

## Undoing Extinction

### *The Role of Zoos in Breeding Back the Tarpan Wild Horse, 1922–1945*

▼ **SPECIAL ISSUE ARTICLE** in *Science at the Zoo: Producing Knowledge about Exotic Animals\**, ed. by Miquel Carandell & Oliver Hochadel

▼ **ABSTRACT** Although episodes of captive breeding for display and acclimatization purposes date back to the 19th century, systematic breeding for species conservation first became the central mission for European zoological gardens in the interwar period. While most scholars explain this shift as a result of a decline in the global trade of exotic animals, my analysis points to the simultaneous renewed interest in native endangered and extinct species as a catalyst for captive breeding experiments. This article considers the role of zoos in one of the earliest de-extinction projects, namely the breeding back of the Eurasian wild horse. By investigating two breeding programs, those initiated by Tadeusz Vetulani in Poland and the Heck brothers in Germany, my analysis reveals not only the political stakes, but also the different methods employed in these attempts to resurrect the tarpan. More specifically, I explore how scientific ideas about heredity and hybridization, as well as understandings of the porous boundary between domestic and wild horses, paved the way for selective breeding to be mobilized as a means of bringing back the extinct species. This ambitious goal reinvigorated the scientific function of the zoo by making it an experimental ground for undoing extinction, and laid the groundwork for its future role in the emergent wildlife conservation movement. In addition to mapping out knowledge exchange between zoologists, geneticists, and

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paaleontologists, this article traces the circulation of specimens between natural history museums, zoos, and wildlife reserves to underscore the material dimension of *ex situ* conservation practices.

▼ **KEYWORDS** Eastern Europe, Zoological Gardens, Genetics, Heredity, Species Conservation, Captive Breeding, De-extinction, Wild Horses

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## Introduction

In June 1919, Polish authorities assumed the responsibility for the zoological garden in Poznań from the Prussian administration.<sup>1</sup> The financial crisis following the Great War had taken a toll on the infrastructure and animal collection, leaving only 243 specimens from 75 species.<sup>2</sup> Most of the zoo's publicity in the coming years stressed the need to support “the last Polish zoo.” The newly appointed director, Bolesław Cylkowski, regularly published appeals in the local and national press promoting visits to the zoo as a patriotic deed, and encouraging hunters, foresters, and landowners to donate specimens of domestic fauna. In one such call from 1921, he wrote:

Despite the constant loss of exotic animals, whose purchase and board are all but impossible nowadays, our zoo collection is constantly expanding through the acquisition of domestic animals, and *the zoo is gaining a native attribute*. Certainly this is in no way detrimental to the zoo, because observation shows that the populace in larger cities are more familiar with exotic animals than domestic ones. Our common animals are often far more interesting biologically, and *it is our duty to get to know them*.<sup>3</sup>

Cylkowski was aware that with the need to rebuild the country after the malaise of war, the zoo and its wild inhabitants were not a high priority, and he concentrated on trying to drum up support from state officials and the wider public. The turn towards domestic species was a strategic move with a dual purpose: new exotic specimens seemed out of reach anyway, and the focus on native fauna validated the national character of the institution he was desperately trying to save.

While the shift from exotic to native fauna may have been necessitated by post-war financial difficulties, it had larger repercussions beyond restocking the depleted zoological collection and enhancing its educational role. With interest in rare and “biologically interesting” native species growing among contemporary life scientists,

<sup>1</sup> The zoo was established in 1874, and remained under Prussian directorship until the formation of the Polish state in 1918.

<sup>2</sup> “Ogród Zoologiczny w Poznaniu” (1921).

<sup>3</sup> “Z ogrodu zoologicznego” [Newspaper clipping] (1921, Jul. 01), unmarked box, Archive of the Poznań Zoological Garden, Poznań, Poland (italics added). All translations are by the author.

the Poznań zoological garden gained not only a “native attribute,” but also a scientific one, in keeping with an interwar European trend to appoint scientifically trained zoo directors. As the institution struggled for survival, it embarked on a new project to preserve creatures on the brink of extinction. The flagship species for this rescue mission was the European bison (or wisent), which had been hunted to extinction by the end of the First World War.<sup>4</sup> With the last surviving specimens, Poznań Zoo became part of international efforts to rebuild a healthy European bison population and eventually reintroduce it to the “wild.”<sup>5</sup>

Whereas the wisent often serves as the poster child of early wildlife reintroduction, there was a slightly less spectacular animal whose recovery became a model of species revivalism. A pair of small, mouse-gray horses were on display in Poznań Zoo from September 1927 as proxies for the extinct tarpan. These humble ponies from the eastern borderlands of the country were known as “Polish *konik*.” An 8-year-old mare and a 6-year-old stallion were selected from local farm horses for an experiment in regenerating the European wild horse. The project, led by Tadeusz Vetulani, a zoologist from the Department of Special Animal Husbandry at Poznań University, quickly garnered interest within Poland, as well as internationally:

When purchasing the specimens of *konik* this spring as a result of Dr. Vetulani's initiative, the management of the zoological garden in Poznań was duly aware of their zoological value; however, at that time, they did not suspect that the presence of *konik* in the Poznań zoological garden would contribute to an increased interest in this horse abroad.<sup>6</sup>

This press release (prepared by Vetulani himself) reported on a request from Lutz Heck, the assistant director of the Berlin Zoo, for a pair of Polish *konik*. Together with his brother Heinz Heck, who had just been appointed director of Tierpark Hellabrunn near Munich, he was also gathering breeding material for their own experiment.

Both Polish and German zoologists used selected domesticated horse breeds as a resource in an attempt to re-craft a mythical creature of the past that held a special place in their respective national imaginaries. As Heinz Heck wrote:

Among the most striking creatures of our homeland, which we have only recently become acquainted with, are the wild horses. What zebras are for the countries of Africa, or wild asses for the countries of Asia, wild horses are for Europe. It is impossible to imagine our ancient grasslands without hearing the neighing of a wild horse, the “savage stallion” [*grimmes Schelch*] as he was called in the *Nibelungenlied*.<sup>7</sup>

4 For more on European bison conservation, see de Bont (2017); Fedotova, Samojlik, & Daszkiewicz (2019).

5 The involvement of Polish institutions and scientists was of great importance because the wisent's last natural habitat was the Białowieża Primeval Forest that had been reincorporated into the Second Polish Republic after the Great War.

6 “Berliński OGRÓD ZOOLOGICZNY ZABIEGA O OKAZY KONIKA POLSKIEGO” (1927).

7 Heck (1936b, p. 2).

The scientists capitalized on the wild horse's symbolic value to increase the genetic value of their experimental animals. While Vetulani envisioned the Polish *konik* as the foundation of a Polish national horse-breeding program, the Heck brothers invested in reviving what they believed was an ancient Germanic wild horse.<sup>8</sup> Although Vetulani and the Hecks shared the goal of recreating the traits of the extinct tarpan, they imagined its origin and species characteristics differently.

These almost parallel projects, with divergent nationalist underpinnings and methodological approaches, are some of the earliest attempts at recovering a lost species by breeding back. When contemporary scientists advocate de-extinction as the future of wildlife conservation and an appropriate response to the sixth mass extinction, advanced techniques, such as cloning and gene editing, are the methods of choice.<sup>9</sup> However, the low-tech selective breeding programs launched in the interwar period laid the foundation for resurrection biology and stretched the temporal horizon of wildlife conservation to include the past and the future. This article compares two competing projects that aimed at recreating the tarpan as the wild ancestor of all European domestic horse breeds. It explores the ways in which both Polish and German zoologists mobilized the zoo as a site for experimental breeding and a space for promotion of their research. More specifically, it investigates which scientific ideas about heredity and hybridization underscored each back-breeding experiment, and the ways in which they utilized domestic horses as genetic reservoirs to bring back the extinct tarpan in a new form.

Environmental historian Dolly Jørgensen notes that “the natural extension of de-extinction is the reintroduction of the species to the wild,” and both of the breeding experiments discussed in this article started in zoos and continued to their final stages in wildlife reserves.<sup>10</sup> This trajectory helps to highlight the process in which, by the second half of the 20th century, the interconnection between *ex situ* and *in situ* conservation practices reshaped the role of the zoo; as a modern Noah's Ark, the increasingly globalized institution was geared towards sustaining “back-up” populations of endangered species through captive breeding programs. Although this new role no longer necessarily privileges local fauna, the story of how Polish and German scientists attempted to breed back the tarpan demonstrates how rare native species temporarily replaced exotic animals as the highlight of many collections and served as prototypes for experiments on undoing extinction. Such an endeavor harbors a host of questions pertinent to the history of science: which scientific disciplines flourished within an institutional network of zoos, museums, and nature reserves?<sup>11</sup> What kinds of politics and temporalities were invoked by scientific interest in extinct species? How were animal bodies turned into artifacts, while alive and after death? In what

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8 For a discussion on both back-breeding projects, see van Vuure (2015); for a longer history of the wild horse, see Forrest (2017; 2019).

9 See Minter (2018); Novak (2018); Sherkow & Greely (2013); Zimov (2005).

10 Jørgensen (2013, p. 719).

11 For more on how this institutional network was crucial in the development of the biological perspective in Germany, see Nyhart (2009).

follows, I map out the shared epistemic cultures cultivated on the individual zoo grounds to show how animal indigeneity was constructed as the horses became the raw material for the foundation of nationalized conservation projects.

## Tracking the Origins and Kinship of Wild Horses

To explain the scientific interest in breeding back the tarpan, it is necessary to review briefly how zoologists understood its relationship to other wild and domestic horses. In 1928, Otto Antonius, the director of the Tiergarten Schönbrunn in Vienna, published his observations on a pair of Przewalski's horses acquired 3 years earlier from the L. Ruhe animal trading company. His article for *Der Zoologische Garten* not only reviewed the current debates on taxonomic categorization of *Equus przewalskii* and its possible sub-types among captive populations, but also referenced 18th-century historical observations on wild horses across Central Asia and Eastern Europe. These reports by German explorers and naturalists contributed to the legendary status of wild horses roaming the Russian steppes, as well as to the confusion about whether they belonged to the same species as the stout stocky horses with erect manes described in 1880 by the Russian imperial geographer, Colonel Nikolai Przewalski.<sup>12</sup> His discovery piqued the interest of hippologists and wildlife traders worldwide, leading to several expeditions to Mongolia that sent some of the last representatives of these horses to European and American zoological collections.<sup>13</sup> Almost three decades later, Antonius noted the following about the display of Przewalski's horses at the Schönbrunn Zoo:

The interest with which our visitors read the legend attached to the wild horse enclosure proves to me every day anew that the purchase of these animals must also be approved from a purely zoological point of view. Made aware of this legend, the public understands the double value of the wild horses: as extinct animals and as the ancestral form of our noblest domestic animal.<sup>14</sup>

A scientist interested in genetics and livestock husbandry, Antonius viewed the zoo both as an institution committed to public education, and as an experimental ground for breeding and acclimatization research.<sup>15</sup> In his description of the two Przewalski's horse specimens, the zoologist detailed their genealogy, behavior in captivity, and physical appearance with particular focus on coat coloration and cranial measurements—the features that zoologists used to identify the wild ancestors of the domestic horse. Originally categorized in 1881 as an intermediate species between

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<sup>12</sup> Boyd & Houpt (1994).

<sup>13</sup> Rothfels (2018).

<sup>14</sup> Antonius (1929, p. 98).

<sup>15</sup> Antonius was the first scientist to be appointed director of Tiergarten Schönbrunn. He is also considered one of the pioneers of zoo biology. See Hofer (2002; 2008); Pechlaner, Schratter, & Heindl (2010).

horses and asses, these primitive equids were widely believed to be the only remaining type of wild horse.<sup>16</sup>

However, there were several candidates for the title of “true” wild horse. According to Antonius, Przewalski's horse was not identical to the mouse-gray tarpan mentioned in historical records. He named the latter *Equus caballus gmelini* to honor Samuel Gottlieb Gmelin, a German explorer and naturalist who in 1771 first described a herd of wild horses near the Russian town of Voronezh.<sup>17</sup> The name tarpan derives from Kazakh and Kyrgyz and was first used by European scientists in the mid-19th century. The species went extinct by the end of the century; it is believed that the last specimen, known as the “Kherson tarpan,” died in Moscow Zoo in 1887.<sup>18</sup> Its skull, along with an incomplete skeleton of another specimen, the so-called “Tauric tarpan,” was considered to be the only remains, albeit partial, of the tarpan, and thus served as an invaluable reference material for osteological and craniometric comparative studies. While taxonomists debated whether the Przewalski's horses brought to Europe were wild or feral, the tarpan silently slipped into oblivion. Despite this loss, Antonius claimed that certain domestic horse breeds from eastern parts of the Austro-Hungarian Empire, particularly Transylvania, Bosnia, and Galicia, resembled the tarpan in their primitive traits.<sup>19</sup> While noting that tarpans and Przewalski's horses must have co-existed at the end of the 18th century, he argued that “more important for the question of descent are the relations of the tarpan to domestic horses which show some similarity to the eastern European ponies mentioned above.”<sup>20</sup> Antonius's conclusion testifies to an increased interest in uncovering the mechanisms of domestication and heredity that led Central European zoologists to direct their attention towards local horse breeds.

Galician farm horses became the subject of zoological studies exploring the ancestry of domestic animals that were promoted at the Hochschule für Bodenkultur in Vienna and the Jagiellonian University in Cracow by Leopold Adametz, an Austrian geneticist specializing in animal husbandry.<sup>21</sup> In the 1920s the area of Biłgoraj in southeastern Congress Poland became known as the “Mecca” of farm ponies that resembled the European wild horse.<sup>22</sup> The descent of Biłgoraj horses from tarpan was first proposed by Jan Grabowski and Stanisław Schuch, who in 1914 under the supervision of Adametz studied the characteristics of local peasant horses often used as draft animals by the Austro-Hungarian army. The Polish zoologists published the results only after the war, and based on their biometric measurements of 85 specimens they identified a type of small stocky horse with short legs and a large head.<sup>23</sup> Grabowski and Schuch emphasized that its grullo, or mouse-gray, coat with

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16 Poliakoff (1881, p. 26).

17 Antonius (1912).

18 Pruski (1959, pp. 54–56).

19 Antonius (1912, p. 515).

20 Antonius (1912, p. 517).

21 Adametz (1926).

22 Adametz (1926, p. 24); Pruski (1960, p. 805).

23 Grabowski & Schuch (1921, p. 699).

no markings apart from typically primitive ones—a dorsal stripe and leg barring—matched the characteristic features of a forest variety of the extinct wild horse that had been described by James Cossar Ewart from Scotland, who postulated that ancestral traits were preserved in certain primitive horse breeds.<sup>24</sup> He was known for his research on hybridization and inheritance in animal husbandry done before the rediscovery of Mendel's laws of heredity.<sup>25</sup> Ewart's crossings of different horse breeds resulted in what he named the “Scottish tarpan,” a breed that resembled the Bilgoraj pony. However, Ewart concluded that “the Tarpan, once common in the east of Europe, cannot be considered as a true wild species” due to its “multiplex origin,” including descent from feral domestic horses.<sup>26</sup>

Unaware of or unimpressed by Ewart's verdict on the tarpan's wildness, Grabowski and Schuch investigated the source of Bilgoraj ponies' wild horse characteristics. They traced historical reports on the wild horses kept in the Zwierzyniec menagerie near Zamość until the 19th century, and speculated that these specimens had been incorporated into the breeding stock of local farm horses in the Bilgoraj area.<sup>27</sup> According to their archival research, the wild horses in Count Jan Zamoyski's menagerie originated from the Białowieża Forest, thus cementing the conviction that Galician peasant horses were directly related to the forest tarpan (“*kuc leśny*”). Such situated genealogy gave rise to the idea of an indigenous variety of wild horse. This compelling origin myth inspired another student of Adametz to further study the remnants of primitive horses in Bilgoraj. Following in the footsteps of Grabowski and Schuch, Vetulani began his research on the local farm horse in 1923. To prove its kinship with the extinct tarpan, he decided to dig below the surface level of phenotype.

## Dead or Alive: Recreating the Tarpan from Bones

Vetulani's research into the Polish *konik's* anatomy, taxonomy, and origin turned an underappreciated peasant horse into a valuable scientific specimen. The Polish zoologist derived his scientific methods from the “Viennese school,” which he considered to be the most influential in the study of animal domestication.<sup>28</sup> He referred to research on phylogeny of domestic species by Antonius and Adametz, as well as Othenio Abel's pioneering work in paleobiology.<sup>29</sup> When it came to hippology more specifically, Vetulani distanced his approach from what he termed the “English school,” represented by Ewart among others.<sup>30</sup> Although both schools agreed on the

24 Ewart (1907; 1909).

25 Ewart (1899). For more on Ewart's influence on animal breeding and genetics research, see Button (2018); Ritvo (2010).

26 Ewart (1906, p. 184).

27 Grabowski & Schuch (1921, p. 699).

28 Vetulani (1925, p. 379).

29 Antonius (1922); Adametz (1926); Abel (1912; 1914).

30 Despite depicting the Viennese and English schools as competing scientific circles, in 1928 Vetulani applied to the Rockefeller Foundation for a research fellowship that would allow him to visit the Institute of Animal Breeding at the University of Edinburgh to study methods of genetic research under the supervision of Francis

multiple origins of domestic horse breeds, they differed on how many primitive types there were.<sup>31</sup>

Before he turned to breeding experiments, Vetulani's initial research classified this primitive breed using horse skulls collected in the Biłgoraj area. The zoologist selected horses with primitive characteristics when they were still alive. Of the 22 skulls Vetulani gathered on this basis, he eliminated 12 because of the specimens' immaturity or deviation from type.<sup>32</sup> Following the craniometric method developed by Adamez, he analyzed the remaining 10 Biłgoraj horse skulls and compared them to other researchers' cranial measurements from various domestic horse breeds, Przewalski's horses, and tarpans. The two Kherson and Tauric tarpan skulls served as especially important reference material.<sup>33</sup> In the odontological part of his analysis, Vetulani also examined the morphology of teeth from his initial sample in relation to prehistoric fossil material.<sup>34</sup> Based on these comparisons, he classified the Biłgoraj horse as an oriental "warm-blooded" horse type with features characteristic of the tarpan, influenced by Przewalski's horse blood.<sup>35</sup> In his first publication, which appeared in Polish and German, he introduced the name "Polish *konik*" for what he concluded to be the "primeval form of horse."<sup>36</sup>

In a later study, Vetulani again compared *konik* skulls, applying the method of differential diagnosis (*metoda różniczkowa*) developed by Polish anthropologist and statistician Jan Czekanowski. This time, he made a critical distinction between two subspecies of tarpan, named after their habitats: steppe and forest.<sup>37</sup> According to Vetulani, the former type adapted to new habitats in forested areas of northern and eastern Europe in the aftermath of the last Ice Age, eventually evolving into the latter. He named the forest tarpan *Equus caballus gmelini Antonius forma silvatica Vetulani* and focused on recreating its characteristics.<sup>38</sup> Although naturalists had proposed the previous existence of a wild forest horse in Europe, Vetulani believed that the last specimens survived in the primeval forest of Białowieża.<sup>39</sup> Building on Grabowski and Schuch's hypothesis, Vetulani made a direct link between the last forest tarpans and the Biłgoraj ponies.

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Albert Eley Crew, a renowned geneticist and student of Ewart. Ultimately, Vetulani did not travel to Scotland. See Vetulani to F. A. E. Crew [Letter] (1928, Jan. 20), P.III-47/1/6, Poznań Branch of the Archives of the Polish Academy of Sciences, Poznań, Poland (hereafter PBA/PAN).

31 Since the 19th century, there were two major theories on the origin of domestic horse. According to the monophyletic theory, supported by Darwin among others, all horse breeds have one wild ancestor, while the proponents of the polyphyletic theory agreed on multiple domestication events and thus several wild ancestors.

32 Vetulani (1925, pp. 385–386).

33 Tscherski (1892, p. 511).

34 Vetulani (1925, p. 409).

35 The 19th-century distinction between light-built, agile warm-bloods and heavy, strong, cold-blood horse breeds was used interchangeably with terms "eastern" and "western," and mapped onto "oriental" and "occidental" cultural realms, reminding us that modern debates about purity and ancestry of domestic horse breeds interweaved with ideas about race and identity. See Guest & Mattfeld (2019a; 2019b).

36 Vetulani (1925, p. 416).

37 Vetulani (1928).

38 Several fellow zoologists criticized Vetulani's theory on the forest subspecies of the tarpan, as well as his research methods. See Herre (1939); Prawocheński & Śliżyński (1931); Skorkowski (1934).

39 See Lydekker (1912, p. 96).



**Figure 1:** Tadeusz Vetulani with Polish *konik* horses at the Poznań Zoo (1927). From the private collection of Zygmunt Vetulani. Reproduced with permission.

For Vetulani, these peasant horses were the remnants of the extinct wild horse typical for eastern Europe—a living relic of the past. Early on, he envisioned a breeding program that would allow him not only to recreate traits of the forest tarpan, but also use Polish *konik* as breeding stock for national thoroughbreds. In 1926, he used the results of his research to lobby state officials for support:

Knowledge that the noble Arabian horse is the purest descendant from the tarpan would undoubtedly facilitate the direction of further breeding. I want to especially highlight that realizing this idea requires finding typical specimens of *konik* and selectively breeding them in “purity.”<sup>40</sup>

Breeding “in purity” refers here to Vetulani's goal of preserving the last representatives of Polish *konik* as a reservoir of the baseline phenotypes for his breeding program. The open question was: where would this experiment take place? Given Vetulani's ambition of elevating a neglected peasant pony to a national heirloom breed, founding a state stud-farm for Polish *konik* was an obvious long-term goal. However, the zoologist gathered his breeding material in public-facing scientific institutions, consciously using their local prestige and national character to promote his experiment among wider audiences and state officials.

<sup>40</sup> Vetulani (1926, Jun.), *Memorjał w sprawie ochrony resztek Konika Polskiego przed zagładą, celem użycia ich dla celów hodowlanych*, pp. 2–3, P.III-47/1/6, PBA/PAN.

In September 1927, Vetulani initiated the purchase of a pair of horses from Biłgoraj for Poznań Zoo. According to reports in the local press,

when buying specimens of Polish *konik*, the Zoological Garden not only considered the museum-like care of our unique fauna, but also contributed to the current and urgent action to save the remaining typical Polish horses, both for scientific purposes and serious breeding plans.<sup>41</sup>

Another breeding pair had been transported to Poznań 7 months earlier, but these horses did not end up on display, suggesting that the experiment was taking place at multiple sites. In fact, the main purpose of the *konik* zoo exhibit was to popularize Vetulani's project:

Even if our science, taking advantage of the last typical Polish *konik*, has duly taken care to preserve materials which would in the future convey knowledge about the native primitive horse of Polish lands, if, moreover, foreign scientific institutions are purchasing bones of the remaining primitive horse of Europe from the Physiographic Committee of the Polish Academy of Arts and Sciences, if, finally, the Zoological Garden of Poznań, the only one in Poland, has enriched its collection with specimens of this typical horse, we can still by no means conclude that everything has been done in this matter and that it can be considered closed.<sup>42</sup>

This patriotic rescue mission embedded the zoo in a network of scientific institutions involved in the early stages of the breeding project. For Vetulani, the gardens were the most appropriate place to display living specimens of this “endangered” small horse, especially given that the zoologist wanted to highlight its primitive traits. In other words, the context of the zoo helped to accentuate the assumed wild descent of the *konik*. Vetulani considered a mare in the zoo named Cnota (Virtue) to be a model specimen for a tarpan-type horse, and used photographs of her to illustrate many of his scientific articles for international journals. While he took advantage of the zoo's educational role to publicize his own project, in turn, as mentioned earlier, this reinvigorated the scientific role of the zoo.

### **Breeding (Back) Between the Zoo and Reserve in Poland**

The interwar period was a time when European zoological gardens began to invest more resources into reproducing their specimens. The Great War and the Blockade of Europe transformed the international animal trade and left many zoos in the former Central Powers operating on shoestring budgets. Captive breeding became a solution to the problem of depleted and ageing zoo stocks. The idea of preserving species endangered with extinction was gaining traction within the international zoological network, and as this concept developed, it strengthened the bonds and relationships

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<sup>41</sup> “Typ Polskiego KONIA W ZWIERZYŃCU” (1927).

<sup>42</sup> Vetulani (1927), *Konik POLSKI W ZBIORACH MUZEALNYCH*, pp. 5–6, P.III-47/1/6, PBA/PAN.

between zoos. Practices used for such restoration missions were often borrowed from livestock husbandry—from selective breeding methods to keeping studbook records. In this context, Vetulani's plan to distinguish the Polish *konik* as a landrace breed and use it to recreate the characteristics of the extinct wild horse straddled the border between agricultural and conservationist modes of breeding. Additionally, by using a domestic horse to achieve both goals, the scientist was treading a fine line between the concepts of species and breed.<sup>43</sup>

In the course of further research, Vetulani became convinced that if he wanted to restore specific wild traits of the forest tarpan preserved in the lineage of Polish *konik*, his breeding experiment needed to be continued *in situ* for two reasons. First of all, keeping pairs made sense to ensure controlled breeding in the zoo, but wild horses lived in herds and their social organization affected reproductive behaviors, including mate selection. Second, Vetulani suspected that certain phenotypic changes might be induced by environment, and zoo captivity might have hindered this process. An ideal place for reintroducing the tarpan-like horses was the Białowieża primeval forest, where he hypothesized the original forest tarpans had dwelled. In 1933, at the meeting of the Polish branch of the International Society for the Protection of European Bison he proposed starting a reserve for Polish *konik* in Białowieża next to the already existing wisent reserve. When lobbying for the establishment of such a sanctuary for tarpan-like horses, Vetulani once again relied on the professional reputation enjoyed by zoological gardens: “the interest other zoos have in our tarpan horse is evidenced by, inter alia, information and inquiries addressed to both me and the management of the zoo in Poznań.”<sup>44</sup> Among other transactions, he mentioned the transfer of *konik* specimens from the Poznań Zoo to the Tiergarten Schönbrunn in 1932, and the acquisition of a mare in Biłgoraj for the collection of the recently founded Warsaw Zoo.<sup>45</sup> In this sense, the institution of the zoo served as an important reference for promoting *in situ* restoration of the tarpan-like horses. In 1936, a 4-hectare area in the Białowieża forest was fenced off for the provisional reserve, and soon five mares selected from the Biłgoraj enclave were released to the enclosure. Vetulani encountered problems with selecting stallions appropriate for back breeding, but luckily, offspring from a pair of *konik* he had secured almost a decade before for the Physiographic Committee in Cracow completed the founding population of the reserve. In *Der Zoologische Garten*, the director of the Poznań Zoo applauded the return of wild horses to the Białowieża forest.<sup>46</sup>

Vetulani's experimental breeding program was geared towards recreating a few wild traits associated with the tarpan that he believed could be restored by selectively breeding Polish *konik* horses, given their assumed genealogical proximity to wild horses released from Zamoyski's menagerie. This wild provenance allowed Vetulani

43 For a discussion on the notion of breed, see Derry et al. (2018).

44 Vetulani (1934), *Memorjał w sprawie Wprowadzenia Konika Polskiego Typu “Tarpana Leśnego” do Rezerwatu Puszczy Białowieskiej*, p. 3, P.III-47/1/6, PBA/PAN.

45 Established in 1928, the Warsaw Zoo was also a place where horse breeding experiments were taking place, as evidenced by a report by Rząśnicki (1934) on crossing Shetland ponies.

46 Szczerkowski (1936).

to mobilize the zoo as one of the “epistemic spaces” of heredity, to use Staffan Müller-Wille and Hans-Jörg Rheinberger’s concept. According to these historians of life sciences, “gardens and menageries, although instituted originally for the descriptive purposes of natural history, also formed the first loci for approaching heredity experimentally,” because removing animals from their natural habitats allowed a separation of environmental and hereditary factors.<sup>47</sup> Vetulani reversed this trajectory: by abstracting Bilgoraj *konik* from the context of agriculture, he transformed them into Polish *konik*, which were then placed in a forest habitat. The zoo was a captive transit zone that allowed the scientist to test the rules of inheritance to bring out the wild traits dormant in these domestic horses.

Crucial for his selective breeding technique was the notion of atavism, which according to Adametz occurs “when characteristics or traits appear in an individual which neither the parents nor the preceding generations possessed, but which were present in more distant ancestors.”<sup>48</sup> He understood this phenomenon in accordance with the modern rules of Mendelian inheritance. One of the examples the Austrian geneticist gives in his handbook for animal breeding is the dorsal stripe and leg barring observed in many domestic horse breeds, which is interpreted as a form of ancestral inheritance from Przewalski’s horses and tarpans. Vetulani had already prescreened Polish *konik* according to these two features, so his later breeding experiment focused on retrieving other traits, especially the seasonal whitening of the winter coat characteristic of several wild species from the north such as the mountain hare, ermine, or grouse.

As this seasonal trait was uncommon in any domestic horse breeds, Vetulani supposed that he was dealing with an atavism reappearing thanks to the phenomenon of multiple gene inheritance.<sup>49</sup> He focused on restoring the winter whitening in horses by inbreeding, or mating closely related individuals. A stallion, Tref, and his sister, Czajka, came to the reserve as a donation from the experimental stables near Cracow, because their coat color changed from mouse-gray in summer to snow-white in winter, with the head, mane, and limbs remaining dark. Vetulani concluded that this primitive trait was characteristic for the forest form of tarpan. Moreover, from his review of Russian scientific literature, the zoologist found a mention by Herodotus of wild, white horses observed in Scythia (an area between southern Belarus and northern Ukraine), and hypothesized that this ancient source referred to forest tarpans that had adapted to the colder European climate.

In January 1939, Vetulani decided to transport Tref—his most valuable specimen—from the reserve to the Poznań Zoo for closer examination. This demonstrates that, although the back-breeding project mostly took place *in situ*, Vetulani still relied on the zoological garden as an experimental space for detailed observation and morphological analysis. Moreover, animal mobility between the zoo and the reserve

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47 Müller-Wille & Rheinberger (2007, p. 19).

48 Adametz (1926, p. 188).

49 Vetulani (1940).

was key for comparative research on heredity, as noted by Antonius in his review of Vetulani's experiment:

It is of great scientific value to record the breeding experiment in all its stages, in order to later compare the pedigrees of the offspring obtained with the pictures of as many ancestors as possible and thus to make a comparison between the original material and the descendants growing up under such completely different conditions.<sup>50</sup>

Although Tref's stay in the Zoo was supposed to be temporary, the outbreak of the Second World War kept the horse in occupied Poznań. In May 1940, Vetulani was still corresponding with the former zoo director, Kazimierz Szczerkowski, about the fate of his precious stallion. Already in exile, Szczerkowski calmed his worried colleague down, assuring him that he had stroked Tref only 2 months earlier and had found the horse in good shape.<sup>51</sup> He promised Vetulani that he would further inquire about the horse's health via trusted sources—although the zoo was under German directorship, the majority of the personnel remained Polish. Szczerkowski reported that, despite the extreme harshness of the winter, Tref's coat did not turn white in 1939. Whether the lack of seasonal change was due to the war or conditions of captivity, the experiment appeared to have been interrupted.

### The Stuff of Legends: Recreating the Teutonic Wild Horse

During the war, Vetulani exchanged quite friendly correspondence with both Lutz and Heinz Heck. This was despite the fact that the war had interrupted the Polish scientist's research, while Lutz Heck was appointed the head of the nature conservation department of the Reich Forestry Office (*Reichsforstamt*) and was responsible for all zoological gardens and nature reserves, including those in occupied Poland. This allowed the German zoologist to pillage the zoos in Warsaw and Kiev and the nature reserves in Białowieża and Askania Nova, taking their most valuable specimens (including wisents and Przewalski's horses). Together with his superior and close friend Hermann Göring, who was the Reich's hunter-in-chief (*Reichsjägermeister*), Lutz Heck managed the Białowieża primeval forest as a timber production site and hunting grounds rather than a national park. In 1942, the Polish *konik* reserve was mostly dismantled, and between January and February at least 30 horses were transported to German zoos. Vetulani suspected that these specimens were used in the Heck brothers' ongoing tarpan back-breeding experiment.

The Heck brothers started working on the regeneration of the European wild horse at roughly the same time as Vetulani. Building on the legacy of their famous father, Ludwig Heck, who as director of the Berlin Zoo had aspired after the First World War to return the institution to its former imperial glory, the brothers

<sup>50</sup> Antonius (1938, p. 103).

<sup>51</sup> Szczerkowski to T. Vetulani [Letter] (1940, May), P.III-47/9/82, PBA/PAN.



**Figure 2:** Stallion “Tref” with winter coat (March 1939). From P.III-47/6/191, PBA/PAN. Reproduced with permission.

continued his project of recreating the authentic German wildlife mentioned in the national epic poem, the *Nibelungenlied*. Apart from this literary inspiration, the Heck brothers also drew from their father's breeding praxis that he had developed at the zoo through his attempts to recreate the ancestor of wild goats by crossing ibex with domestic goats.<sup>52</sup> Interpreting this experiment as a successful “reawakening” of common wild traits by back-breeding, they employed a similar method to resurrect the legendary wild horse:

No animal is completely extinct of which the hereditary material still exists. It can be crossed with other animal species. Even though it suffered modifications by selective breeding [*Rassenbildung*], it lives and is still there, and with the help of today's knowledge of heredity it can be brought to existence again. Crosses can be bred out of each other, and domestication can be reversed by suitable selection. In this way, animals that had vanished for centuries can reappear. Extinct animals can live again! Back-breeding is the only way which allows man to recuperate from his crimes committed against the animal world by ruthless extinction of some species.<sup>53</sup>

<sup>52</sup> With little regard to modern findings on genetics, the brothers even joked that they owed their joint work to their “paternal inheritance.” Heck & Heck (1934, p. 14).

<sup>53</sup> Heck & Heck (1934, p. 12).

For the respective directors of Germany's oldest zoo in Berlin and the world's first geo-zoo in Munich, their institutions were not only central for saving rare species from extinction, but also served as an experimental ground for reversing it. The back-breeding of tarpan shows how these two goals were materially intertwined on the site of the zoo. On the one hand, a herd of Przewalski's horses kept in Berlin Zoo since 1901 was bred to preserve the last wild horse species, and for Heinz Heck, it was "incomprehensible that there are so few zoological gardens that have taken serious care of this animal, which should be more important to us than any zebra."<sup>54</sup> On the other hand, the brothers crossbred these steppe equids with domestic breeds to recreate the Teutonic forest tarpan. For them, crossbreeding wild and domestic animals contradicted neither the zoo's species preservation mission, nor the Nazi ideals of racial purity, because they assumed the eternal nature of the "original" hereditary material was shared within the reproductive history, common traits, and instincts of different breeds; "this is especially noticeable when one has the opportunity to breed both wild and domestic animals in a zoological garden."<sup>55</sup>

Although the Heck brothers distinguished between the steppe and forest forms of the wild horse, they never acknowledged Vetulani's contribution. Just like the Polish scientist, they considered the finer-built forest variety to be the last wild horse remaining in Europe, and the ancestor of "warmblood" breeds and the noble "hotblooded" Arabian horse. However, the most defining characteristics of the forest tarpan the German zoologists strived to recreate were the mouse-gray coat ("the wild color") and short, upright mane, both represented in the Stone Age cave paintings recently discovered across Europe. According to Heinz Heck, this last trait was lost in all domestic horse breeds because breeders over the centuries had preferred long flowing manes.<sup>56</sup> The desire to recreate the zebra-like erect mane determined their choice of breeding material, especially with the inclusion of the Przewalski's horses into the stock, despite their heavy, "cold-blood" constitution that the zoologists wanted to eliminate. From a sequence of hybridizing various breeds, such as the Celtic Exmoor, Icelandic, and Swedish Gotland ponies, the Norwegian Fjord horse, and Polish *konik* with Przewalski's horse, and then mating the offspring once again, a foal was born in the Hellabrunn Zoo on May 22, 1933. The brothers proudly celebrated this date as the return of an all-Germanic wild horse: "the first forest horse is back! An animal has been born, which no one had hoped to see. This is like a fairy tale, only much more exciting."<sup>57</sup>

Heinz Heck continued the back-breeding experiment in the Hellabrunn Zoo, which underwent major renovation before its re-opening in 1928. This restructuring included a breeding facility for wild horses, equipped with an enclosure large enough for them to gallop, and filled with sharp gravel that helped the primitive horses wear

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<sup>54</sup> Heck (1936b, p. 4).

<sup>55</sup> Heck (1934b, p. 4).

<sup>56</sup> Heck (1936a).

<sup>57</sup> Heck & Heck (1934, p. 13).

off their hard hooves.<sup>58</sup> The spacious exhibit was designed to showcase equine herd behavior and encourage the public to appreciate the mouse-gray horses, which in the zoo had to compete for attention with exotic specimens like the zebra. As mentioned before, Heck cultivated his father's romantic nationalism and was interested in reviving the myth of the savage stallion ("*der grimme Schelch*") from the *Nibelungenlied*.<sup>59</sup> He noted that, while it was listed among Siegfried's quarry of wisent, aurochs, and elk, the wild horse was the only species given an epithet indicating its dangerousness.<sup>60</sup> Following this interpretation, Heck counted the wild stallions among the most dangerous inhabitants of the zoo: "they bite, knock down the enemy, and trample him to the ground."<sup>61</sup> The zoologist also emphasized this behavioral quality to explain the forest tarpan's demise in Europe: he speculated that colts chased away from their herd would "steal" domestic mares into their own herds, and due to this wanton behavior they were gradually driven away from human settlements and hunted down. This gendered representation portrayed the wild stallion as a cunning beast able "to collect as large a harem as possible," who "with boldness and perseverance stole every mare within his reach."<sup>62</sup> The characterization of the authentic German forest tarpan as brave and virile was also compatible with neo-Lamarckian theories of degeneration, which fueled Heck's understanding of domestication as a process that corrupts the natural strength and beauty of wild animals. He envisioned that back-breeding had a practical purpose because it could provide horse breeders with a baseline stock, unspoiled by "effeminate degenerative characteristics."<sup>63</sup> The appreciation of masculine traits in horses echoed the Nazi gendered order in which strength and virility were the basis for racial politics.<sup>64</sup>

The Heck brothers saw the modern zoo as a cross between a public education institution and a breeding laboratory, in the service of a wildlife conservation mission that encompassed restoring German natural landscapes along with their unique fauna. Reintroduction was part and parcel of their de-extinction projects. In 1934, the first horses were released to the Schorfheide forest reserve near Berlin. One of the largest sylvan landscapes in Germany, it was gradually rewilded with primeval fauna back-bred in the zoological gardens. Reporting on a tour of the newly established nature reserve, Heinz Heck reflected on the role of zoos in wildlife conservation:

For us zoo-people, this day was more than just a few hours of animal observation in one of the most beautiful places in our German homeland .... Like Noah's ark

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58 According to Heinz Heck, the softness of horse hooves was another sign of domestication resulting from the artificial practice of shoeing working horses. He proudly proclaimed: "My tarpans however have hooves like steel." Heck (1952, p. 341).

59 It should be noted that the Hecks interpreted the word "*Schelch*" as corresponding to the modern German word *Beschäler* or stallion, even though it is unclear what species it actually refers to. For discussion on possible meanings of this word, see Franz (1967).

60 Heck (1934b, p. 6).

61 Heck (1936b, p. 8).

62 Heck (1936b, p. 8).

63 Heck (1936b, p. 12).

64 For more on the horse as a symbol of masculine power in Nazi Germany, see Sax (2000, pp. 92–98).

with its animals on board, zoos have been sailing for a long time through a sea of ignorance and foolish hostility ... For the first time in our history, some animals could disembark from Noah's ark.<sup>65</sup>

Such a triumphant vision of the zoo as a lifeboat that carries endangered species (and even brings back the extinct ones) was a harbinger of the postwar turn towards captive breeding programs. The interwar back-breeding efforts, spearheaded by the first scientifically trained directors, furnished the subsequent transnational turn towards the zoo imagined as Noah's ark. This new zoo was an institution devoted to the science of preventing and undoing extinction.

### Accumulating Genetic Capital

Whereas before the war, Vetulani frequently referred to the Heck brothers' cross-breeding efforts in his writings to show that his project enjoyed international resonance, he later discredited their methods by stating that they "were considered dilettantes in serious prewar German zoological circles."<sup>66</sup> After the war, Vetulani devoted the rest of his life to retrieving the stolen Polish *konik* horses and resuming his experiment. He gathered evidence of the whereabouts of his horses that were scattered between zoos in Königsberg, Berlin/Schorfheide, Augsburg, Hellabrunn, and the Stellingen Tierpark. Importantly, Vetulani's revindication mission not only concerned the stolen specimens, but also their offspring, thus demonstrating that when it comes to breeding, the question of property encompasses the genetic material. Such understanding stems both from the scientific theories on heredity and from livestock husbandry practices, in which pedigree translates into what historian Harriet Ritvo calls "genetic capital."<sup>67</sup> Building on this notion, sociologist of science Carrie Friese argues that "the selective breeding practices developed in agriculture have provided a basis for creating genetic value in zoos."<sup>68</sup> Analyzing contemporary techniques for cloning endangered species, she proposes that "genetic value" is operational in zoos as a strategic form of essentialism because "genetic definitions of species have enabled the zoo to transform itself into an ethical institution that assists rather than hampers conservation efforts."<sup>69</sup>

Vetulani and the Heck brothers strived to extract genetic value from domestic horses by breeding them to resemble their primeval species form more closely. They worked within the same epistemic space of interwar studies on inheritance and animal husbandry, as well as within the physical spaces of zoos, natural history museums, and forest reserves to produce new breeds resembling the tarpan. Through this institutional network as the "shared space of heredity," back-breeding bridged *ex*

65 Heck (1934a, p. 16).

66 Vetulani to the Department for Nature Protection of the Forestry Ministry [Letter] (1946, May), p. 2, P.III-47/4/36, PBA/PAN.

67 Ritvo (1995).

68 Friese (2013, p. 123).

69 Friese (2013, p. 127).

*situ* and *in situ* conservation. Both experiments relied on selective breeding, but they understood the mechanisms of inheritance differently. In his 1938 article, Antonius briefly compared the projects, clearly privileging Vetulani's methods:

For this is not a matter of obtaining phenotypically corresponding animals as quickly as possible—for this purpose, crossing with Przewalski's blood, as it is operated in the Schorfheide and in Hellabrunn, is certainly preferable—but on the contrary, it is a matter of preserving the Biłgoraj *Koniks*, while bringing the genetic material of the old Polish wild horse as far as possible from the foreign admixtures.<sup>70</sup>

While the Heck brothers crossbred several horse breeds they considered primitive, Vetulani focused on one group of ponies selected from a particular geographical area. In other words, the Heck brothers strove to extract value from a wider gene pool, whereas Vetulani thought ancestral traits were best preserved in a small population of farm horses that he believed were directly related to the last representatives of forest tarpans. Each project fixated on different characteristics: the upright mane was more important for the Hecks, while Vetulani was preoccupied with coat whitening. When it comes to behavioral aspects, the German zoologists accentuated the ferality and virility of their horses, while the Polish scientist praised the *konik's* utility. Another important difference was that, in his scientific writings, Vetulani never claimed to have actually recreated the wild horse, but rather promoted the Polish *konik* as a breed “of the same type as tarpan.” For him the Biłgoraj horse was already valuable enough to be preserved. These two approaches to back-breeding indicate a shared interest in conjuring national exceptionalism from native wildlife, on the one hand, and different routes towards constructing equine wildness from available genetic material and historical resources, on the other.

## Conclusion

The two back-breeding projects discussed in this article intersected at many points. Starting with the legal purchase of Polish *konik* horses for the Berlin Zoo in 1927, and followed by the theft of Vetulani's breeding stock from the Białowieża reserve in 1942, there was a material continuity between the experiments. Even though their methods differed and their relationship was not devoid of tension, both Polish and German zoologists enshrined the tropes from archival sources and literature to construct the extinct wild horse as an indigenous species, native to their respective national contexts. Building on the mythologization of the wild horse, they all invested in narratives of wildlife heritage to legitimize and promote their back-breeding programs. In Poland, the context of the zoo contributed to the formation of a “national” horse that combined indigenous wildness with utilitarian primitivity. These experiments were some of the first instances of systematic breeding protocols and

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<sup>70</sup> Antonius (1938, p. 107).

records, such as studbooks, being implemented in a zoo setting to monitor progress. The breeding-back scientists used the zoological garden as an experimental space for undoing extinction, even if they only produced new breeds phenotypically similar to the tarpan. This not only introduced captive breeding, which soon became the main tool for species conservation in zoos, but also paved the way for future rewilding projects that still often use the Polish *konik* and Heck horse breeds as proxies for the extinct tarpan.

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