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# Soy, Domestication, and Colonialism

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## Abstract

Soy is one of the world's most important crops by area, volume, and value. It is especially distinctive for serving as key nexus between food, livestock feed, fuel, and myriad industrial products. Its rapidly multiplying uses provide a powerful touchstone for analysis of how resources are not only created, but also constantly recreated and redesigned. In turn, these transformations reflect the shifting political ecological foundations that undergird resource creation – above all the territorial expansion of an extractive mode of production intimately associated with colonialism – and illustrate how resource-making processes generate new socio-ecological relations in their own image. This chapter begins with the historical interdependence of agriculture and colonialism, framing the domestication of plants as the archetype of resource-making. It then traces the cultivation of soybeans from its domestication and dispersal throughout present-day China through Han colonial expansion; through its early industrialization at the hands of Japanese colonizers of Korea and "Manchuria," followed by US industrialists; to its key role in the contemporary colonization of South American hinterlands and its projected neo-colonial expansion across Africa and Asia. Finally, I critique the neo-natures created by transnational soy agribusiness through biotechnology, and the neo-colonial expansion of "Western" diets worldwide.

## Soy as resource, and domestication as resource-making

Over the past century, soy became one of the world's most important crops. It now covers an area equal to France, Spain, Portugal, and Ireland combined (~1.3 million km$^2$), yielding over 350 million tons each year, for a total value of about 130 billion US dollars (according to average international prices).[1] Its significance for international markets is illustrated by its key role in the US-China trade war, but its strategic importance roots down into the soil where this leguminous plant doubles as "green fertilizer" that replaces nitrogen taken up by maize, cotton, and other crops with which it is usually rotated. Above all, soy has become the key nexus between human food production and livestock feed, as well as biodiesel and myriad industrial products (Oliveira and Hecht 2016; Oliveira and Schneider 2016). The rapidly multiplying uses of soy provide an excellent touchstone for analysis of how resources are not only created, but also constantly recreated and redesigned. In turn, these transformations reflect the shifting political ecological foundations that undergird resource creation – above all the territorial expansion of an extractive mode of production intimately associated with colonialism – and illustrate how processes of resource-making generate new socio-ecological relations of their own.

My theoretical framework draws upon political ecology and critical agrarian studies, as I frame the *domestication* of plants and animals as the quintessential process of resource-making. While geographers and other social scientists (re)turn to the examination of resources and materiality, Richardson and Weszkalnys (2014) remark that little attention has been given to insights from political ecology and critical agrarian studies, likely because many believe the bulk of this literature "applies to resources – rather than derives from them – theoretical approaches" (Bakker and Bridge 2006, 7). Yet critical agrarian studies and political ecology have contributed significant theoretical advancements that can inform research on resources and materiality, including approaches that transcend facile distinctions between production and consumption (Anderson 1997; Freidberg 2004; Mandelblatt 2012) and native/invasive species, orienting multi-species ethnography (Rocheleau, Thomas-Slayter, and Wangari 1997; Robbins 2007; Ogden, Hall, and Tanita 2013). I build upon this literature to frame *domestication* as key for understanding resource-making. I define it as the material *dialectic of co-evolution* between social organizations and ecological relations, extending this dialectic from a perceived "moment" of domestication through a continuum of socio-ecological interventions – otherwise identified as agriculture and livestock husbandry, industrialization, etc. – through a historical analysis of the processes that make-and-remake "resources," their "users," and the world in which they co-exist.

Adopting domestication as theoretical framework for critical resource geography must not be confused with an uncritical assumption of shallow binaries between humans/nature or domination/subjection, as though describing a process in which humans gain control over an external environment, and overlooking the parallel autonomy and agency of the non-human (Ogden, Hall, and Tanita 2013; Richardson and Weszkalnys 2014). Rather, my analysis makes more explicit how geographers are contributing to the vibrant field of transdisciplinary studies about domestication, which already resists any dualism "intrinsic" to the topic. After all, while there is no consensus on the definition of domestication, and there is lively debate about why/when/where/how it occurs (and does not occur), there is unanimous agreement that it is *not* simply a practice undertaken "by humans on nature," as attested by well-known cases of leaf-cutting ants and the fungi they cultivate, and "dairying" ants and their associated aphids (Stadler and Dixon 2005). Moreover, as domestication results from a co-evolutionary process of mutation-induced behavioral, physiological, and morphological changes in both species, it is a fundamentally dialectical process that requires recognition of agency and adaptation on behalf of all beings who become engaged in this increasingly mutualistic relationship (Larson et al. 2014). Domestication involving humans may occur faster than mutation-induced transformations among other species, but contemporary humans also display co-evolutionary traits dialectically related to their non-human domesticates, such as the continued production of lactase into adulthood among humans who co-evolved with dairying livestock, and the absence of this phenomenon in other groups. As it rests fundamentally on the generative capacity of the non-human to participate in the co-production of biophysical and socio-economic processes, domestication as the dialectic of co-evolution can revitalize frameworks of the "production of nature" in ways that surpass their supposed "diminishing returns" (*pace* Bakker and Bridge 2006).

This is most blatantly evident when the domestication of plants and animals develops further into agriculture and livestock husbandry. This ongoing process of domestication undergirds the transformation of both humans and our planet into a dialectical whole, characterized on the one hand by a novel ecosystem and historical era usually called (albeit undialectically) the Anthropocene (Smith and Zeder 2013), and on the other by the origins of private property, class society, the state, and colonialism (Scott 2017). The fact that agriculture is intrinsically associated with colonialism is worth highlighting. Once agricultural cultivation of floodplains and state conscription of non-settled peoples increased populations of early sedentary societies beyond their capacity for self-sufficiency, humans began to clear hillsides and other marginal land for agricultural production. Overtime, pests co-evolved with crops, soil fertility became depleted, and deforestation for incorporating new areas into agricultural production accelerated soil erosion and the sedimentation of rivers, causing crop failures, increasingly catastrophic flooding, and a further drive of agricultural societies to expand their territory. This cycle repeats itself world-historically, as the co-evolutionary process of domestication becomes the dialectic of making-and-depleting agricultural soils, creating-and-destroying resources for food, fiber, and shelter, and conquering territory through colonialism (Moore 2017; Scott 2017).

In this chapter, I trace the historical geography of soy from its origins in Chinese tributary colonialism, through Japanese imperialism, to contemporary US-led neo-colonial globalization and the expansion of "Western" diets worldwide. I identify each moment's key driving processes – domestication, industrialization, flexing, and genetic modification – and the most prominent resources created, including vegetable protein, nitrogen fertilizer, edible oil, livestock feed, biofuel and myriad industrial inputs, and a veritable agro-industrial neo-nature in its own right.

## Domestication, Chinese tributary colonialism, and vegetable protein

Wild precursors of soybeans began to be used in present-day northeast China at least 9,000 years ago, and were domesticated between 6,000 and 3,500 years ago (Hu 1963; Hymowitz 1970; Ho 1975). This region was inhabited by groups of nomadic proto-Tungusic tribes, who transformed a scrambling leguminous plant with small black seeds encased in easily-shattered pods (which facilitated long-distance seed dispersal) into an essential resource for humans, namely a source of edible protein that could be first gathered from wetlands and then cultivated on the mountainous areas in which they lived. The transformation of a wild legume into an important supplementary source of food took place through a dialectical process of co-evolution over millennia, just like all processes of domestication. At first, the small black seeds were gathered by nomadic tribes from the fragile pods of soy's wild ancestor, and then competing plants were removed from their surroundings (becoming "weeds" in the dialectical process of resource-making) as these sites became frequented more often by increasingly semi-nomadic descendants of the tribes that first identified uses for soy's precursor. Gradually, plants with larger seeds were selected for replanting, encased in stronger pods that prevented dispersion by wind and rain, progressively developing the originators of modern varieties of soybeans. In turn, this process of resource-making enabled the gradual transformation of semi-nomadic tribes into increasingly more settled communities of part-time farmers (Hu 1963; Hymowitz 1970; Ho 1975).

Meanwhile, the ancestors of the Han people who compose the majority of modern-day Chinese had already advanced much further the cultivation of millet and sorghum, and established the earliest East Asian networks of city-states and dynastic kingdoms on the Yellow River valley and loess plateau of northern China.[2] Written evidence of domesticated soybeans only appears during the early Zhou dynasty (c. 3,000 years ago), and etymological and historical studies indicate early varieties of soy were still identified as a rambling crop sticking close to the ground, but valued as well for the nitrogen-fixing nodules in its root. Zhou elites first came into contact with (early varieties of) soybeans from tributes provided to them by the Tungusic tribes to their northeast. They never subjected those tribes to their direct rule or conquered their territory, but integrated soy into their own agricultural production systems because it provided not only a high-protein vegetable food source, but did so in a way that also addressed the crisis of soil fertility that contributed to the collapse of China's first dynasty (Shang) during the previous century. After all, millet and sorghum cultivation were already driving the exhaustion of the loess plateau soils upon which the Neolithic ancestors of the Shang originally domesticated them. The introduction of soybeans into millet/sorghum rotation systems enabled the nitrogen-fixing bacteria that co-exist symbiotically in the nodules of soy roots to provide increasing food yields while postponing further depletion of soil fertility (Hu 1963; Ho 1975).

This was a unique moment in the historical geography and political ecology of soybeans. The crop did not expand through settler colonialism, simplifying the agro-ecosystems into which it was integrated for the purpose of advancing the territory of its producers and their extractivist mode of production. In fact, the co-evolution of soybeans with the Tungusic tribes assured their relatively independence in face of Zhou rulers, who were satisfied with receiving this newly created resource as tribute. Meanwhile Zhou elites began to mandate the integration of soybeans among their Han ethnic subjects. As a result, soybean domestication advanced at relatively fast pace, spreading to the entire territory controlled by the Zhou (north and central China). Farmers in Zhou territories began to select for reproduction not only plants with larger (and yellower) seeds, but also plants with stronger and taller stems, which prevented loss of seeds, facilitated harvest, and provided post-harvest kindling for the winter (Ho 1975).

During the Zhou dynasty, this expansion, intensification, and new techniques for soybean domestication transformed this plant from an exotic form of edible protein into a crucial source of nitrogen for the depleted soils of millet/sorghum fields, a supplementary source of fuel, and an essential resource for human diet. By the end of the Zhou dynasty, techniques to ferment soy had been developed, producing soy sauce, *jiang* (Jp.: *miso*, fermented soybean paste), and soy-based wines, in addition to steamed, boiled, or fried whole soybeans, which caused soy to match millet as the staples of Chinese society (Chang 1977).[3] In turn, soy transformed the Zhou from an adventuring clan who seized power over a decaying kingdom, into the longest-lasting (c. 1046–256 BCE) and most formative dynasty in China. During their rule, the Chinese script emerged, as well as China's leading religions/philosophies of Confucianism and Daoism, and the notion that the dynasty's rule is maintained by a "mandate of heaven," evidenced through their ability to sustain their subjects and their agricultural production – fed, warmed, and fertilized by the domestication of soybeans.

## Industrialization, Japanese imperialism, and fertilizer/vegetable oil

There is no sharp distinction between domestication and continued agricultural development through seed selection: these are better understood as a continuum in the process of resource-making (cf. Larson et al 2014). As agricultural practice rewarded cultivators with more useful resources – soy plants with larger edible seeds, encased in stronger pods, held by taller and stronger stems, harboring more nitrogen-fixing root nodules – seed selection extended to improvements in taste, nutritional value, resistance to droughts/floods, and multiple pests that began to thrive in this newly-made world of soy fields. By the early 1900s, on the eve of industrialization in China, there were over 6,000 varieties of soybeans throughout the country, and an equally rich diversity of food products and artisanal methods for producing them, including various types of soy sauce, paste, milk, flour, as well as multiple dishes and snacks made of pickled, boiled, steamed, or fried soybeans, and above all, various types of tofu (Chang 1977). Animal products accounted for as little as one percent of most people's diet, so soybeans had become their most vital source of protein. While soy production and consumption as human food, fuel, and fertilizer expanded along with Chinese (i.e., ethnic Han) imperial expansion and settler colonialism (and Buddhist proselytization across east Asia, promoting vegetarian diets), this rich diversity collapsed with the process of industrialization at the hand of Japanese and US imperialists during the twentieth century (Oliveira and Schneider 2016).

Soybeans first reached Japan during China's Tang dynasty (618–917 CE), one of the periods of furthest Han ethnic imperial expansion, and strongest influence of Buddhism (and its associated promotion of vegetarianism). Soybeans and fermented soy foods became integral to Japanese farming practices and diets over the next centuries. But to understand how the Japanese transformed soy into an industrial resource, which in turn assisted in the transformation of Japan into a regional empire, it is necessary to first grasp how new resources were made through pre-industrial crushing of soybeans in China itself.

As soy production increased and varieties with large oily seeds were developed, Chinese people began to crush soybeans (circa 980 CE) in order to supplement vegetable oil production from sesame and rapeseed. These were utilized in cooking, as fuel for lanterns, as sealant for caulking boats, and as lubricant for cart wheels and other purposes. The soy meal by-product was considered of little importance, given to livestock as feed or discarded as waste. However, increased domestic trade along the north-south canal of central China during the Qing dynasty led to increased attention to this byproduct (1616–1912 CE). Cotton, tea, sugarcane, and other cashcrop production intensified in southern China to supply Beijing and other cities in the north (and for export), but depleted soil fertility in the process. Traders began to ship soy meal back south in otherwise empty barges, transforming this waste by-product into a cheap source of agricultural fertilizer that also eliminated the wasted cost of navigating empty ships (Hiraga and Hisano 2017).

Meanwhile, as Japan industrialized during the late 1800s, the combination of rural exodus and depletion of soil fertility created a dire need for fertilizers there as well. Domestic fishmeal supplies were insufficient, and imported guano from the US and European colonies were unaffordable, so Japanese traders began importing Chinese and Korean soy meal instead. A poor soy harvest in 1889 led to a partial restriction of Korean soy meal exports to Japan, precipitating the Japanese invasion of Korea and the First Sino-Japanese War (1895–1896), and their subsequent war against Russia (1904–1905) for influence over the Korean peninsula and northeast China, then known as "Manchuria." The procurement of coal to supply Japan's growing industrial economy remains widely recognized as a major factor in these confrontations, but almost forgotten was the equally important pursuit of soybeans as a food and agricultural resource. After these wars, Japanese trading companies and fertilizer manufacturers created the first industrial soybean crushing operations in the world in Manchuria. Eighty percent of exports (by value) from Manchuria consisted of soybeans and soy meal for Japan, and soy oil for Europe and the US, where this versatile product was becoming a new resource in the manufacturing of soap, margarine, and several industrial products (Seth 2011; Hiraga and Hisano 2017).

The Japanese structured colonization of Korea and Manchuria around an extractivist mode of production that hinged on control of ports and railroads. Integrating Chinese (and Korean) soybeans into a global market through industrial processing, Japanese imperialism transformed soy into an essential resource for its further industrialization, intensifying agricultural production domestically, and increasing food supplies even while its own peasantry was dispossessed in the process. The South Manchuria Railway Co. (SMR), "Japan's *de facto* colonial institution" in northeastern China during the early 1900s (Hiraga and Hisano 2017, 12), derived as much as 57% of its profits from soy trade. Moreover, the SMR established a network of soybean crushing factories, warehouses, hotels for soybean traders, and deep-water port facilities to facilitate extraction of this newly created industrial resource. Significantly as well, Japanese industrialization promoted the *standardization* of soybeans, rewarding production of varieties with high oil and protein contents, and marginalizing other varieties that may have been more suitable for food production, more nutritious, more resistant to pests or environmental hazards, or richer in other socio-ecologically desirable features.

Demand for vegetable oil and initial experimentation with soy meal for concentrated livestock feed increased along with industrialization in Europe and the US during the first decades of the 1900s. Meanwhile, after the collapse of the Qing dynasty in China, warlords in Manchuria began to assert greater control over the region's soy economy from the SMR. In response, the Japanese imperial army occupied China during the 1930s, and with the onset of war against the US during the 1940s, it restricted soybean, oil, and meal exports. This triggered US government, farmer, and agribusiness interest in the establishment of a domestic soybean agro-industry, which would come to dominate global markets after the US defeated Japan in 1945 (Midori and Hiraga 2017).

## Flexing, neo-colonial globalization, and agro-industrial integration

The multiple uses of soy that emerged as it became an industrial resource, and the flexibility of agro-industrial processors to incorporate it into existing formulations of vegetable oil products and meal for livestock feed, advanced vertiginously once the US government adopted soy as part of its total war effort. An increasingly integrated agro-industrial economy consolidated the process we call "flexing" (Oliveira and Schneider 2016; cf. Goodman, Sorj, and Wilkinson 1987), that is, (re)creating numerous uses and markets for a resource, malleably interchanged with other agro-industrial inputs according to variations in prices, timing of harvests, and other conditions. This enabled not only US soybean agribusiness to surpass its historical center of production in northeastern China and the pioneering trading and processing companies from Japan, but also to control the technologies and markets developed through neo-colonial globalization along the twentieth century.

Many imagine the use of soybeans for the production of biofuels and industrial products is a recent invention, and contemporary agribusinesses often portray themselves as entrepreneurial innovators of a "green economy." Gustavo Grobocopatel, for example, the patriarch of an Argentinian soy conglomerate, proudly proclaimed in 2014 that:

> What is to come in ten years is a sort of Green Industrial Revolution, plants begin to be transformed into factories. That is, a plant that until now produced grain begins to produce energy, bio-plastics, molecules and enzymes for industrial use. (Quoted in Oliveira and Schneider 2016, 168)

Yet this entrepreneurial triumphalism is utterly revisionist. Albeit eccentrically, Henry Ford already boosted the use of soy as a dietary supplement and industrial input, and imagined his car's non-metallic structures composed mostly of soy derivatives (Oliveira and Hecht 2016). In fact, his famous Model–T was a flex-fuel vehicle that could be adjusted to run on ethanol, gasoline, or a "gasohol" blend. But corn-based ethanol and soy-based biodiesel were displaced after the 1920s, when the anti-knock properties of tetraethyl lead enabled the powerful petroleum industry in the US to monopolize automotive fuel markets (Oliveira, McKay, and Plank 2017). Moreover, decommissioned bomb factories in the US enabled the production of abundant synthetic fertilizers.

So during the twentieth century it was no longer the fertilizer industry that drove demand for soy (meal) as in Japan, but the vegetable oil industry in the US, Europe, and newly industrializing countries like Brazil and Argentina where soy production also began to take root (Oliveira and Schneider 2016). As in the US, wheat and corn farmers in those South American countries welcomed soy production because this nitrogen-fixing legume assisted their efforts to reduce fertilizer use and delay the depletion of soil fertility (Oliveira 2016).

The main driving force of soybean flexing shifted with the rapid integration of soy meal as key ingredient for livestock feed in newly created concentrated animal feeding operations (CAFOs). Prior to the twentieth century, livestock feed was a minor supplement mainly utilized during winter months, and efforts to concentrate livestock failed because animals became sick too quickly. This was due to the absence of sunlight (which induced absorption of vitamins A and D), and the increased vulnerability and exponential proliferation of infectious diseases that resulted from their agglomeration in confined spaces. When industrialization rendered antibiotics, vitamins and other nutritional additives cheap enough for use in livestock feed, year-round confinement of large numbers of livestock in CAFOs became possible. The soy meal by-product of the burgeoning vegetable oil industry in the US, therefore, was quickly identified as a cheap and abundant source of protein for livestock feed. These technological advancements soon spread from the US to other countries, especially Brazil (Oliveira 2016).

The US did not colonize Brazil and Argentina directly, but it did support the integration of agribusiness experts – agronomists, biologists, chemists, food engineers, economists, etc. – into leading land-grant universities in the US, where they fostered technical expertise in the adaptation of soy for industrial farming practices, and the flexing of this resource for multiple markets and industries. Moreover, the US also trained, armed, and supported the Brazilian and Argentinian militaries to put down peasant uprisings and communist movements advocating for the redistribution of land and agrarian reforms aimed at reducing the power of the landed oligarchy and the export-dependence of these South American post-colonial economies (Oliveira 2016). Through brutal military dictatorships that ruled these countries for decades during the twentieth century, an increasingly technified and capitalized agro-industrial production system consolidated the neo-colonial patterns of land distribution, labor relations, extractivist production, and export-dependent global integration of this region, which the Swiss-based agrochemical and biotechnology company Syngenta advertised as the "United Soybean Republic" (Oliveira and Hecht 2016).

Neo-colonial globalization drove the expansion of soy production and the advancement of Brazilian and Argentinian agroindustrial elites over their own hinterlands, and thereby transformed them into sub-imperial powers in their own right. Brazilian farmers took advantage of close ties between military dictatorships to effectively colonize Paraguayan and Bolivian lowlands with soybeans, and Argentinian firms partnered with US agrochemical and biotechnology giants like Monsanto to gain control over seed and other agroindustrial input markets throughout the continent (Oliveira 2016; Craviotti 2016). Brazilian and Argentinian soybean conglomerates are now major vehicles for US, European, and Japanese agribusiness investments, collectively controlling over a million hectares across South America (Oliveira and Hecht 2016). Their efforts are expanding to Uruguay, Colombia, Venezuela, Cuba, and various African countries, where Japanese financiers – who promoted Brazilian soy since the 1970s to reduce dependence upon US exports, and now seek to reclaim international agroindustrial markets – are coordinating a new round of neo-colonial globalization of soybean agribusiness (Oliveira 2016).

## Genetic modification, dietary colonization, and neo-natures

The latest intervention remaking soybeans into new resources delves into the very genetic materials of this plant itself, and spans the entire landscape over which soy production dominates, generating a veritable neo-nature. While agroindustrial integration and neo-colonial globalization expanded soy production astonishingly, it simultaneously eradicated the biodiversity of the ecosystems it engulfed in South America (as wheat and corn had done in the US Midwest before), and reduced genetic diversity of soybeans to a meager handful of varieties. After China opened up its markets for soybean imports, effectively outsourcing the production of resources for its rapidly growing network of CAFOs and vegetable oil industry, the invaluable wealth of thousands of soybean landraces domesticated over millennia has virtually disappeared (Oliveira and Schneider 2016). Now, agricultural research companies and institutes value non-industrial varieties of soybeans for the genetic material they may provide for biotechnological developments, particularly necessary to address increasingly devastating pest outbreaks, progressively troublesome herbicide-resistant "super weeds," and the unpredictability of climate change – vulnerabilities largely created by the expansiveness of monocultures and their agroindustrial production practices in the first place. The appropriation of soybean landraces and transgenic seeds through patents and other intellectual property rights has itself created a new resource in genetic material (Kloppenburg 2010).

Despite these challenges, the present-day abundance of soy has transformed it into one of the cheapest and most versatile agro-industrial inputs. Among its uses are: adhesives, analytical reagents, antibiotics, asphalt emulsions, anti-corrosive agents, anti-static agents, binders for wood/resin, caulking compounds, cosmetics, core oils, disinfectants, dispersing agents, dust control agents, electrical insulation, epoxies, films for packaging, foams and anti-foaming agents, fungicides, herbicides, inks and crayons, insecticides, linoleum backing, leather substitutes, metal casting, oiled fabrics, paints, plastics and plasticizers, plywood, protective coatings, polyesters, pharmaceuticals, putty, rubber manufacture, soaps/shampoo/detergents, textiles, vinyl plastics, waterproof cement and wallboards. Similarly, there are innumerable processed foods that contain soy products in small amounts, such as soy flour, stock, lecithin, glycerol, fatty acids and sterols. These are used in the production (or low-cost "extension") of baby food, beer and ales, breads, cookies, pancakes and other bakery products, candies, chocolates, and confections, cereals and grits, creamers, dietary products, frozen desserts, instant milk drinks, juices, liquid shortening and yeast, noodles, salad dressing/oils, sandwich spreads, sausage casings, toppings, vegetable shortening, and, of course, mayonnaise and margarine. Soy products are not only used as processed food ingredients, but also as emulsifying or stabilizing agents, shortening and coatings (Oliveira and Schneider 2016).

The amount of industrial products and processed foods that include soy inputs is astounding, yet the soy and food processing industries continue unsatisfied with the "slow uptake" of this new resource, and actively lobby TV stars, health advocates, medical doctors, and nutritionists to recommend soy foods and soybean-infused products. Ironically, however, these new processed foods – or age-old East Asian dishes associated with (mostly) vegetarian diets – do not account for the largest share of human-consumed soy. That is the indirect consumption of soy meal converted into meat through livestock feed. The "meatification" of diets – particularly in China – has become the single largest driver of global soybean demand (Oliveira and Schneider 2016). There, this dietary transformation is intimately associated with a broader neo-colonial "Westernization" of diets, including rising amounts of meat consumption, dairy replacing soy milk, and "Western-style" breads, which combine above all in "Western" fast foods like burgers and pizzas.

These industrial and processed food markets are extensive due to their variety, but the second largest market for soybeans (after livestock feed and vegetable oil) is biofuel. This return to soy as a fuel resource reemerged with the energy crisis of the 1970s, and accelerated with more recent concerns about fossil-fuel driven climate change, and the need of agroindustrial processors to find new and ever-expanding markets to sustain demand and high prices for their key resource (Oliveira and Schneider 2016; Oliveira, McKay, and Plank 2017). Agroindustrial processors justify the production of soy-based biofuel mainly through idea that agricultural intensification and biofuels can limit deforestation and reduce carbon emissions, but this argument is scientifically discredited, or at least highly disputed (Oliveira and Hecht 2016; Oliveira and Schneider 2016; Oliveira, McKay, and Plank 2017). Still, just as agroindustrial resource-making has contributed to an anthropogenic planet, so too does "green entrepreneurialism" around climate change now contribute to the dialectical remaking of soy into "new" resources.

Most encompassing is the valuation of soybean-transformed landscapes as sites of further agro-industrial investment and capital accumulation, whereby agribusiness companies do not profit from soy production itself, but utilize this resource in the making of "developed" farmland for resale. This occurs because soy prices tend to fall with agro-industrial expansion and intensification, while production costs rise with treadmill effects that require new "improved" transgenic seeds, increasingly more toxic and expensive agrochemical inputs (to manage progressively more agrochemical-resistant pests and weeds), and ever-growing amounts of fertilizer to sustain production on soils that lose their organic matter and biological capacity for nutrient recycling, as constant agrochemical use effectively reduces it to a barren substrate. Moreover, environmental regulations in Brazil during the 2000s and 2010s made the conversion of standing forests into agricultural fields increasingly prohibitive, so "developing" deforested landscapes like degraded pastures for agroindustrial crop production became a profitable business practice. Multiple investors from the US, Europe, and Japan – including pension funds like TIAA and Harvard University's endowment – are partnering with South American agribusinesses to use soybeans as a key instrument for making "developed" farmland (Oliveira and Hecht 2016). They lose money on soy production itself, but profit from the speculative valorization of farmland "development" and resale, as neo-Malthusian narratives of future food and farmland scarcity sustain conjecture that farmland prices will continue to rise as population grows and production conditions collapse. Thus, soy contributes to the making of the Anthropocene, which dialectically remakes soybeans into an agroindustrial resource for the production of a neo-nature in its own right.

**Conclusion**

The co-production and co-evolution of soy farmers and soybeans is an under-acknowledged force in the making and remaking of a world-historically important set of resources – food, feed, fuel, and fertilizer above all, as well myriad industrial products, genetic resources, and even a neo-nature that extends to the commodification of land and whole environments themselves. I have argued that it provides a strong basis for theorizing domestication as a process of resource-making, and fertile ground for examining the dialectic between resource-making and world-making through colonialism, imperialism, and neo-colonialism.

Not all resource-making is rooted in agriculture, nor are all forms of agriculture (e.g., agroecology) embroiled in some form of colonialism and imperialism. Yet, when domestication is theoretically understood as resource-making in a continuum that extends through agricultural development and livestock husbandry, it also brings attention to the interrelated practices of class formation, state-making, and colonialism (Scott 2017) as crucial for the analysis of the process of resource-making as well. This brief but sweeping history of soy domestication and resources reveals the dialectic of co-evolution between resource making and world making, and provides fruitful fodder for the further theoretical development of global political ecology, critical agrarian studies, and, of course, critical resource geographies. Above all, this approach lays to rest the critique that political ecology and critical agrarian studies "appl[y] to resources – rather than derives from them – theoretical approaches" (Bakker and Bridge 2006, 7), as my analysis derives a distinctive and theoretically robust account of "domestication" from the historical geography of soybean resources, and thus places the human-environment dialectics of domestication as a core theme for research in critical resource geographies.

**References**

Bakker, Karen, and Gavin Bridge. 2006. "Material worlds? Resource geographies and the matter of nature." *Progress in Human Geography* 30(1): 5-27.

Chang, K.C. 1977. *Food in Chinese culture: Anthropological and historical perspectives*. New Haven: Yale University Press.

Freidberg, Susanne. 2014. *French beans and food scares: Culture and commerce in an anxious age*. Oxford: Oxford University Press.

Goodman, David, Bernardo Sorj, and John Wilkinson. 1987. *From Farming to Biotechnology: A theory of agro-industrial development*. London: Basil Blackwell.

Hiraga, Midori and Shuji Hisano. 2017. "The First Food Regime in Asian Context? Japan's Capitalist Development and the Making of Soybean as a Global Commodity in the 1890s-1930s." AGST Working Paper Series No. 03. Kyoto: Kyoto University.

Ho, Ping-ti. 1975. *The Cradle of the East: An Inquiry into the Indigenous Origins of Techniques and Ideas of Neolithic and Early Historic China, 5000–1000 B.C.* Chicago: University of Chicago Press.

Hu, Daojing. 1963. "Interpretation: On the understanding of soybean root nodules by ancient Chinese peasants." [In Chinese.] *Essays on Chinese Literature and History* 3: 111-115.

Hymowitz, T. 1970. "On the domestication of the soybean." *Economic Botany* 24(4): 408-421.

Kloppenburg, J. 2010. "Impeding dispossession, enabling repossession: Biological open source and the recovery of seed sovereignty." *Journal of Agrarian Change* 10(3): 367–88.

Larson, G., D. Piperno, R. Allaby, M. Purugganan, L. Andersson, M. Arroyo-Kalin, L. Barton, et al. 2014. "Current perspectives and the future of domestication studies." *Proceedings of the National Academy of Sciences* 111(17): 6139–6146.

Mandelblatt, Bertie. 2012. "Geography of food." In *The Oxford Handbook of Food History*, edited by Jeffrey Pilcher, 154 – 171. Oxford: Oxford University Press.

Moore, Jason. 2017. "The Capitalocene, Part I: On the nature and origins of our ecological crisis." *Journal of Peasant Studies* 44(3): 594-630.

Ogden, Laura, Billy Hall, and Kimiko Tanita. 2013. "Animals, plants, people, and things: A review of multispecies ethnography." *Environment and Society* 4(1): 5 – 24.

Oliveira, Gustavo de L. T. 2016. "The geopolitics of Brazilian soybeans." *Journal of Peasant Studies* 43(2): 348-372.

Oliveira, Gustavo de L. T., and Mindi Schneider. 2016. "The politics of flexing soybeans: China, Brazil, and global agroindustrial restructuring." *Journal of Peasant Studies* 43(1): 167-194.

Oliveira, Gustavo de L. T., and Susanna Hecht. 2016. "Sacred groves, sacrifice zones, and soy production: Globalization, intensification and neo-nature in South America." *Journal of Peasant Studies* 43(2): 251-285.

Richardson, T., and G. Weszkalnys. 2014. "Introduction: Resource materialities." *Anthropological Quarterly* 87(1): 5-30.

Robbins, Paul. 2012. *Lawn people: How grasses, weeds, and chemicals make us who we are*. Philadelphia: Temple University Press.

Rocheleau, Dianne, Barbara Thomas-Slayter, and Esther Wangari. 1997. *Feminist Political Ecology: Global Perspectives and Local Experience.* London: Routledge.

Scott, James. 2017. *Against the Grain: A deep history of the earliest states*. New Haven: Yale University Press.

Seth, Michael. 2011. *A History of Korea: From Antiquity to the Present*. Lanham: Rowman & Littlefield.

Smith, B. and M. Zeder. 2013. "The onset of the Anthropocene." *Anthropocene* 4: 8-13.

Stadler, Bernhard, and Anthony Dixon. 2005. "Ecology and evolution of aphid-ant interactions." *Annual Review of Ecology, Evolution, and Systematics* 36: 345-372.

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[1] Estimated volume of global production multiplied by average international price of whole soybeans, based on USDA 2019 data.

[2] Although the name "China" would not become common until the 1800s, as the kingdoms and empires that waxed and waned over this region usually took the name of ruling dynasties, I employ this term anachronistically for the sake of brevity.

[3] Rice, domesticated in southern China, was restricted to elite and ceremonial consumption in northern China until recent development of high-yield varieties, but soy was consumed across northern and southern regions equally (Chang 1977).