

Animals as and on Resource Frontiers

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Keywords: settler colonialism, de-faunation, livestock, enclosures

Abstract: This paper attempts to locate changing interspecies relations in the dynamism and violence of capitalist expansion on a world scale, setting out two primary ways that the rising exploitation of non-human animals contributed to the development of settler-colonial economies, destabilization of Indigenous societies, and transformation of ecosystems. One path was set by burgeoning demand essentially turning some wild animal species into increasingly valuable commodities and driving the rising scale and systematization of extraction and trade, which tended to quickly undermine conditions of abundance and make these animal frontiers very mobile. The second path started from the introduction of domesticated animals, with the muscle power and bodily commodities derived from proliferating populations valued not only in the expansion of agricultural landscapes but also in the formation and functioning of other resource frontiers, and ultimately bound up in waves of enclosures and expulsions. This framework seeks to simultaneously pose challenges for historical analysis and provide insights that help to understand the trajectory of animal life today.



Mexico City - Palacio Nacional. Mural (1929 - 1945) by Diego Rivera: *Exploitation of Mexico by Spanish Conquistadors*. [WikiMedia Commons](#).

The conquest of new resource frontiers has been an important part of the expansion of capitalism since the 15th century, with cheap nature repeatedly fuelling widening circuits of accumulation and productivity gains. At the heart of this cheapness is a denial of the intrinsic value of other species and self-organizing ecosystems, paired with a denigration of other human modes of living in relation to them (Moore 2015). This paper suggests that radical changes in interspecies relations should be understood as a central feature of this dynamism and violence, and identifies two primary ways that the rising exploitation of non-human animals has featured in settler-colonial expansion, Indigenous expulsions, and sweeping ecological change, with reference to some important historical examples.

The first involves the sudden transformation of some wild animal species into valuable commodities, leading to a rising scale and systematization of killing, processing, and trading animal body parts. Because these resource frontiers hinge on a fundamental biological contradiction – requiring abundant populations of wild animals while incentivizing rates of harvest above natural rates of reproduction – they have tended to be extremely mobile. The second involves introductions and rising populations of domesticated animals, which at once became major sources of value in themselves as well as being crucial to the extraction of other resources. This obviously starts from the production of food and other bodily products, and also includes the use of animals to demonstrate private property rights over land (i.e., as a mechanism of enclosure), the role of coerced muscle power in extending agriculture and extracting other commodities, and the effective subsidy to further development afforded by the unplanned spread of feral animals beyond settler-colonial frontiers.

The paper concludes with some brief reflections on how this framework for approaching animals as and on resource frontiers relates to the fast-changing present context, in which populations of wild animals are crashing almost everywhere while soaring populations of livestock animals command immense areas of land.

Wild Animals as Resource Frontiers

Improving techniques and growing prowess in hunting, trapping, and fishing were fundamental to the radiation of the human species around the world, along with land bridges created in the last Ice Age. The movement of Paleolithic humans into new landscapes coincided with the extinction of some large herbivore and predator species in a range of settings, from Australasia to the Americas, though it is impossible to entirely distinguish hunting pressures from climatic stress in Pleistocene mega-fauna extinctions (Browswimmer 2002; Flannery 2001). However, beyond these extinctions and the associated destabilization of food webs, animal species had to become sufficiently wary of human predation to survive. While subsequent human hunting and trapping might have caused extirpations (especially of large herbivores and top predators) or periodic declines in some populations, it did not cause animal extinctions (apart from some islands), even as the rise and spread of agriculture and herding slowly but surely reduced habitats over the past 10,000 years. It was not until the rise of colonialism and capitalism that hunting and trapping pressures again began driving new waves of extinctions, as well as greatly expanding the scale at which animals were extirpated from ecosystems (Dawson 2016; Richards 2014; Browswimmer 2002).

Capitalism established a new motive force for hunting, trapping, and fishing, such that bodily materials from certain species of wild animals began to be conceived not only in terms of meeting basic needs but also increasingly as sources of value that could be exchanged for other things. As indicated, a basic condition for these frontiers is abundant populations of certain species, which typically depends upon relatively self-organizing ecosystems (or only modest levels of human intervention) and implies that animals maintain autonomous lives up to the point they are killed. However, when various body parts become valued commodities it incentivizes increasing killing beyond natural rates of reproduction, and without regard for how the depopulation or extirpation of certain species can affect the health of ecosystems. As this frontier is essentially a

free gift of nature to begin with, the simple response is to rip into other such gifts; that is, to move into new spaces where desired populations are still abundant, or turn to other species. Although this cycle of plunder and movement might leave behind less evident ecological destruction than other resource frontiers (i.e., without tearing down forests, tearing up natural grasslands, or filling in wetlands), big population declines or the complete elimination of some animals can fundamentally alter the nature of food webs, with cascading effects on how ecosystem function (Dirzo et al. 2014)¹. Part of this dynamic is powerfully conveyed by the notion of increasingly ‘empty forests’ (Redford 1992).

Two important examples help to illustrate this sort of commodity frontier. The first case arose from the value that European elites placed on the pelts of particular fur-bearing animals, which were used in items like hats and coats that not only helped some people cope with cold winters but came to play a part in displays of class status. After Europeans ravaged local populations of fur-bearing animals, Russia became Europe’s first great fur frontier, as well as exporting to temperate parts of Asia where furs were also in demand. By the early 16th century, a network of harvesting and trading routes was already well established far to the north of Moscow, with pelts extracted from a range of small and large mammals, and export earnings from furs came to be dominated by the monarchy and provided a crucial source of revenue for the early modern state. Thus, as populations of key species were decimated, there were powerful interests determined to keep pushing Russia’s fur frontier eastward and northward across Siberia, contributing to successive territorial acquisitions and the colonization of Indigenous peoples. By the

mid-18th century, Russian explorers and fur traders had moved eastward into North America, with bountiful continental and maritime furs (especially sea otters) the key motive for the establishment of Russian settlements in Alaska at the end of the 18th century (Richards 2014; Gibson 1980; Fisher 1943).

The wealth and ultimate declines of Russian fur frontiers led early European explorers in North America to quickly recognize that abundant assemblages of furbearing animals there could generate great riches. The fur frontier in North America was characterized by the familiar cycle of decimation followed by further incursions in pursuit of healthy populations, with the establishment of fur trading posts marking the geography of colonial expansion westward and northward. Furs provided a major source of export revenue for British and French colonial governments and stoked the rivalry between them, as well as exacerbating or generating new tensions between some Indigenous nations². Well into the 19th century, the mercantile Hudson’s Bay Company largely governed Euro-settler exploration and economic activity across a vast area of modern-day Canada once named Rupert’s Land, and the centrality of beaver was reflected in the fact that its fur (or what was referred to as ‘made’ or ‘prepared’ beaver) acted as a barometer of exchange for other furbearing animals, and a sort of currency could be traded for commodities such as cloth, alcohol, hatchets, and guns (Innis 1999)³.

The fur trade also had a vanguard role destabilizing Indigenous cultures. While subsistence hunting, trapping, and fishing continued amidst European incursions, these activities increasingly unfolded alongside

¹ Trophic cascades are most often discussed with respect to top predators and large herbivores, though some smaller animals can also have unique and important functional roles.

² The most famous instance of this was the so-called Beaver Wars of the 17th century in the St. Lawrence Valley and Great Lakes region, which were driven by British and French competition but reverberated in conflict and warfare between Iroquois and Algonquian nations.

³ Beavers have a remarkable capacity to reshape microenvironments to a degree that they collectively affect the configuration of whole watersheds where populations are healthy. The decimation of beavers on a continental scale is a dramatic illustration of how the removal of some animal species (and not only top predators or large herbivores) can profoundly alter the dynamics of ecosystems.



Kent Monkman. (2011). *Les Castors Du Roi*. Acrylic on Canvas. Photo source: [WikiArt](#).

attempts to kill, prepare, and sell as many furbearing animals as possible, as quickly as possible. The ensuing exchanges deeply eroded self-sufficiency over time, as Indigenous peoples became more dependent on buying and selling and as more goods moved from perceived luxuries to necessities, which both amplified extractive pressures and entrapped many in relations of debt (Richards 2014; Innis 1999). This not only involved profound material changes to ways of life, but also deep perceptual changes about animals and interspecies relations, with acts of killing severed from cultural mores that had long venerated restraint and sufficiency.

Whales are another very significant example of a group of species becoming suddenly prized as a resource frontier and subjected to increasingly systematic extraction. While

smaller-bodied whale species were hunted in nearshore environments over millennia, this was only possible at an extremely small scale relative to populations and ranges and could not affect abundance. Ships dedicated to whaling in the North Atlantic Ocean began to emerge in the 17th century, but commercial whaling did not truly erupt until the Industrial Revolution. Industrialization created booming demand for a variety of bodily products, most of all whale oil (derived from blubber) as a lubricant in factories. In the first half of the 19th century, the eastern seaboard of the US was the heart of the global whaling frontier and the scale of US whaling industry increased roughly tenfold (Richards 2014; Thompson 2012).

Although the US whaling boom burst in the second half of the 19th century, outmoded



Whale oils casks, New Bedford, Massachusetts, late 1800s. Photo source: [New Bedford Whaling Museum](#).

by discoveries of oil that represented a cheaper, more abundant, and easily substitutable resource, global whaling frontiers continued expanding on a world scale into the 20th century, enabled by bigger, stronger, and faster oil-powered ships. The rising scale of extraction was such that by the 1940s, scientific experts were issuing dire warnings that most large whale species would be driven to extinction within just a few decades if actions were not taken, a prospect that led to the establishment of the International Whaling Commission (IWC) in 1946. However, it was not until the 1960s and 1970s that the IWC started to impose stronger limits, followed by a complete global moratorium on commercial whaling in 1986⁴, which has helped reverse the population decline of a few greatly imperilled species. Still, many of the largest species continue to survive on a knife's edge, with populations just a tiny percentage of their extent two centuries ago. The magnitude of whale population and biomass declines is such that it has been shown to have affected the dynamics of carbon sequestration in the oceans (Pershing et al. 2010).

Both fur and whaling frontiers have played out over massive areas, contributed to great economic changes, and drastically altered the populations and geographic distributions of a range of species in the space of just a few centuries. But wild animals can also constitute resource frontiers at much smaller scales, and affect more localized social, economic, and ecological changes, and there are many cases that warrant further study, both historically (e.g. the dynamics and impacts of the harvest and trade for things like elephant ivory, tortoise shells, and maritime furs in various settings under European colonial rule) and as part of contemporary conservation challenges, as discussed in the conclusion.

Domesticated Animals as and on Resource Frontiers

The long course of domestication was highly uneven, with Eurasia possessing most of the species of large mammals that were good candidates to be tamed and herded, whereas the Americas contained far fewer possibilities

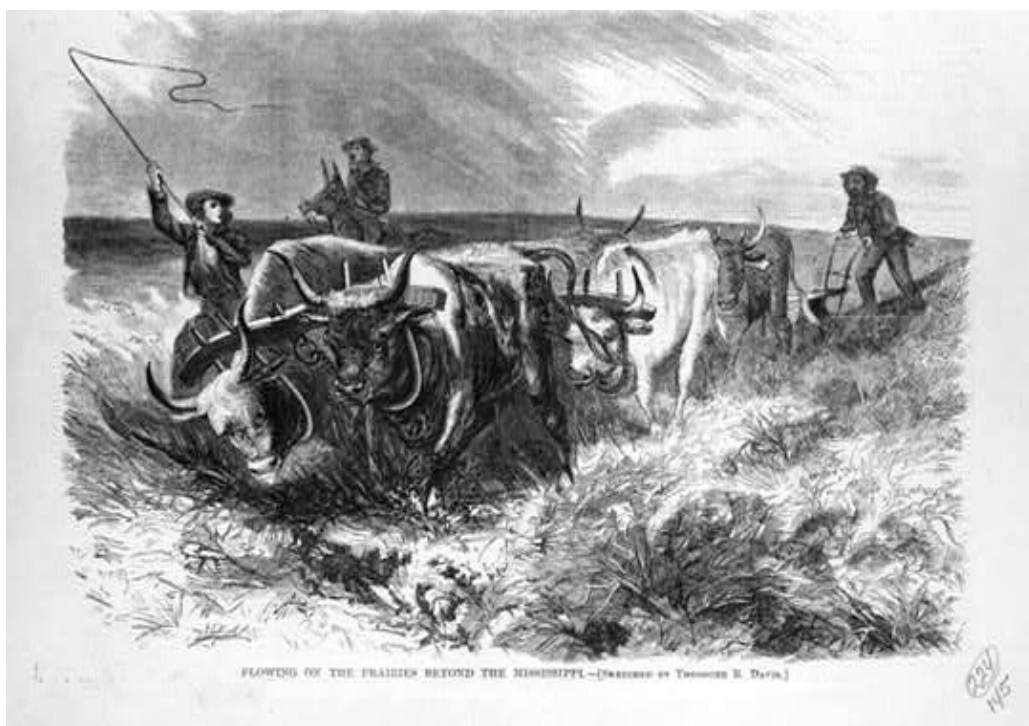
⁴ Other mechanisms allowed some whaling to subsequently continue at reduced levels, most notably by Japan, which for decades used scientific permits to sanction some hunting (before withdrawing from the IWC in 2019), and Norway and Iceland, which issue some whaling permits on the grounds of tradition and culture.

and Australasia almost none (Fagan 2017; Diamond 2002)⁵. As well as providing readily accessible stores of protein-dense foods, domestication also established important sources of muscle power on farms and to transport goods over space, with cattle, horses, donkeys, water buffalo, and camels the most important ‘beasts of burden’ for human civilizations. The growth of domesticated animal populations played a crucial part in the slow expansion of agricultural frontiers in Eurasia and Africa over long periods of time (Fagan 2017), both in the heavy work of tilling land and carrying materials, and in the increasing organization of land for crops and pasture – although some migratory herding unfolded across natural grasslands and livestock were often fed in ways (e.g. crop stubble, fallowed lands, household food wastes, and surrounding ecosystems) that did not significantly augment the land under cultivation.

Domesticated animals played significant parts in Europe’s colonial wars, military rule, and resource extraction in various parts of Africa and Asia (Hevia 2018), but the impacts of

introduced animals were most dramatic in the regions where the course of domestication had been radically different: the Americas and Australasia. At the point of European conquest, llamas and alpacas were the only domesticated mammals in the Americas that provided any muscle power, and they were relatively limited in geographic extent and paled in strength in comparison to the livestock species of Eurasia and Africa. Australasia had no large domesticated mammals at all. The rapid introduction of domesticated animals was a pivotal aspect of European colonialization in both the Americas and Australasia, including cattle, pigs, horses, donkeys, sheep, goats, and chickens, dogs, and cats⁶, greatly enhancing the ability of settler-colonists to sustain themselves in new bioregions and the speed with which they were able to transform ecosystems (Flannery 2001; 1995; Crosby 1986; 1972).

The east coast of Brazil and the islands of the Caribbean were early resource frontiers in the Americas that introduced domesticated animals helped to operationalize, through



Theodore R. Davis. (1868). *Plowing on the Prairies Beyond the Mississippi*. Photo source: [USA Library of Congress](#).

⁵ In essence, these were large herbivores that live in herds and are not too skittish or picky about what they eat.

⁶ In Australia, the introduction of rabbits and foxes was also very ecologically transformative.

both the provision of food and muscle power. In the Caribbean, introduced animals spread like wildfire from the arrival of Columbus onwards, without any large native predators to contain them, and with the Tainos and Carib populations decimated by the introduction of new infectious diseases and the violence of conquest (Crosby 1986; 1972). While the Spanish quickly turned their attention towards the mineral riches of central Mexico and the Andes, the populations of introduced animals – both managed and those that went feral and had to be hunted – helped make Caribbean islands significant refueling stations for transatlantic shipping to Spain, as well as providing sources of leather and tallow for the mining economy as it emerged. After sugar and slavery came to define the colonial economies in both eastern Brazil and the islands of the Caribbean, the muscle power of animals was still needed for tasks like pulling plows, dragging felled trees, and carting materials, and horses and dogs were used to help track and capture escaped slaves⁷.

Europeans immediately introduced domesticated animals wherever they established colonies in North, Central, and South America⁸, and the growth of livestock populations became important sources of value through flesh, milk, hides, and other bodily products, which helped spur speeding expulsions and enclosures – a dynamic that was again greatly accelerated by a series of epidemic diseases that ravaged Indigenous populations (Crosby 1986; 1972). The labour-intensive agricultural systems that had previously prevailed in the most densely populated regions of Mexico, Central America, and South America were swiftly transformed under Spanish colonial rule, with surviving Indigenous populations pushed to more marginal lands and much of the best fertile land devoted to haciendas comprised of extensive livestock ranching and grain monocultures (Wolf 1982).

As Crosby (1972:109) put it, the expansion of “livestock provided not only much of the muscle with which exploitation of America

was undertaken, but was in itself an important end-product of that exploitation, and a factor spurring Europeans to expand the areas being exploited,” with cattle repeatedly at the forefront of advancing colonial frontiers. Livestock simultaneously provided an invaluable source of power in extensive agricultural systems, helped settler-colonists assert property rights over land, and generated commodities with relatively little human labour in contexts where labour was often scarce. In the Spanish and Portuguese colonial realms, the values of both muscle power and bodily products were deeply entwined with the extraction of the mineral riches of central Mexico, the Andes, and Minas Gerais. While mining enterprises hinged on the compulsion of Indigenous labour and enslaved Africans in the first instance (Wolf 1982), they were also inconceivable without the strength and endurance of horses, donkeys, and mules hauling heavy materials over long distances and often rugged terrain. The commodities produced in extensive ranching and grain farming were not directly exported to Europe, but helped enable the mining economy and other sorts of resource extraction, foremost through food but also with other essential materials, such as leather bags and tallow lamps.

Unlike the Caribbean, introduced domesticated animals faced large predators in North, Central, and South America, but many nevertheless had similar success in going feral, especially cattle and pigs, with progeny capable of moving beyond European-controlled landscapes. Nowhere was this more dramatic than with the large populations of feral cattle that came to thrive on some South America’s great grasslands. Pigs also proved extremely hardy and adaptable, aided by their ability to eat almost anything, which contributed to their ecological destructiveness, from damage to tree seedlings to preying on a variety of animals not adapted to their presence (Crosby 1986; 1972). Sheep are clearly less equipped to cope with large predators, but high rates of reproduction still allowed them to become

⁷ The terror associated with hunting dogs also comprised an important part of the disciplinary apparatus.

⁸ Horses and fighting dogs were also part of the military superiority of the Spanish conquistadores, and their incredibly fast conquests of the powerful Aztec and Incan Empires.

major agents of ecological change in some regions, most dramatically in large areas of modern-day Mexico (Melville 1994).

Although feral livestock had agency of their own in moving into new landscapes, this still served to subsidize settler-colonial interests, as it established a sort of hybrid frontier where abundant populations were hunted for food and other resources while food webs were destabilized, initiating a process of biological simplification that made ensuing conversions of land easier. The Pampas region is a prime example, as wild cattle were hunted on horseback for a significant period of time, reaching into the foothills of Patagonia, before natural grasslands were more systematically reorganized for agriculture (especially wheat) and cattle ranching (including the introduction of plants like clover and alfalfa for grazing), transformations that enabled Argentina to become one of the first major exporters of wheat and beef in the late 19th century. The expansion of cattle also helped propel enclosures and conversions of land in other parts of South America, such as the Cerrado, Chaco, Pantanal, and Llanos regions, both under Spanish and Portuguese colonial rule and beyond independence (Crosby 1986; 1972; Prado 1967).

In the modern-day US and Canada, introduced livestock mostly advanced with the westward march of settler-colonial enclosures, with cattle and pigs the most important species in the mixed crop and livestock model of family farming that emerged. Cattle were prized in mixed farms for their flesh, milk, manure, and muscle power, and pigs were prized for their reproductive speed and the relative ease with which they could be tended and fed, scavenging close to farms and households and consuming otherwise unusable farm wastes and household scraps (although, as elsewhere, some pigs succeeded in going feral from early on⁹). In addition to oxen, the muscle power of horses, donkeys, and mules played immeasurable parts in: the conversion of forests to fields; the production and movement of outputs from family farms

(which were characterized by chronic labour shortages and a high degree of market-orientation); and the functioning of the forestry frontiers from the eastern seaboard to the Great Lakes, dragging massive logs over snow and ice in the winter to water bodies where they could be floated in the spring.

In the early 19th century, settler-colonists still had only a limited agricultural footprint on the Great Plains and Prairies of the US and Canada, and the commercial harvest of wild animals was still a primary form of resource extraction. However, in the second half of the 19th century, especially after the US Civil War, there was a tidal wave of enclosures, expulsions of Indigenous peoples, and destruction of ecosystems, with the radical reconfiguration of animal life a fundamental part of the violence that swept over the grasslands (Wishart 2016; Daschuk 2013; Isenberg 2000). A key aspect of this was the onslaught of bison hunting, one of the greatest flurries of wild mammalian slaughter in world history, as the bison population that numbered in the tens of millions in 1800 was driven to the brink of extinction by 1900. This bears some resemblance to the transfiguration of certain species into resource frontiers, as new markets emerged for bison hides (as belts in eastern factories) and ground up bones (as fertilizers on eastern farms), but market signals were also augmented by direct government payments as part of a pacification strategy in the late 19th century. The basic goal of these subsidies was to obliterate the ways of life and cultures that revolved around the bison, starving remaining Indigenous resisters into submission and forcing them onto small land allotments. Thus, while the race to slaughter bison was partly driven by their value as commodities, there was also a de facto military expense at play, one tragic reflection being that countless carcasses were simply left to rot (Wishart 2016; Isenberg 2000).

Along with this mass slaughter, the proliferation of introduced livestock was integral to the breakneck pace that land – held as a commons over millennia by Indigenous

⁹ Later introductions of wild European boars for hunting augmented the feral turn of some domesticated pigs, and the descendants of both continue to be a highly destructive invasive species across large areas of the US to the present day (Snow et al. 2016).



Photograph 1892 of a pile of American bison skulls waiting to be ground for fertilizer. Burton Historical Collection, Detroit Public Library. Photo source: [Wikimedia Commons](#).

societies – was summarily enclosed for settler-colonists, from Texas to Saskatchewan. Because these grasslands were composed of dense assemblages of plants with deep and hardy root systems, that had evolved to cope with considerable variability in rainfall, it took the innovation of the steel plow paired with the muscle power of draft animals to tear up thick roots and unlock the bounty of this rich soil frontier, enabling farmers to plant crops like wheat and corn and ranchers to introduce new grasses for grazing animals. As production boomed, pigs began to be conceived as a new way for farmers to store and add value to corn and other coarse grains, with the abundance of both corn and pigs in the Ohio River basin having already given rise to the industrialization of animal slaughter in Cincinnati (Cronon 1991). By the late 19th century, core dynamics of the industrial grain-oilseed-livestock complex had been established, with rising populations of animals reared in greater densities, commanding increasing shares of arable land (with animals serving to profitably absorb chronic grain surpluses), and oriented towards large slaughter and processing facilities – a

model that has subsequently spread across large areas of the world's best agricultural land (Weis 2013; Cronon 1991).

Although there are no rich soil frontiers left to be discovered, livestock continues to be a major part of the ongoing colonization of some low-quality agricultural frontiers, most destructively in the Brazilian Amazon, where marginal cattle pasture – marked by low stocking densities and high rates of erosion – now covers much of the deforested land in the region. This enormous region was largely unexploited until the 1960s, when the Brazilian state began to aggressively subsidize deforestation, fired by a combination of political (i.e., as a means to asserting sovereignty) and economic motives (i.e., speculating on energy and mineral resource potential). Large landholders reaped windfalls of direct payments and tax concessions when they could demonstrate control over land, with cattle ranching the cheapest means to accomplish this. In other words, the advance of ranching frontiers across the Brazilian Amazon has been much more complex than simply the direct earnings (Hecht and

Cockburn 2010), although rising beef production is increasingly lucrative in itself, influenced by cheap land and Brazil's powerful meat-processing sector (Philips et al. 2019). In addition to rising beef production and exports, livestock are also entwined with the soybean boom in Amazonia, as it is by far the dominant crop cultivated in the region and primarily used as animal feed, both domestically and through exports (Song et al. 2021; Oliveira and Schneider 2016).

Beyond the tropics, the only other possibility for developing new agricultural frontiers lies in boreal regions, as climate change could soon establish warm enough average temperatures and sufficiently lengthen growing seasons to allow for cultivation, provided soils could be duly enhanced (Hannah et al. 2020). While one can only speculate on the roles that ranches, mixed farms, and industrial operations could play in this development, it would surely bring disastrous outcomes for wild animals, many of which (especially large carnivores and herbivores) are already reeling from habitat loss to other resource development.

Some concluding thoughts

The context of non-human animal life is drastically different today than it was when mass harvests of wild animals comprised important resource frontiers or when domesticated animals played vital roles establishing, extending, and operationalizing resource frontiers, in ways that involved food values but also extended far beyond them. The reduction and fragmentation of natural habitats combined with climate change are at the center of the process of de-faunation, a term that describes the widespread impoverishment of animal life, which is not only reflected in worsening extinction risks but also steep population declines across a wide range of not-yet threatened species (ZSL/WWF 2020; Ceballos et al. 2017; Dirzo et al. 2014). De-faunation can also be seen in the fact that wild mammals and birds comprise a small and declining share of the total biomass of all animals on earth (Bar-On et al. 2018; Smil 2013).

As habitats and wild animal populations wither, there are obviously far fewer regions

where significant wealth can be made from extracting large numbers of cheap bodies. With respect to fur-bearing animals, the declining abundance of populations in the wild has been met with increasing intensification, as the vast majority of the annual global volume of fur produced now comes from 'fur farms', which are marked by extraordinary densities, sensory and behavioural deprivation, and suffering (Harris and Pickett 2015). The value of wild animals as resource frontiers now increasingly derives from conditions associated with de-faunation; that is, rarity, the difficulty of extraction, transshipment, and sales (including the clandestine nature of black markets), and high unit prices, from tiger pelts to elephant tusks, shark fins to tortoise shells. Rarity and high prices per individual mean that the frontiers for extracting animals are increasingly pressing within parks and protected areas, and urgent efforts to stop these micro-frontiers are vital to the near-term survival of a number of charismatic mega-fauna, including increasingly militarized conservation efforts (Duffy 2014). Growing demand for exotic pets in recent decades has also created some new micro-frontiers for extracting and trading live animals that rest upon high prices (at least at the point of final sale) for individuals (Collard 2020).

In addition to the ecological and ethical implications, the extraction and trade in exotic animals increases the risks of zoonotic disease transfer and evolution, as it presents new conditions for infectious bacteria, viruses, and other germs to move between long-term reservoirs (i.e., the animal species where they chronically reside) and new hosts, with opportunities for contact that were previously impossible or far more improbable. The great danger with these opportunities is that occasionally new strains of established diseases can emerge with more virulence and/or transmissibility, and eventually spillover into human populations – risks that should be abundantly clear amid the Covid-19 pandemic, whatever its ultimate origins are determined to be. Zoonotic disease risks are also being magnified by the ongoing expansion of agricultural, forestry, and mining frontiers into tropical forests, which increases the proximity of wild animal disease reservoirs to both domesticated animals and humans, and decreases the possibilities that

more virulent emergent strains will simply ‘burn out’ in the forest before they could spillover into a human host (Wallace 2020; Davis 2020; WWF/ZSL 2020).

The flipside of de-faunation is fast-rising populations of a small number of livestock species, a growing share of which are reared in great densities and brought from birth to slaughter with great speed. Livestock command close to one third of all habitable land through pasture and feed crops and are responsible for the lion’s share of the total greenhouse gas emissions associated with agriculture and food (IPCC 2019; Weis 2018; 2013; Machovina et al. 2015). The enormity of this presence can also be sensed in terms of weight with a converse dynamic to that of de-faunation, as livestock now comprise the majority of all mammalian and bird biomass on earth (Bar-On et al. 2018; Smil 2013), and systems of industrial production also bear heavily on future risks of zoonotic disease evolution (Wallace 2020; 2016; Davis 2020).

It is impossible to overstate the urgency of stopping the ongoing advance of all agricultural frontiers in the tropics and resisting future conversions of boreal regions for pasture or crops, both for the future of wild animals and for any prospects of climate change mitigation, given the magnitude of carbon stored in forests, soils and wetlands, and the reduction of sequestration capacity that the conversion entails. But ultimately biodiversity conservation and climate change mitigation require much more than this, and must also involve the ecological restoration of large amounts of land presently devoted to pasture and crops – which demands drastic reductions in global livestock populations and levels of animal consumption (WWF/ZSL 2020; IPCC 2019; Weis 2018; 2013; Machovina et al. 2015).

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*All photos provided by the author.

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Cite this article:

Weis, T. (2021). "Animals as and on Resource Frontiers" *Commodity Frontiers* 3: 1-13. doi: 10.18174/cf.2021a18154.

Commodity Frontiers is an open-access journal edited by the CFI Editorial Board, Mindi Schneider, senior editor. Read it online at [Commodity Frontiers](https://commodityfrontiers.com), or our website, commodityfrontiers.com.

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