876) (https://polona.pl/item/obrazki-z-zycia-zwierzat-bobr,MzkzOTYyNDY/97). AA = 3.93.

A lithography signed G. Ebenhusen accompanied Władysław Ludwik Anczyc's description of European bison in a popular book "Obrazki z życia zwierząt. Bóbr. Żubr" [Animal life in pictures. Beaver. European bison (Janota & Anczyc 1876). AA of animals, surrounded by a landscape similar to BPF's one, was evaluated at 3.93 (**Fig. 6.34**).

Walery Brochocki (1847–1923), Polish landscape painter, mentioned in chapter 4, published his plate depicting European bison in BPF (**Fig. 6.35**) in a popular magazine "Wędrowiec" in 1885 (Brochocki 1885). Brochocki visited BPF and observed bison in their natural environment, which explains the high score the AA of his illustration achieved: 4.04.

Fig. 6.35. Walery Brochocki's illustration „Z Puszczy Białowieskiej: żubr" [From Białowieża Primeval Forest: European bison] published in 1885 (Brochocki 1885) (https://bcul.lib.uni.lodz.pl/dlibra/publication/421/edition/272). AA = 4.04.

A lithograph showing European bison signed by S. Czeiger, an engraver based in Vienna, was published in Gustav von Hayek's (1836–1911) "Wielki atlas do zoologii, botaniki i mineralogii" [The great atlas of zoology, botany and mineralogy] published in 1887 (**Fig. 6.36**). It's AA was assessed by experts at 4.36 (the highest scoring illustration among experts)

Fig. 6.36. Illustration of European bison, signed by lithographer S. Czeiger, in Hayek 1887 (https://kpbc.umk.pl/dlibra/publication/30919/edition/39801). AA = 4.36 (highest-scoring).

Richard Friese (1854–1918), a German animal and landscape painter mostly known for his illustrations of animals in Africa and polar region, left several sketches and drawings depicting the species. The one showing the animal in most neutral pose, in side view, was selected for analysis (Fig. 6.37). The illustration, dated 1888, probably had limited circulation, as it was in all likelihood not published. The AA of the depicted European bison was assessed at 3.68.

Fig. 6.37. Richard Friese's "Wisent" [European bison], drawing from 1888. Collectie Rijksmuseum Twenthe, Enschede. Bruikleen particuliere collectie, Haaksbergen, inv. BR3092 (https://collectie.rijksmuseumtwenthe.nl/zoeken-in-de-collectie/detail/id/2dc5dfd6-e1db-55c8-bc3a-8ba016817df7). AA = 3.68.

Joseph Smit (1836–1929), Dutch zoological illustrator, contributed to Richard Lydekker's 1898 book "Wild oxen, sheep, & goats of all lands living and extinct". His drawing of European bison (Fig. 6.38) in the eyes of experts achieved an AA score of 3.46.

The last illustration analysed from this period was made by German painter Ludwig Beckmann (1822–1902) before 1900. His European bison depiction was made in a zoo in Köln and is accompanied with information "drawn from nature" (note: titles of the works or labels such as "drawn from nature" were not shown to the evaluating experts as they could bias their scoring) (Fig. 6.39). Its AA was evaluated at 3.68.

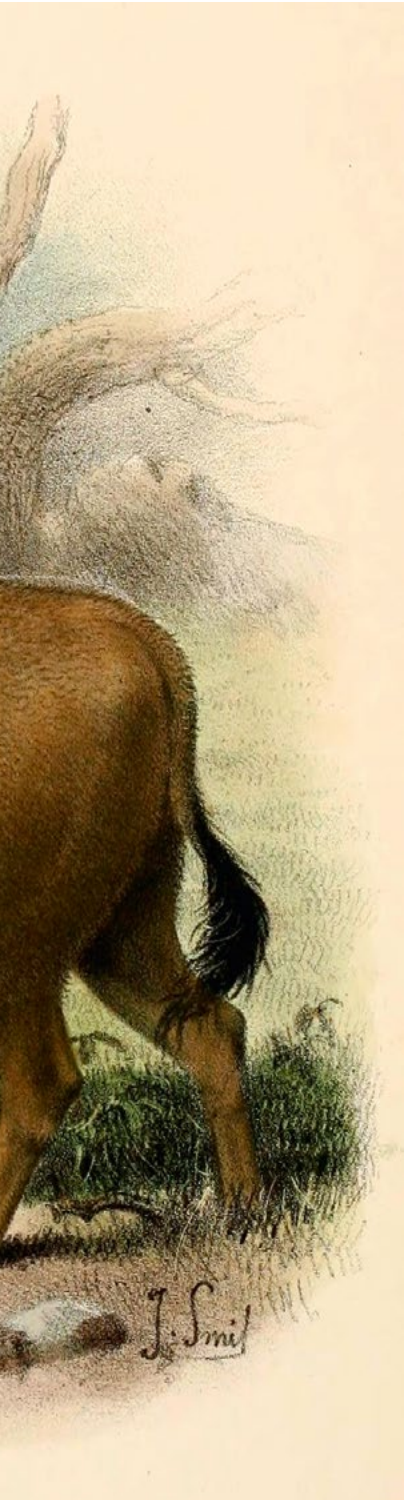


Fig. 6.38. Joseph Smit's depiction of European bison in Lydekker's book published in 1898 (Lydekker 1898) (www.biodiversitylibrary.org/item/36741#page/97). AA = 3.46.

The AA of bison depictions from 1851–1900 was highly ranked by experts, with the average score of 3.5. The average AA for the entire 19th century was assessed at 3.1.

Looking at experts' evaluation of AA of depictions from the entire analysed timeframe (Fig. 6.40), it is quite obvious that the expected gradual rise in precision and accuracy in European bison illustration, connected with the accumulation of knowledge about bison, did not occur. No correlation between time of creation and AA of European bison images in consecutive periods evaluated by experts was found (R=0.07). Chronologically older images were ranked higher or at the same level than more recent ones, with the exception of the last interval, which was assessed the best in terms of AA (but this did not affect the overall lack of observed correlation). Interestingly, there was no single trait of bison's anatomy which would score consistently high among all experts.

Fig. 6.39. Ludwig Beckmann's "Die Auerstiere im Zoologischen Garten zu Köln. Nach der Natur gezeichnet von L. Beckmann" [European bison in zoo in Köln. Drawn from nature by L. Beckmann], before 1900 (National Museum in Warsaw, nr inw. Gr.Pol.28499). AA = 3.68.

r gezeichnet von L. Beckmann.

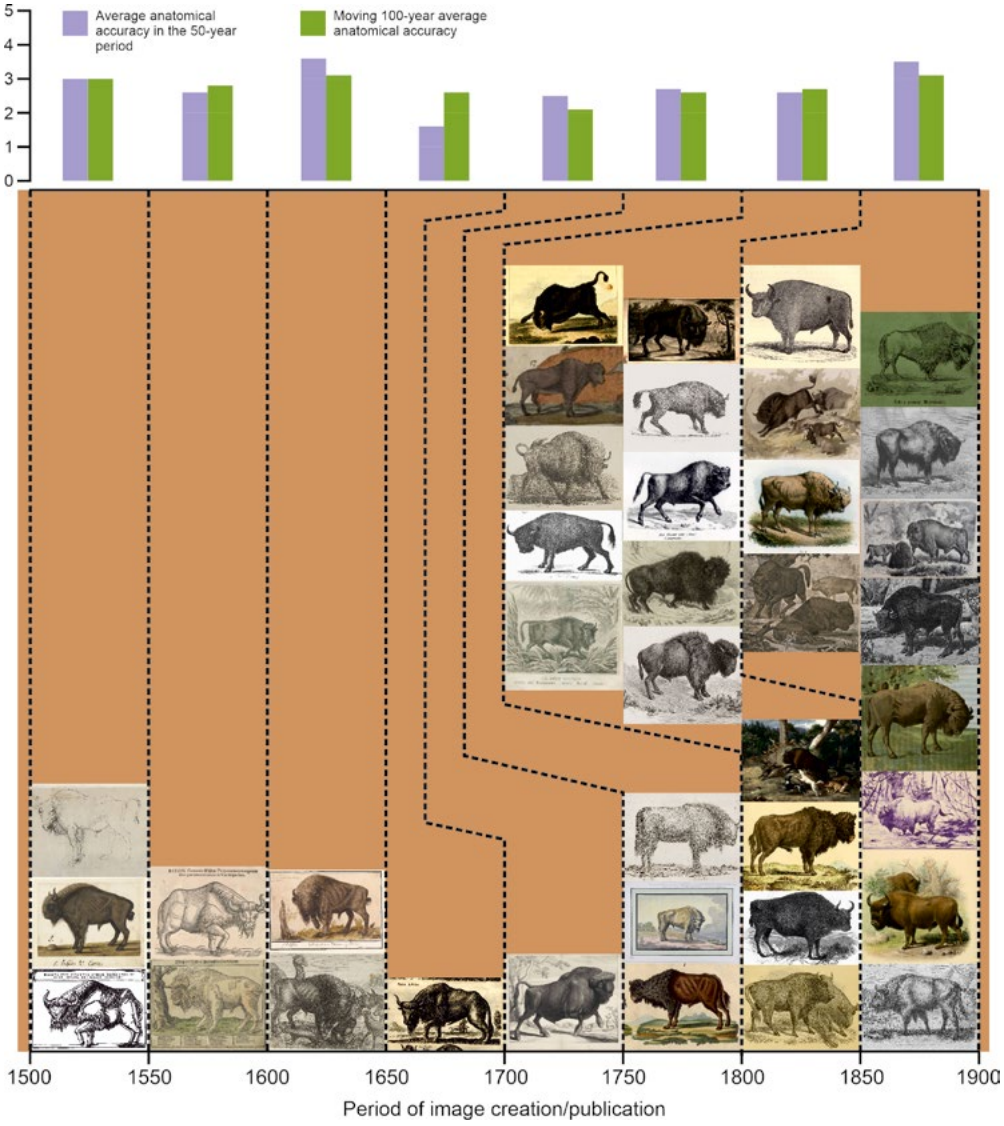


Fig. 6.40. Evaluation of anatomical accuracy of historical depictions of European bison by experts, in division to 50-year intervals.

Historical depictions of European bison (one selected from each 50-year interval) was also made by non-specialists on the basis of online surveys. Among 145 collected surveys, 75 (52%) were filled by persons with a background in science, 15 with experience in nature protection (10%), 20 in art (14%), 6 in forestry (4%), and 29 with "other" professional background (20%). Images of European bison selected for the survey were the mostly highly ranked by experts: their AA was assessed at 2.21 for

1501–1550, 3.04 for 1551–1600, 3.57 for 1601–1650, 1.64 for 1651–1700, 2.5 for 1701–1750, 2.79 for 1751–1800, 4.18 for 1801–1850 and 3.64 for 1851–1900. It turned out that in most cases survey respondents highly evaluated the same depictions as experts – there was a positive correlation between experts' assessments and evaluation of accuracy of depictions in surveys (R=0.75).

The other question in the survey was connected with the potential of using images in conservation of European bison. In general, it was ranked lower than the perceived correctness of depictions (**Fig. 6.41**). Nevertheless, there was a high correlation between perceived correctness of the image and its conservation appeal with R=0.98.

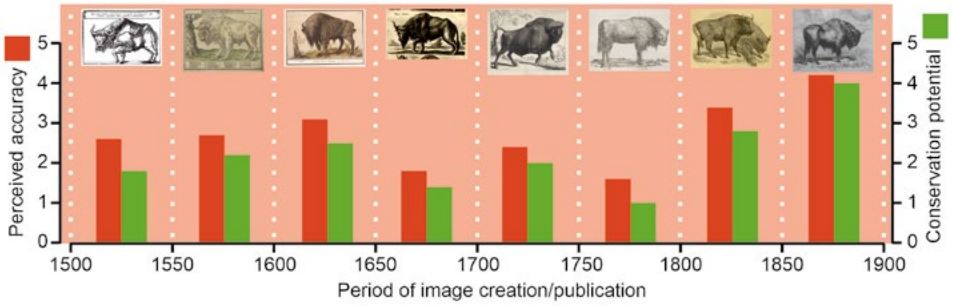


Fig. 6.41. Anatomical accuracy and conservation potential of historical images of European bison assessed by general public (non-specialists) based on an online survey with 145 respondents.

The contemporary public reception of European bison images (both in observers' evaluation of the correctness of depictions and their conservation potential) was not linked with the period of creation. Instead, the modern perception of anatomical accuracy was nonchronological. Images from the last two time intervals were evaluated higher in both aspects, in line with experts' assessment. Conservation potential of images assessed by viewers was strongly linked with their evaluation of accuracy of depictions.

The centuries-long process of building the knowledge base on European bison and creating the idea of European bison as a charismatic, iconic animal had obviously no immediate effect on the correctness of depictions of the species. Anatomical accuracy of depictions was most probably linked more with the direct observation of the animal by artists than with the existing knowledge about the species at the time. The 19th century – the period with the most rapid development of scientific and popular knowledge about bison, was also the period most abundant with anatomically accurate images of the species. The modern perception of correctness of historical depictions mostly followed experts' evaluation and was also nonchrono-

logical. Despite being subjective, the perceived correctness of depictions was linked with modern assessment of conservation appeal of historical images of European bison.

The novelty of this approach, i.e. the ability to reach back to the year 1500 for analysis and observe the development of images depicting species nowadays considered iconic is also its biggest constraint. There is no way to test the actual influence of the imagery on the perception of the species, as well as the direct impact of popularization of knowledge and widespread use of bison images on the success of the recovery campaign after the extinction of the species in the wild in 1919. Quite obviously the perception of the natural world differed in previous ages and changed over time. The example of such changing perceptions is the female beauty canon in European art (Givhan & Morales 2020), and similarly current awareness of nature conservation is very different than in eras when the concept of conservation itself was non-existent. The decision to test the modern public's evaluation of historical depictions and resulting analysis is nevertheless justified when it comes to the lessons for contemporary conservation campaigns. It is the modern perspective they must appeal to when using imagery of bison or other species. What we know for a fact is that the International Society for the Protection of European Bison used historical images and photographs of European bison in their publications to promote the idea of species conservation, e.g. in the album published after the 5th annual meeting of the society in 1929 (Andenken 1929), which falls after the scope of this work. Perhaps the historical imagery was believed to carry a stronger message in building the status of European bison as an "ancient beast". Measuring the impact of such imagery would be much easier today, achievable through direct information on donations transferred by individuals to organizations responsible for conservation campaigns around particular species. Nevertheless, our study allows us to draw some lessons from the past, as it falls in line with recent research on pro-environmental outcomes of using animal imagery.

First, it seems that the aesthetic appeal of animal imagery has proven to have an impact on attitudes towards wildlife conservation. In a review by Thomas-Walters et al. (2020) images of animals were found to have positive effects on emotional responses in people and their willingness to contribute to animal conservation, but it was not the anatomic accuracy of pictures but rather their aesthetic appeal and amount of exposure that contributed to these impacts. The use of carefully selected visual material in mass media can change people's attitudes and behaviours (Joffe 2008), and photographs of animals are a powerful tool of such campaigns. This is observed particularly in social media, which are a relatively new and rapidly developing tool for increasing public awareness about endangered species. When articles posted on social media are accompanied by abundant high-quality images, videos and animations (Wu et al. 2018), it can foster kinship with animals and respect for their sentience and individuality (Kalof et al. 2016). Verissimo et al. (2017) found that the level of public support was higher for so-called appealing or charismatic species. The appeal or charisma of a species is a complex variable, consisting of traits such as

the size of an animal (with bigger animals being usually more attractive; Clucas et al. 2008) or presence of forward-facing eyes (Smith et al. 2012). European bison fits both these categories.

Second, what this approach showed was the fact that the actual anatomical correctness of images plays a secondary role to subjective perception, which was particularly visible in two periods of the 19th century, where experts' evaluation did not match the one from public surveys. Such subjective view is also observed today, to an extent that even cartoony versions of animals (albeit carefully selected) can have positive impacts on observers' attitudes towards conservation campaigns (Osinski et al. 2019). Presenting animals in animation is seen as a tool for building charisma of species (Albert et al. 2018) but also influences public interest and increases conservation efforts, such as donations for zoo animals (Fukano et al. 2020). Silk et al. (2017) noted that animated animal-focused movies affect public awareness about featured species (e.g., fossa *Cryptoprocta ferox* featured in the movie "Madagascar", Spix's macaw *Cyanopsitta spixii* in "Rio" and blue tang *Paracanthurus hepatus* in "Finding Dory"). A possible down side is that such films could spur an upsurge in the pet trade (Militz & Foale 2017).

Although two thirds of surveys came from persons with backgrounds in science or forestry, who were potentially more invested in species conservation and possessed a higher level of knowledge about European bison, no difference between their answers and answers from persons with non-science backgrounds were found. This suggests that education and professional background of surveyed persons did not bias the results of the study.

But there are some constraints of using images of iconic animals in conservation campaigns. Smith et al. (2012) found almost 200 threatened species that fit the category of large species with forward-facing eyes but are not widely used for conservation campaigns. This was explained by the fact that conservation campaigns tend to be overly conservative and focus only on a few well-known, large and aesthetically appealing mammals, overlooking many "Cinderella" species. This falls in line with Colléony et al. (2017) who observed that donations in conservation programmes not necessarily echoed the threat status of a species, being rather driven by the charisma of the species (or even order of presentation on a website, Verissimo et al. 2017) than ecological or scientific considerations. Home et al. (2009) showed that flagship species used as a conservation organizations' marketing tool to promote and encourage public support for preventing the loss of biodiversity are selected for their perceived charisma. In some cases, such species often serve as logos, emblems, or marketing visual symbols used to promote consumer products as detached from wildlife as alcohol (Feldhamer et al. 2002). Curtin and Papworth (2018) suggested that shifting attention between charismatic and unpopular species can be achieved by directing the marketing effort to specific groups, and also by delivering additional information about less appealing species, as it has been done for bats in the wake of white-nose syndrome in North America (Frick et al. 2010). Angulo and Courchamp (2009) provided evidence that in general, people value rare species more than they

do common species which can potentially have negative outcomes such as exploitation (e.g. ecotourism or exotic pet trade, see Collard 2020) of rare and endangered species leading to their extinction. Clucas et al. (2008) show that conservation organizations tend to focus their publicity on large charismatic species and in this way end up communicating a selected and narrow sample of conservation problems. Courchamp et al. (2018) pointed out the paradox: the most charismatic species are at risk of imminent extinction while their media presence is strong. Species often seen in media can be easily and falsely perceived as abundant in nature, which leads to a lack of public awareness of the actual, threatened status of these species. Even in the most drastic cases when a species is presented as being on the brink of extinction, this wide media coverage raises the public awareness only for a limited period of time, after which the event is no longer perceived as noteworthy (Clements 2013).

In the case of European bison the long-lasting building of the status of an iconic species, accompanied by knowledge accumulation and presentation of the animal in rising numbers of depictions has led to a positive outcome after its extinction in the wild in 1919. International collaboration brought the animal back to BPF in 1929 where it is thriving until now. Despite centuries dividing our era and the times discussed in this article, the general mechanism of building up a vision of European bison is the same – popularizing the increasing knowledge base and presenting depictions of the species, with different levels of anatomical accuracy but focusing more on appeal to the viewer. With modern media and unprecedented speed of global communication, now is the chance to employ similar mechanisms to promote conservation campaigns and build appealing images of other species, less charismatic, but no less important for biodiversity conservation.

The bison, European and American, is of course a flagship, keystone, and potential umbrella species…

Our key finding—that the conservation potential of images assessed by viewers was strongly linked with their evaluation of depiction accuracy—can help inform current conservation outreach. The accuracy with which scientists or illustrators depict a species seems to be key in engaging the public in conservation of the animal in question. Furthermore, for artists and authors of animal depictions, access to species could result in more accurate images of the species, potentially benefiting its conservation. In this respect, our results support the "with" option in the long-lasting debate on how to best preserve biodiversity: with, or without people (Mace et al. 2014).

Chapter 7.

The past, current and future "primeval forest"

When Białowieża Primeval Forest (BPF) became the focus of interest of Western European naturalists by the end of 18th-beginning of the 19th century, it became the embodiment of pure – disconnected from reality – ideas of a pristine, virgin state of forest. Numerous scientific and popular works praised BPF's natural features such as the mixture of forest types and tree species, abundance of dead wood or presence of a unique set of animals, including European bison, long gone from other parts of Europe. At the same time, authors recognised BPF's history, its protection and use, and traces of centuries-old human presence – all of this having little to no influence on the perception of the Forest as primeval, pristine, or virgin. It was only the development of modern, scientific forestry that imposed the discrepancy between the naturalness of the Forest and the presence of man. In the 19th-century, BPF forestry management led to a conflict between the local population – the people who had been utilizing the Forest in a variety of ways for generations – and the forest administration, steered by Russian authorities (more on that subject in Samojlik et al. 2020). In the 20th-and especially 21st century, this discrepancy was used to push for an increase in intervention and exploitation in BPF. The argument that BPF should not be treated as primeval but rather as an artificial forest, shaped by management especially since the emergence of scientific forestry, and that current management should focus on maximizing the production function of the forest was represented both by scientific works connected with forestry (e.g. Hilszczański and Jaworski 2018, Brzeziecki et al. 2018) and by popular materials, like tourist guides, leaflets, and informational materials printed by State Forests (e.g. CILP 2017A, 2017B). This exact argument was used in an official statement issued by the Polish Ministry of Environment in 2017, defending the decision to log bark-beetle-infected spruces in BPF: "*the state and percentage of cover of habitats* (...) *as well as of the species existing at those sites* (...) *resulted from the use of the Forest in the past (obtaining wood from stands planted in the past). This has been thoroughly documented in many documents* (...), *which have been fully ignored by the European Commission, according to whom the Forest constitutes a primeval forest untouched by man*" (Ministry of Environment 2017).

Nowadays, over 80% of the Polish part of BPF is managed by State Forests focusing on timber exploitation, and the rest is incorporated into Białowieża National Park, with little to no human intervention allowed. Scientific circles for decades have urged authorities to strengthen the protection of BPF and stop logging in the old growths of the Forest. These proposals were strongly opposed not only by foresters (Niedziałkowski 2016) but also by at least a part of local communities, attached to the tradition of timber production and processing as the foundation of the local economy (Mikusiński & Niedziałkowski 2020). This tradition sees the Forest as shaped by long-lasting human presence and utilization, moreover – as a "work of human hands". A quote on a tombstone in the cemetery in Hajnówka, a town on the border of BPF, represents this view the best. The writing under the name of a woman who died in 2010 at the age of 103 years, reads: "Ten las ja sadziłam" [I planted this forest]. It is both touching – as one can be sure it is an absolutely honest statement, many local people were involved in massive cutting and plantation of trees in BPF since 1945 – and confusing, as it falls into the pattern of the discrepancy mentioned above. If a forest is planted, how can it be called primeval? This exact quote was also used in the Ministry of Environment's defence of the decision to bring heavy machinery, i.e. harvesters, to log BPF: if the forest was planted, and therefore designed by man, it should always be managed by man.

European forests have been utilized, logged, burned and changed into arable or pasture land already in ancient times. The majority of these forests have experienced at least one phase of complete deforestation, be that in the ancient, mediaeval or modern periods (Williams 2003). BPF is the only lowland forest of such size in Europe that has been continuously covered by forest vegetation since the last glaciation (about 11 to 12 thousand years ago; Latałowa et al. 2015, 2016). This unique status does not mean the Forest was devoid of humans – on the contrary, the presence of man in BPF is well documented for several millennia. Anthropogenic indicators in the palynological record, although "weak" and evidencing a low level of anthropogenic pressure compared to other parts of lowland Europe, allowed to discriminate five major phases of human presence in BPF (Latałowa et al. 2015, 2016). Those phases, confirmed also by archaeological finds and historical sources, were:

(1) **An ancient phase**, with traces of settlements, cereal cultivation and animal husbandry (lasting to the 5th century AD; Krasnodębski et al. 2008, Olczak et al. 2018).

(2) **Early mediaeval to early modern phase** (8th-16th century AD), with modest settlement and economic activity visible in palynological records. There were two waves of Slavonic settlers in the Forest, the first in 8th-9th century (evidenced by cremation burials; Krasnodębski et al. 2011), and the second in the 11th-13th century (inhumation graves; Krasnodębski et al. 2005). Since the 14th century and the Polish-Lithuanian union in 1385, the Forest became a royal forest, and for the next four centuries it served mainly as a hunting ground for Polish and Lithuanian monarchs. The royal status of hereditary property of Lithuanian grand dukes and Polish kings meant that the Forest was protected

against poaching, illegal logging or settling, by a suite of several hundred men – guards, riflemen, beaters – controlling and protecting the Forest on a daily basis (Hedemann 1939). At the same time, the local population was given the right to enter the forest and use it in a non-destructive way (e.g. by collecting hay, producing honey, fishing in forest rivers or pasturing cattle in forest clearings; Samojlik 2005).

(3) **Modern phase** (17th-18th century), in which human activity indicators in palynological data increased due to the introduction of more invasive, and also profitable, methods of forest utilization: burning potash, wood tar, birch tar and charcoal. All these activities involved handling fire in the Forest and coincided with a rise in the number of small-scale, low-intensity forest fires (Niklasson et al. 2010). There were also attempts at commercial logging, albeit on a limited scale. All this did not change the status of the Forest as a royal hunting ground. Strengthened protection allowed the Forest to survive until the end of the 18th century with a major part of the woodland in a state close to natural, with no visible traces of man-made destruction (Samojlik et al. 2013A).

(4) **The fourth partially colonized/occupied phase** (19th-mid-20th century), i.e. the period of Russian rule over BPF, WWI, and the subsequent interwar period of Polish administration in BPF up to the WWII. In the 19th century, despite common knowledge attributing major changes in the Forest to Russian forestry management, several factors, including the presence of European bison, lack of good transportation routes, overabundance of dead wood, and persistence of traditional types of non-timber forest uses, attempts at introducing timber-oriented forest management to BPF were hindered. Instead, the Forest became again a royal hunting ground, this time belonging to Russian tsars (Samojlik et al. 2019A, 2019B, 2020). The first time BPF became the subject of mass-scale robbery timber exploitation was during World War I, when the Forest was occupied by the German army (1915–1917). However, the Germans used mainly selective cutting to remove the most valuable timber – clear cuts were introduced already after the war, when a newly reinstated Polish government contracted BPF to a British company, The Century European Timber Corporation. The contract was terminated by the Polish government. Around the same time, in 1921, for the protection of the best-preserved and most valuable parts of the Forest, the first reserve was created, later transformed into Białowieża National Park (Więcko 1984).

(5) **The fifth contemporary phase** encompasses the most modern part of BPF's history with its dual approach to the Forest: partially managed for timber, partially under protection, prone to the most recent debate on the future of the Forest.

It is then safe to say that the history of BPF has been entangled with the history of human presence since ancient times, making the Forest absolutely ill-fitting to the western standard definition of primeval forest (Buchwald 2005). At the same time, it

is safe to say that naturalists who visited BPF in the 18th-beginning of the 19th century saw the Forest as we see it today: wild, untamed, breath-taking in its natural beauty in some parts (**Fig. 7.1**) and bearing traces of human activities or recovering from man-made disturbances in other areas (**Fig. 7.2**). Why then is it nowadays disputed if BPF "deserves" to be called primeval? Is this only due to the fact that forestry-oriented definitions have dominated the perception of primeval and virgin forests as "untouched"?

Despite a long-lasting history of human presence in BPF and a plethora of uses of forest resources the Forest has witnessed in past centuries of even millennia, there is still evidence of the unique preservation of BPF's environment. This area was never deforested in the past 11 to 12 thousand years, the Forest itself, even after a major natural or anthropogenic disturbance, was able to fully regenerate thanks to long gaps between different waves of settlers or phases of human presence. In the mod-

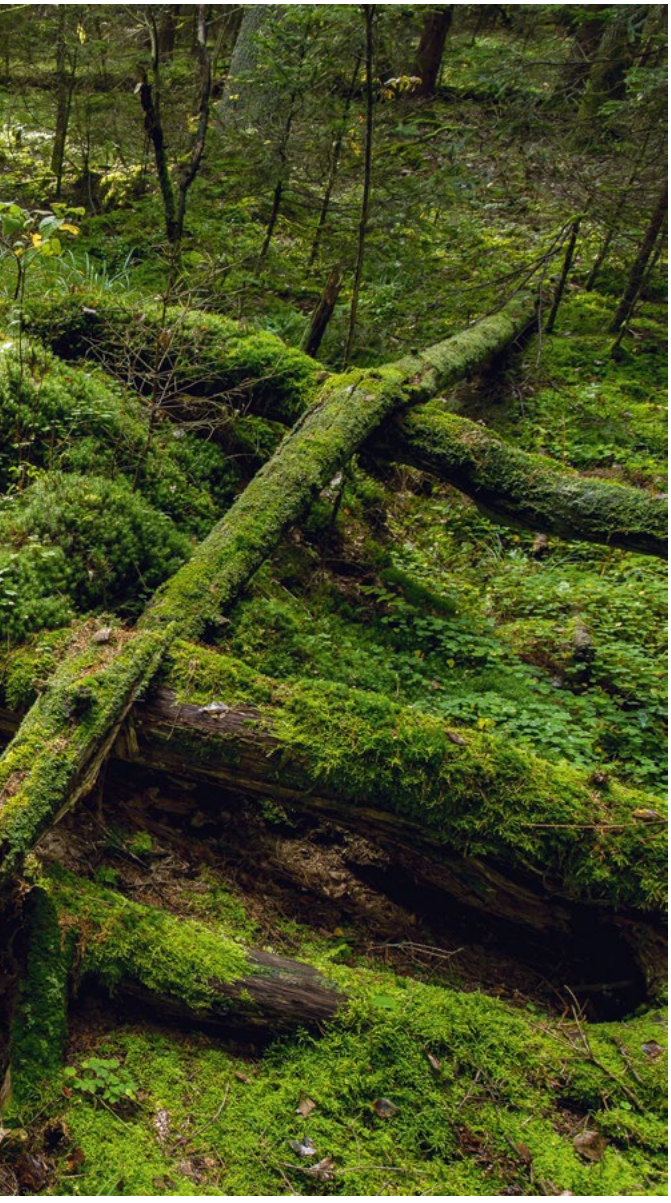


Fig. 7.1. The best-preserved fragments of old growth in Białowieża Primeval Forest (Photo by Krzysztof Onikijuk).

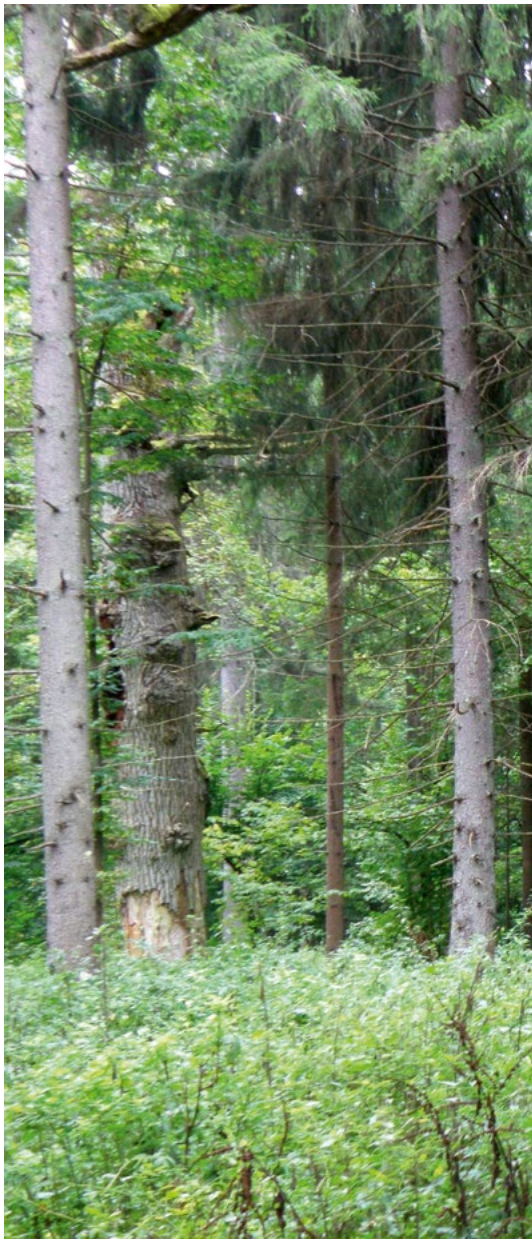


Fig. 7.2. One of the oldest oaks in Stara Białowieża [Old Białowieża], a place where the first known royal hunting manor of Polish kings and Lithuanian grand dukes was located in the 16th century. A group of such oaks has grown on the ruins of the manor (Photo by Tomasz Samojlik).

ern period (16th-18th centuries), human impact on the natural environment was much weaker compared to most other areas in the rest of Europe and allowed BPF to avoid the fate of neighbouring forests at that time – Bielska, Kamieniecka, Tokarzewska, Pużycka or Narewka Forest, known only from historical documents. Traditional utilization of forest resources in the modern period, however, led to the creation of traditional or cultural landscapes in BPF, combining natural habitats with

anthropogenically modified elements. An example of such landscape is a royal hunting garden: large parts of the forest (5–10 square kilometers) surrounded by a wooden fence, incorporating different forest habitats with a part of a stream or small river. Big game – European bison, moose, red and roe deer and wild boar – were driven and closed inside such fences prior to monarchical hunts (Fig. 7.3). Long-lasting maintenance of such fenced areas, with anthropogenic glades and bowers for hunters, cre-

ated a particular cultural landscape. In 1784, two such areas were present in BPF (Fig. 7.3), one of which (Kletna) declined after the political fall of Poland in 1795, and the other (Teremiska) served as a Russian game park in the 19th century and was transformed into the Polish breeding reserve for European bison after 1929 (Samojlik et al. 2013B). In the 19th century-beginning of 20th century, despite attempts at introducing modern rational forestry, the natural processes of succession and regeneration were not affected, and the continuity of forest habitats was not disturbed. Destruction inflicted during WWI and management undertaken in subsequent periods, including artificial regeneration, remains a fact, yet it was still a relatively short-lasting factor that did not encompass the entire Forest, ensuring the preservation of natural processes governing the entire forest ecosystem. Numerous research projects and publications document the natural processes of BPF, such as cycles of tree seeds production, insect outbreaks, rodent population peaks or the multi-aspect influence of the presence of a large volume of decaying trees in the Forest (Wesołowski et al. 2016). The Forest is used as a benchmark by conservation science, ecology, forestry and evolutionary sciences (Jaroszewicz et al. 2019).

Fig. 7.3. "Location of Białowieża with two marked Hunting Gardens", a hand-drawn map by royal cartographer Michał Połchowski, 1784 (Central Archives of Historical Records, Warsaw, Cartographic collection AK147).

At the same time, each episode of massive felling or mass-scale extraction following insect outbreaks, motivated by the definition of primeval forest, brings us closer to finally break the connectivity of the forest – and thus also the persistence of natural processes (Mikusiński et al. 2018).

The analysis of Europe-wide perception of BPF in natural studies, literary descriptions or works of art leaves no doubt that since the late 18th century the Forest was seen as unique. Numerous scientific studies in various fields of natural sciences in the 19th-early 20th century confirm that the Forest was treated as an interesting research object. On the other hand, investigations into BPF-related topics contributed to the development of natural sciences themselves, especially in the field of nature conservation. Numerous writings in the popular press indicated that the Forest started to be recognized as a priceless natural and cultural heritage. It also helped in creation the reserve Białowieża in the heart of the forest in 1921, later transformed into the Białowieża National Park. Similarly, the long-lasting process of building the image of European bison as an ancient beast and charismatic animal, connected with BPF, left a trace on public perception of the species. The iconic status of European bison was one of the factors that contributed to a successful campaign of rescuing the species after its extinction in the wild in 1919. Now, there is no doubt that European bison is one of the most valuable species needing constant effort and special protection. Interestingly, BPF is not so unanimously perceived as primeval, despite a similar history of its recognition and presence in European culture, despite its role in shaping the idea of primeval forest and influencing the development of modern forestry, phytosociology, biogeography and nature conservation.

Dealing with this problem would require shifting the baseline of what is defined as primeval. Since the literal understanding of primeval forests as "untouched" practically denies the existence of such places (Potapov et al. 2008, Bernier et al. 2017), maybe it would be wise to come back to the 19th-century awe and respect of wilderness that has enough space to host both unaltered woodlands and a plethora of forest-human interactions and cultural landscapes resulting from them. A new, modern definition of primeval forest would then incorporate human presence as one of the factors shaping the ecosystems – to better suit the forest conservation needs nowadays. Indeed, elsewhere in the world, for example in the old growth forests of the Pacific Northwest, "primevalness" and human beings are not mutually exclusive; these forests have long been intentionally "gardened" by Indigenous Peoples (Curry 2021).

The primeval forest can therefore be understood as a palimpsest of past natural and anthropogenic disturbances, still characterized by a high level of connectivity and regeneration potential, enabling it to both maintain large-scale natural processes and to support megafauna, such as the European bison.

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Mammal Research Institute, Polish Academy of Sciences

Mammal Research Institute is an independent scientific research unit of the Polish Academy of Sciences (PAS). It is one of the oldest scientific institutions of the Polish Academy of Sciences, founded in 1952 by prof. August Dehnel. Research conducted by MRI PAS has been shaping the development of theriology (mammalogy) in Poland. Studies on the morphology, taxonomy, systematics, evolution, population genetics, ethology and ecology of mammals conducted by the Institute have theoretical character, but also find application in wildlife conservation and management of animal populations. One of the biggest assets of MRI PAS is its location in the heart of Białowieża Primeval Forest, UNESCO Biosphere Reserve and World Heritage Site, offering an opportunity to study natural processes in an environment that experienced relatively low anthropogenic disturbance since the last Ice Age.

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The book, written by an international team of interdisciplinary researchers, is composed of a series of scientific essays touching on themes of roots of the idea of primeval forest in the connection with Białowieża Primeval Forest (BPF) and scientific recognition of BPF and European bison in European research. We trace specimens of European bison from BPF in European nature museums and show their significance in building the iconic status of the species, we follow the perception of BPF in popular writings and collect information on initiatives to reintroduce wild animals as an attempt to re-create the fauna of a primeval forest. We also attempt to describe the evolution of the visons of European bison in art and its connection with the development of knowledge on the species. Lastly, we conclude that contemporary conservation needs a new definition of primeval forest, taking into account the history of this term in the context of BPF.

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