

Co-Colonizing:
The Ecological Impacts of Settler Colonialism in the
American Supercontinent

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Abstract

Environmental historians and ecologists have long sought to document the changes to the natural ecosystems of the Americas since colonization by Europeans beginning in the 15th century. They have developed theories for understanding how ecosystems have been altered, through introduction of nonnative species or human intervention. This has led to the study of invasive species, the mechanics of invasion, and the impacts of biotic homogenization. This paper seeks to contextualize the ecological degradation within the coinciding structure and historical development of settler colonialism as well as investigate the ways that the colonization of the Americas has impacted its biomes and the Indigenous peoples that inhabit them as well as begin to theorize a decolonial ethic by which to guide ecological study. It draws from both the emerging fields of invasion ecology and conservation biology as well as on the transdisciplinary work of Indigenous and non-Indigenous scholars of settler colonial studies, anthropology, and history to envision an ecology of invasion that considers the ecological and sociocultural aspects of colonization and Indigenous sovereignty.

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"The people have a right to their land but the land also has a right to its people."

-Roxanne Dunbar-Ortiz,
An Indigenous People's History of the United States



Figure 1- Douglas fir-dominated forest overrun with English Ivy. From California Invasive Plant Council.

Introduction

The English ivy had overgrown its gardens, overflowed and drowned out the understory of the forests of the Doo, the "Inside." Its lush green vines sprawled across the damp soil, blocking out the light reaching the ground beneath the canopy of cedar, maple, and fir. At their trunks, the ivy reached its relentless vines, gripping tightly to the giants whose presence signified the incompleteness of their project: to reign above the forest into which they had crawled. Below them grew the tiny saplings that stood as testament of another project just beginning,

The continents today known as the Americas have undergone significant and relatively sudden ecological change within the last 500 years. Specifically, these changes have coincided with the political and cultural changes that accompanied colonization of the North and South American continent by first Europeans and later American settlers. Among historians and anthropologists, these changes have been widely discussed as they relate to the effect on Indigenous communities and

cultures across the continent. Within the scientific community, however, much of the attention has been focused on habitat degradation, resource overexploitation, and invasive species and their effect on native ecosystems into which European and American settlers introduced them.

Environmental historians have traced the changes to both the biotic and abiotic components of American ecosystems under different land use regimes, particularly those employed by Indigenous communities and European settlers (Cronon, 2003). They have documented the broad changes to ecosystems, from disruption of forest succession through deforestation related to agricultural and industrial development to the introduction of invasive species, both intentional and unintentional (Cook et al., 2006)(Halverson, 2010)(Trigger, 2008). This historical analysis has also provided some complicated insight into the constantly changing nature of ecosystems and the ways that Indigenous communities did in fact alter and interact with their natural environment (Cronon, 2003).

Many scholars of environmental history have argued against a simplistic and nostalgic view of ecosystem stasis and pristine condition pre-contact with European settlers (Cronon, 2003) (Fuller et al., 2016). Instead, they argue for a dynamic understanding of how ecosystems constantly shift in their biotic and abiotic components and how humans, like all species, have always interacted with their environments in an intentional way. Cronon (2003) and others remind us that what may be different is the ways in which human populations and cultures conceptualize and choose to interact with the ecosystems to which they belong.

Conservation biologists and ecologists meanwhile have developed their own way of understanding one of the major components of post-contact changes to native ecosystems with the rise of native species restoration and particularly the field of invasion ecology. First described by Charles Elton in his 1958 *The Ecology of Invasions*, invasion ecology sought to systematically study the process of invasion by introduced species as well as document and indeed warn of their potential harms to native ecosystems. Since his initial work, many ecologists have responded either to his call to study invasive species or have disputed his claims. Some have argued that judging introduced species to be “invasive” amounts to xenophobic nativism (Davis et al., 2011) while others go further to argue that invasive species are beneficial to the ecosystems they disrupt. Many ecologists reject both of these claims (Simberloff, 2011) (Alyokhin, 2011) (Lockwood et al., 2011) (Lerdau & Wickham, 2011).

Another major point of contention within the field of invasion ecology, along with many other fields of natural science, is the politicization of the discipline, with some authors arguing that invasion ecology has dissociated from mainstream ecology with its distinction between native species and introduced colonizers (Davis et al., 2001) or that ecology should not be politicized and applied to public policy (Veda & Walters, 1999). In recent years, though, it has been generally accepted and practiced by ecologists and conservation ecologists that ecological considerations should be included in public policy.

The work of environmental historians and invasion ecologists has made clear that there is a synchronic relationship between the colonization of the continent by European and later American settlers and the introduction of invasive species. It is

well established that many invasive species that threaten native ecosystems were either intentionally introduced as part of the settler colonial project or accidentally through various vectors such as ballast water, on humans, or on imported plants and animals (Heise & Christensen, 2017)(Mann, 2007). This introduces what Timothy Neale, a settler-scholar studying weed ecology in Australia, calls “a parallel or companionship” between settlers and weeds (2017). Here, I refer to this process of collaborative colonization of a native habitat by two or more invasive species (including human populations of settlers), especially from the same biogeographical region, as “co-colonizing.” This concept will be useful in understanding the invasion of many distinct ecosystems by European settlers and the plant, animal, and microbe species that accompany them in a holistic ecological and historical analysis.

Another informative concept that has emerged within ecology itself is what researchers have termed biotic homogenization (Olden et al., 2005). It is described as the replacement of native communities with “locally expanding and cosmopolitan, non-native ones” (p. 1) and causes a local, regional, and global homogenization of biological species pools as well as ecosystem types and interactions. This theoretical framework is particularly important and indeed unique in that ecologists explicitly draw the connection between biotic and sociocultural homogenization that is described by social scientists. It brings to attention at once the connection between social and biotic factors of invasion and the impending harms of the reduction of biological and cultural diversity that we observe in an increasingly globalized world. I will attempt here to integrate the

ecological framework of homogenization with a critique of settler colonialism and its homogenizing effects on the world.

The discourses surrounding and emerging from invasion ecology, and to a lesser extent, the environmental history of the American continent, have to varying degrees addressed or failed to address the settler colonial structures that cause and inform the occurrence of invasive species and environmental degradation in the particular context of the Americas post-contact. Namely, invasion ecology illuminates the processes and structures of invasion by animal and plant species while obfuscating the structure of settler colonialism that is the foundation of European-American society. As will be discussed later, the study of invasive species within the settler scientist community allows settlers to discuss invasion without grappling, and more crucially, relinquishing their position as settlers on occupied Indigenous land. The borrowed and shared terminology between settler colonial studies and invasion ecology such as “colonizing,” “invasion,” or “native,” begs the question of what is analogous between plant, animal, and human colonization of the Americas, and what is nonanalogous. One thing that becomes clear in the literature is that applying ecological theories and methodologies to complex human sociopolitical interactions is fraught with ethical and theoretical problems.

There has already been significant study of the structures, processes, and impacts of settler colonialism within the fields of Indigenous and settler colonial studies. The interrogation of settler colonialism as a structure rather than an event (Wolfe, 2006) provides theoretical frameworks and principles that are applicable to a potential ecology of invasion that understands, critiques, and challenges settler

colonialism rather than ignores or reinforces it. One work in particular that has propelled forward an analysis of settler colonialism and decolonization, as a process of repatriating Indigenous land, is Eve Tuck and K. Wayne Yang's (2012) "Decolonization is Not a Metaphor." In it, the authors explain decolonization as the project of undoing colonization via repatriation of land and restoration of Indigenous sovereignty. They also discuss how decolonization is made a metaphor, rendering it impotent and allowing settler colonialism to remain unchallenged.

"Decolonization is Not a Metaphor" contributes a number of useful theoretical frameworks, including a broad understanding of land as consisting of all biotic and abiotic components of the ecosystems inhabiting it (Tuck and Yang, 2012). This conceptualizing of land is actually not far removed from the understanding of the scope of the field of ecology. Ecology textbooks like *Ecology & Field Ecology* (Smith & Smith, 2001) and *Ecology* (Odum, 1966) define the scope of ecology as the "total relationships of the animal both to its inorganic and organic environment" and the biosphere, "the biologically inhabited soil, air, and water," respectively. It is interesting to note that most ecology textbooks recount the origin and meaning of the term, from the Greek root "oikos": the study of *home*. Tuck and Yang state that settler colonialism is unique in that "settlers come with the intention of making a new *home* on the land" (emphasis mine) and "insists on settler sovereignty over all things in their new domain" (2012). Whose home is being studied and how do populations claim a home? And how do they negate the claims of others? It is necessary to problematize settler scientists' conception of home in this way, as it is based on settler occupation and ownership of Indigenous land.

The centrality of land and its reframing as property in settler colonialism is accompanied by a particular form of violence that severs Indigenous people, plants, and animals from land. Both of these conceptions regarding land relate to the ecology of invasion, with introduced species both competing for access to abiotic and biotic resources of the ecosystem they enter as well as disrupting the native species' ability to survive in the environment in which they have evolved. Tuck and Yang offer up a response to colonialism: decolonization, which, at its most basic, is a process of undoing colonialism. The parallel within invasion ecology might be eradication of invasive species and restoration of native species and their habitats but it is important to acknowledge Tuck and Yang's point that these are not automatically the same thing, that eradication of invasive species does not equal an undoing of settler colonialism. Both are contentious and as described later, fraught with theoretical questions surrounding the state to which ecosystems/histories should be "restored," but for settlers (scientists included), the eradication of invasive species requires much less personal and collective sacrifice on the part of settler society.

This contention exists because the disentangling of what Tuck and Yang call the settler set of relations requires a dismantling of settler claims to land as property. This, predictably, is met with great resistance from settlers, much more than the call for eradication of invasive species. Decolonization responds to this difficulty by shifting the focus away from settler's concerns with settler futurity; it is not the responsibility of the project of decolonization and its adherents to ensure

the future of settlers, but rather it is concerned with the futurity of Indigenous lands and peoples, two categories that it views as co-constitutive and inseparable.¹

Though discussion of the merit of or arguments for decolonization is beyond the scope of this paper, it should be noted that the intent is to consider the possibility of both incorporating ecological considerations into the project of decolonization and, perhaps more importantly, developing a decolonial ethic of studying the ecology of the geographically specific and historical world we inhabit. Tuck and Yang argue that civil rights or social justice movements often contradict decolonization and that there needs to be a reframing of their aims in order to be accountable to the Indigenous people whose land they occupy. Likewise, invasion ecology must take into account the settler colonial project that contextualizes the invasion of species and settler scientists should strive to do their work in a way that is accountable to Indigenous communities. Should we fail in this endeavor, it will be a retrenchment of the very processes of settler colonial occupation that cause the ecological and cultural harms that we lament.

¹ “Indigenous peoples are those who have creation stories, not colonization stories, about how they came to be in a particular place - indeed how they came to *be a place*. Their relationships to land comprise their epistemologies, ontologies, and cosmologies” (“Decolonization is Not a Metaphor”, p. 6).

² Cattelino (2017) points out that it is then unsurprising that most natural history

Environmental History

One of the primary challenges in developing a decolonial framework of ecology is determining both what existed before colonization, and what is possible afterwards. There is limited information available to ecologists about the state of America's ecosystems prior to the arrival of European settlers. Indigenous peoples, meanwhile, have produced and passed down multiple millennia of ecological observation of their surrounding world. This knowledge, consisting of intricate awareness of seasonal changes, biotic/abiotic interactions, migratory patterns as well as management techniques relating to forestry, fish and game populations, and agriculture, is contained within Indigenous cultural institutions and narrative. Because of its inaccessibility to settler scholars, often times purposely guarded to protect it from exploitation or misuse, environmental historians have had to rely heavily on the accounts of early European settlers (Cronon, 2003).

Cronon's (2003) *Changes in the Land* discusses the difficulty in piecing together an accurate picture of the state of ecosystems prior to European colonization both because of settler's misconceptions about the "untouched" nature of the forests and meadows that they encountered and because of their exaggeration of abundance of plants and animals that later resulted in observers such as Thoreau concluding that the previously pristine and abundant ecosystems that their predecessors had described were by then degraded (Cronon, 2003). The former is particularly important to understanding both the popular perception of the "new world" they encountered and the ideological and political principles that guided and justified colonization, particularly *terra nullius*. The early settler's mistaken

assumption that the land was *terra nullis*, or “unused” by the Indigenous people they displaced, served as a major justification for the expropriation of Indigenous land.

Cronon (2003) goes on to explain that the landscape that the European settlers encountered was in fact profoundly and intentionally altered and managed by Indigenous communities. This included wide use of intentional forest fires, used to clear understories and ensure open hunting and foraging grounds, management of wild game populations and migration, and agriculture of various types. Not only did European settlers remain unaware of these actions, they lamented the loss of the wild pristineness of the very forests that they themselves were altering for their own agricultural and timber needs. This is reminiscent of what Rosaldo (1989) describes as “imperialist nostalgia,” where the people who studied the ecosystems developed a nostalgic feeling towards some distant and more pure past while being a part of the very structures that are causing their degradation.

Part of this process of degradation and change was due to the shifting relations to land, from the conception of usufruct land use held by many Indigenous communities to the recasting of land as private property by settlers (Cronon 2003)(Tuck and Yang, 2012). The ceding of land to settlers has been shown to correspond with the loss of old growth forests, as seen in figure 2. Settler

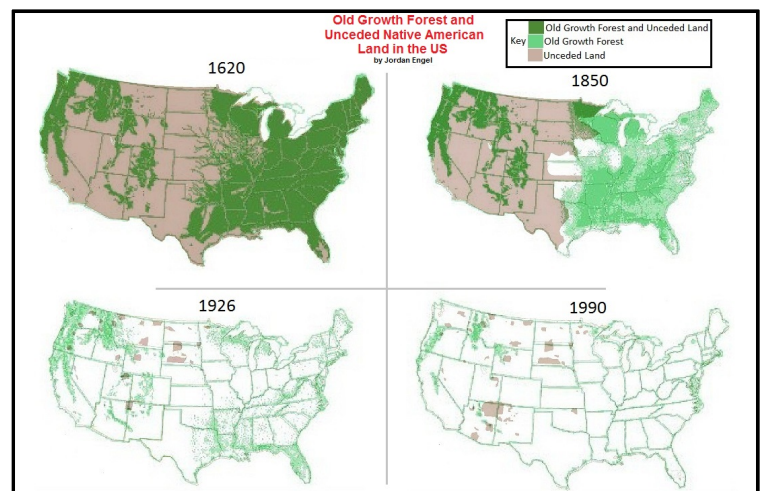


Figure 2- Map showing the correlation between the expropriation of Indigenous land and disappearance of old growth forests.

conceptions of land were based both on the idea of property, with ownership of land granting total sovereignty over it and its plant and animal inhabitants, and permanence. Agricultural plots became delineated permanently, ensuring that topsoil and nutrients would be depleted with intensive cash crop cultivation in stark contrast to the cyclical process of clearing land and allowing it to lay fallow practiced by Indigenous communities (Cronon, 2003).

It is important to note here that change in ecosystems, in both biotic and abiotic components, is not inherently disruptive or degrading. Cronon acknowledges that Indigenous hunting, agricultural, and forestry practices were not always stable and sometimes overexploited natural resources. In fact, *Changes in the Land* stresses the fact that all human communities alter and manipulate their environments and that ecosystems are never static, which is an assertion increasingly supported by the scientific ecological literature (Hobbs et al., 2009).

Ecologists and anthropologists alike have pointed out that the conceptualization of static ecosystems and the privileging of equilibrium fails to acknowledge the dynamic nature of ecosystems and cultures. Cattelino (2017) reminds us that the static model arises from the same ideological tradition as structural functionalism in anthropology, which has similarly framed change within Indigenous cultures as resulting in “cultural loss, inauthenticity, and loss of sovereignty” This is also problematic because it collapses Indigenous peoples and nature, perpetuates what settler colonial scholars call the disappearing native trope that is central to settler colonialism, and limits Indigenous peoples and cultures to a static, bygone past (Cattelino, 2017)(Tuck and Yang, 2012).

Still, it is undeniable that the landscape of the American continent has changed dramatically and rapidly since the arrival of European settlers. Along with the coinciding development of the Industrial Revolution, which was directly funded by the extraction of resources and exploitation of land as well as chattel slave labor (Drayton, 2005), the colonization of the continent has resulted in global shifts in atmospheric temperature, deforestation, and the rapid extinction of many species. Vitousek et al. (1997) estimate that carbon dioxide concentration in the atmosphere has increased by almost 30% since the Industrial revolution (Figure 2 shows that CO₂ emissions nearly doubled), about 39-50% of Earth's land has been transformed or degraded by humanity, and that about a quarter of Earth's bird species have been pushed to extinction because of direct and indirect human action.

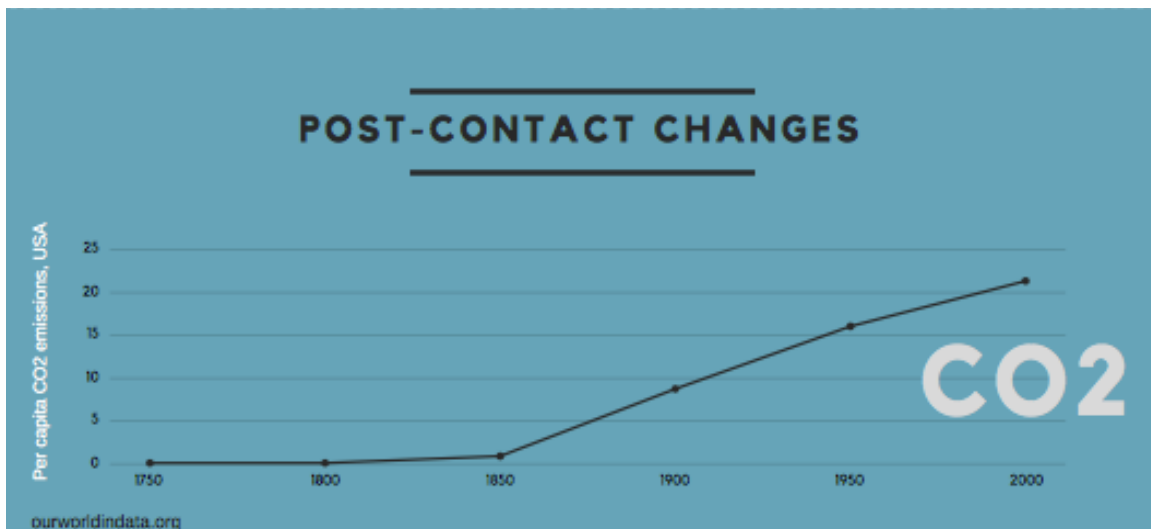


Figure 3- Chart showing the US CO₂ emissions between 1750 and 2000. Data from ourworldindata.org.

Though these developments are not due solely to the colonization of the Americas, the connection between settler colonialism and the Industrial Revolution as well as the rise of global capitalism that has spread Western land use practices to

a large portion of the world has been made clear through historical analysis (Drayton, 2005). With interdisciplinary study of the links between European colonization and global ecological changes, it can be concluded that there is a causal, though complicated, relationship between the spread of European and then American colonialism and ecological degradation.

Theorizing Collaborative Colonization

There is one example that appeared in multiple literatures discussing the environmental history and invasion (human and otherwise) of the American continent: the earthworm. The introduction of European earthworms serves as a parable of sorts, offering insight into the ways that the introduction of invasive species, the disruption or degradation of native ecosystems, and the European colonization and domination of Indigenous lands and people are intimately interrelated. In "America, Lost and Found," Mann (2007) recounts how earthworms, native species of which had largely gone extinct in the Americas during the glacial periods that began some 200,000 years ago, were brought to the British colonies either intentionally or unintentionally with the root balls of imported trees.

Gradually, earthworms became widespread across the continent as Europeans and their agriculture spread. While earthworms and their consumption of leaf detritus in forest systems in Europe and other parts where they existed naturally serve a significant and positive ecological role, native ecosystems of the Americas had developed without the presence of these organisms for thousands of years (Roth, 2015). The disruption of normal cycles of accumulation of leaf litter

caused both a leaching of nutrients essential to native tree species and a decrease in moisture retained and available, especially for tree saplings (Roth et al., 2015), as shown in Figure 4.



Figure 4- (Above) a deciduous forest unaffected by earthworm introduction and (below) a forest impacted by earthworm consumption of leaf detritus. The effect on the understory and tree saplings is particularly apparent. From sciencenewsforstudents.org

While presumably unintentional, the introduction of earthworms and their effect on both disrupting local biotic and abiotic processes *and* preparing the soil for settlers' introduced crop and forest species hints at what Neale (2017) describes as a parallel or companionship between settlers and the species they bring, or what I call collaborative colonization. Researchers like Roth et al. (2015), who noted earthworms'

favorable influence on invasive hawthorn colonization, and Neale (2017) note that species that originate from a shared

biogeographical region can sometimes work together to alter the ecosystems they are invading in a mutually beneficial way. Though usually understood between nonhuman animal and plant species, symbiosis of this sort can be framed in a way that includes human use of introduced plants, animals (domestic or wild), and microbes.

In fact, human introduction of species is often intentionally or unintentionally connected with the project of settler colonialism. Cook & Dias (2006), for example posit that the Australian government intentionally introduced invasive species in efforts to disrupt, alter, or control both the natural ecosystems and the Aboriginal peoples who they were trying to exterminate. In the Americas, Mann (2007) offers the example of settlers' pigs that escaped and established large feral populations and ended up overexploiting sources of wild edibles like tuckahoe, which North Eastern tribes relied on when corn crops failed. In essence, the species of animals like pigs that were introduced for settlers' consumption and survival eventually began to not only do that, but also disrupt and weaken Indigenous foodways. Some general relationships between introduced and native species are shown in Figure 5 below:

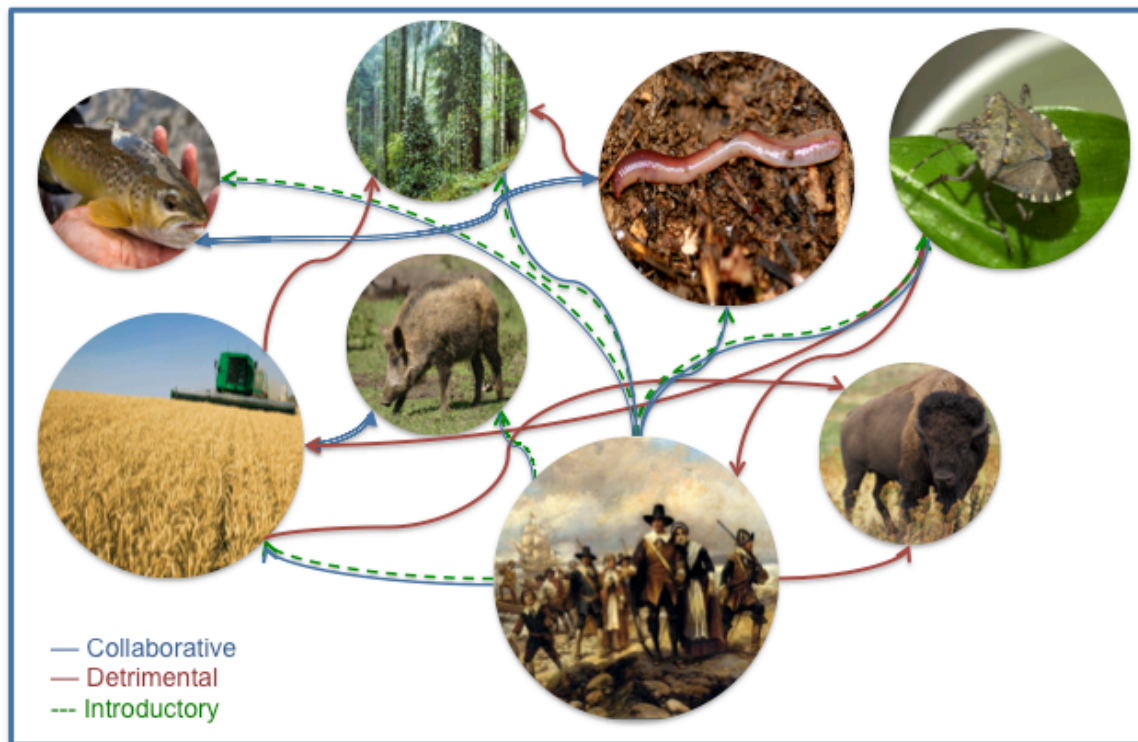


Figure 5- Diagram illustrating some biotic interactions between native and nonnative species, with blue double lines depicting collaborative colonization relationships, red lines depicting detrimental relationships by invasive species/populations on native species, and green dotted lines depicting species introduced by settlers.

Similarly but arguably more devastatingly, introduced species directly and indirectly served the settler colonial project of elimination of Indigenous peoples. Microbes such as smallpox, measles, and the flu were spread both unintentionally and intentionally, with historical examples of weaponized use of smallpox-infested blankets delivered to Indigenous peoples in false peace offerings, which caused massive reductions in the Indigenous populations whose lands Europeans were attempting to seize (Dunbar-Ortiz, 2014). This is a particularly severe example of collaborative colonization. As European settlers worked to displace, remove, or eliminate Indigenous people from the land they colonize, microbes with which they had co-developed for several centuries were spread, allowing both species to colonize new land and bodies.

While not directly related to the collaborative colonization of the Americas, it is important to note here the role of intentional ecological destruction on the part of settlers in their colonial pursuits. As described earlier, forest clearing for timber, grazing, and farming, mostly of exportable and profitable crops grown by slave labor, was a large part of both settler colonial project and the resultant disruption to local ecosystems (Cronon, 2003). There were also examples of trophic disruptions with the overhunting of native species like beavers, wolves, and bison and the introduction of nonnative game species like lake and river trout (Neale, 2017). The mass extermination of bison serves as a historical example of the ways that settlers disrupt natural ecosystems and in turn, by design, disrupt Indigenous foodways and especially cultural and spiritual practices (Dunbar-Ortiz, 2014). Not only are bison a central biotic component of the Great Plains prairie ecosystem *and* a major food

source for Indigenous hunting tribes, but they are also a central figure in Indigenous cosmological and cultural identity. The efforts to restore bison populations in the North American Plains have been somewhat fraught, as will be discussed later.

There is a critical intervention that must be made here, provided by anthropologists such as Cattelino (2017) in “Loving the Native: Invasive Species and the cultural politics of flourishing.” In discussing the ways that ecosystems have traditionally been framed as stable systems maintaining equilibrium, Cattelino (2017) points out that change is often understood as disturbing and aberrational. This view is parallel and arises from the same time period and intellectual tradition as structural functionalism in anthropology, which holds that cultures, too, are static and that change is caused by disruption (Cattelino, 2017). This connecting and collapsing of biological and cultural equilibrium makes it so that 1) Indigenous peoples are produced and conceptualized by settler society as “nature,”² 2) perpetuates the disappearing native trope that Indigenous scholars have argued serves to entrench and justify settler colonial domination of Indigenous land and culture (Tuck and Yang, 2012)(Wolfe, 2006), and 3) marks Indigenous peoples and cultures as static and of a bygone past, limiting them to preserve a mythical pure past (much like Thoreau’s Golden Age) or inauthenticity that supposedly comes with change, threatening Indigenous people’s claims to aboriginal rights to land.

These critiques of both anthropological and ecological equilibrium and the association, even, of Indigenous culture and natural ecosystems is relevant to this project of understanding the ecological impacts of colonization and the ways that

² Cattelino (2017) points out that it is then unsurprising that most natural history museums contain exhibits on native peoples as species of natural world.

settler colonialism interacts with, facilitates, and is benefitted by the ecological degradation of native ecosystems via physical changes to the landscape, shifts in land use, or introduction of nonnative species. As we proceed in discussing the ways that invasive species and study of their interaction with native ecosystems and fellow nonnative species fit into the historical development of settler colonialism, it is important to remember Cattelino's (2017) warning: that rather than relying on the analogy of Indigenous people /native species and settler/invasive species, we must critically examine the nonanalogous ways that nature, Indigeniety, and belonging are co-produced in settler society. How is settler colonialism different than the invasion of ecosystems by nonnative species, and how do society's responses to both differ? This can be partly understood by looking at how invasive species are studied by settler scientists.

The Study of Invaders

While Indigenous scholars and communities have studied and reckoned with both the process of colonization and settler society itself, as a matter of survival and resistance, settler scholars have for the most part focused their scientific inquiry in the symptoms of their occupation of the Americas. Within ecology and biology, this took on the form of studying the patterns of ecosystems pre- and post-contact, as described by Cronon (2003), describing the process of changing ecosystems by way of succession, range expansion of introduced species (Hui & Richardson 2017), and the concentrating on categorizing, managing, and evaluating invasive species. In 1958, Charles Elton published *The Ecology of Invasions of Animals and Plants* and

kicked off the development of the field of Invasion Ecology. Since then, ecologists have sought to address various questions about invasive species, what makes them invasive, the factors that make certain ecosystems more or less prone to invasion than others, and what value or detriment introduced species have.

One of the initial problems addressed by invasion ecology is the categorization of species as either native, nonnative, or invasive. These categories are sometimes difficult to distinguish due to various possible time and geographic scales used to analyze a species' nativeness or foreignness (Davis & Thompson, 2000). In "Eight Ways to Be a Colonizer, Two Ways to Be an Invader" Davis and Thompson (2012) categorize species colonizing a novel ecosystem into eight types, with two of them being invasive. Several others have also tried to consolidate varying and redundant nomenclature and hypotheses into a single unified theoretical framework (Catford, 2009). Part of this endeavor includes formation of hypotheses that attempt to explain invasions through a mechanistic lens. Some factors of invasion that have been identified and suggested are invasiveness (genotypic/ phenotypic and behavioral qualities of species that successfully colonize novel ecosystems) and invasibility (internal qualities of recipient ecosystems that make them vulnerable to invasion) (Hui et al., 2016), range expansion into adjacent ecosystems (Davis & Thompson, 2000), and succession-related colonization, whether related to human or non-human disturbance (Davis & Thompson, 2000).

It can be said that the concepts of invasiveness and invasibility have analogues in settler discourses in the form of the purported inherent settler

superiority or Indigenous inferiority, whether biological, racial, or cultural, that have been used to justify colonialism and racial domination, while range expansion and succession-related colonization can be seen as akin to the normalizing of settler colonialism as natural human migration (range expansion) and the blameless role that epidemics such as smallpox had in enabling the settler domination of Indigenous populations. All of these factors of ecological invasion, if applied to settler colonialism, can be viewed as normalizing or naturalizing of these structures and sets of relations.

Within settler colonialism, this is done through a series of what Tuck and Yang call settler moves to innocence which include settler nativism, settler adoption fantasies, colonial equivocation, conscientization, representing Indigenous people as either at risk of disappearing or as insignificant numerically, and re-occupation (2012). These moves are ones that allow settlers to absolve ourselves of guilt or responsibility for the harms of colonialism and, most importantly, to maintain control over stolen land we occupy. It is my contention here, guided by the work of Indigenous scholars of settler colonialism as well as authors like Cattelino (2017), that the singular focus on invasive species, but not settler colonialism itself, is a move to innocence made by settler scientists that deflects attention away from the settler colonial structures that inform ecological degradation of colonized lands.

Some ecologists have argued that the category of invasive species is problematic itself because it judges species on their foreignness rather than the function they serve or the value/detriment they represent to the ecological community they enter. In a Nature commentary signed by 19 ecologists, it was

argued that calling nonnative species invasive represented a xenophobic and nativist trend amongst ecologists (Davis et al, 2011). This line of thought, while superficially progressive, is problematic for two reasons presented by Indigenous and non-Indigenous scholars of settler colonial studies.

First, the framing of invasive species as victims of xenophobia parallels the tendency for public discourse to frame all Americans as immigrants, whereas scholars of Indigeneity, transnationalism, and settler colonialism point out that immigrants are those who are accountable to the laws and customs of the Indigenous communities they enter while settlers replace Indigenous people and impose their own laws and customs (Tuck and Yang, 2012). In a similar way, invasive species are those that drastically alter biotic interactions via resource competition, predator/prey interactions (Terborgh & Estes, 2010), change abiotic factors affecting other species (such as soil) (Simberloff, 2011), have no natural enemies or relationships with other members of the biological community, or decrease genotypic diversity via bottlenecks due to originating from small numbers of initial colonizers (Alyokhin, 2011).

Scholars like Davis and Thompson (2000) attempt to argue that nonnative species increase biodiversity and that their economic and ecological benefits should be considered in decisions concerning their management. This parallels what is discussed in the work of Indigenous historians and scholars as being the settler narratives surrounding “improvement” of empty land (Tuck and Yang, 2012) and the myth of a multicultural democratic society that obscures the settler colonial reality of the United States, Canada, and other settler societies (Dunbar-Ortiz, 2014).

The second challenge to the argument that invasive species management is nativist and xenophobic is akin to the less common but sometimes heard justification for settler colonialism: that decolonization and its call for an end to settler domination and occupation of Indigenous land is xenophobic. Cattelino (2017) pointedly notes the irony in the discourse surrounding invasive species management and eradication: in its positioning of settler scientists as the stewards or managers of native ecosystems and species, settlers root themselves to the land they occupy and position themselves as native. Nativism on the part of settler scientists and policy makers on behalf of native plants and animals not only negates Indigenous people's claim to land, but also suggests that settlers are better able to "preserve" native ecosystems even though Indigenous knowledge and methodologies have been acknowledged by ecologists as crucial to proper management of ecosystems (Ween & Colombi, 2013).



Figure 6- Comics, logos, and posters warning against the dangers of invasive species, without reflection on their settler colonial contexts. From californiachaparral.org, keywordsuggest.org, and duesllc.wordpress.com, respectively.

Instead, Cattelino (2017) points out that settlers' role in management of native ecosystems is part of the process of maintaining patrimony over occupied

Indigenous land and that invasive species and more broadly, ecological, management must center Indigenous agency, governance, and scientific participation. Tuck and Yang (2012) provide us with settler futurity, a useful concept for understanding the driving intention behind this positioning of settlers. In settler colonial societies such as the United States and Canada, it is settler futures that are enshrined, protected by the state, and guaranteed by the material and political economies that structure life. Both institutions and narrative settler moves to innocence serve to ensure that settlers and their descendants will remain in a dominant position within the colonial society.

Invasive species are generally not afforded this protection and guarantee of futurity in the habitats in which they've invaded, and instead are often marked for systematic and state-funded eradication (Davis, 2011) (Lockwood et al., 2011). The discrepancy between settler society's response to invasive species (demonstrated in the images in Figure 6 above) and settler colonialism itself is precisely what must be interrogated within a holistic ecology of invasion of this continent, with a constant reflection on how we might be making moves to innocence within our study of ecological systems in the land we occupy.

Cattelino (2017) also contests the use of invasive species as an ontological or ecological category, not because it is nativist but because it is a shifting category rather than a static one. Species that are invasive in one context might not be in another (Cattelino, 2017), or may fulfill a new ecological niche in one ecological community (such as introduced earthworms) but dominate and replace a native

species in another.³ The challenge of generalizing the invasiveness of a species due to varying impacts of introduced and range-expanding species (Davis & Thompson, 2000) makes it difficult to rely on invasive species as a category. As Cattelino puts succinctly, “categories do things and sustain structures” (2017, p. 133). Animal and plant species, like humans, navigate and defy categories which themselves are ever shifting.

Homogenization of a Colonized World

With the contentious and nebulous nature of ecological invasions and settler colonialisms, how has colonization of one human populations’ land by another affected the global biosphere? It is undeniable that ecological changes have occurred across all time and space on Earth, especially following the emergence of biological life and the complex ecological communities they form. And if all life, from the smallest microbes to the swiftest animals and grandest plants, has always been expanding its habitat range, inhabiting new spaces and roles, then what is the biological and political issue presented by colonization of new ecosystems and the arguably more complicated structure of settler colonialism?

This question is impossible to answer with biology alone. Still, within the framework of conservation biogeography the concept of biotic homogenization is a valuable way of understanding the processes of invasion of many types and what is at stake with the current historical and ecological development of the world. Having

³ Grosholz (2005) offers a historical example of co-colonizing with a nonnative clam species that was not invasive nor destructive to native clam species until the introduction of an invasive species of green crab that disrupted the native clam species via predation and allowed the nonnative clam species to competitively exclude native species.

its roots in Darwin's investigations of speciation and Wallace's separation of biomes, biotic homogenization is defined by Lockwood & McKinney (2001) as "the replacement of local biotas with non-indigenous species" which "often replaces unique endemic species with already widespread species."

At a global scale, biotic homogenization involves the increasing similarity between biotas across time and space resulting in many ecosystems across the world consisting of the same common species and ecological relationships (Olden, 2006). In essence, the overall diversity of biological communities is decreased as certain dominant species and biotas become widespread around the world. Olden (2006) breaks biotic homogenization into three types: genetic homogenization, in which genetic similarity of gene pools increases with hybridization or extinction;

taxonomic homogenization, in which cosmopolitan species replace endemic species; and functional homogenization, in which ecological roles served by species become increasingly similar.

Several studies have used now-widespread species of rainbow and brown trout as informative cases of the three types of biotic homogenization (Olden, 2006)(Neale, 2017). The stocking of lakes and rivers in regions colonized by Europeans with genetically similar

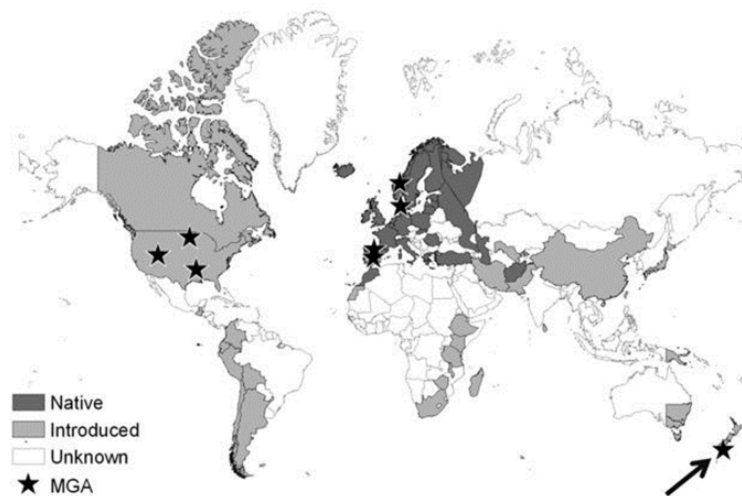


Figure 7- Map of Brown trout (*Salmo trutta*) native habitat (dark gray) and introduced range (light grey). From esapubs.org.

populations of trout, the extirpation of native endemic species, and the alteration of native ecosystem predation patterns all served to homogenize the genetic and taxonomic diversity of these freshwater biotas and, interestingly, the predation pressure on native plankton species was found to increase the rate of invasion of these ecosystems (Olden, 2006). Neale (2017) focuses on the introduction of brown



Figure 8- Brown trout (*Salmo trutta*), an introduced species now found in many lake systems around the world. From hatchmag.com.

trout to New Zealand's waterways by European settlers and its role in disrupting Indigenous food and water sources and serving settler desires and needs, but both studies of trout introduction point to some of the issues of homogenization: it disrupts Indigenous people's lives and

connection to land in service of the project of settler colonialism (Neale, 2017) and it makes native ecosystems more vulnerable to invasion (Olden, 2006).

In the "Human Dimensions of Biotic Homogenization," Olden, Douglas, and Douglas (2005) turn to both the ways that biotic homogenization affects human social and cultural practices and the "parallels and linkages" between biotic and cultural homogenization described in the social sciences (p. 1). They make important contributions to the discussion of biotic homogenization and its effect on local Indigenous communities as well as counter the argument that introduction of species (invasive or otherwise) increases species richness and local diversity (α -diversity) by noting that biotic homogenization is accompanied by loss of overall γ - and β -diversity (Olden et al., 2005). Their conclusion that decreased biodiversity and the extinction of native species affect specific biogeographical relationships

between Indigenous communities and the species that they cohabitate with relates directly back to the notion of the introduction of nonnative species and eradication of native species being tools of settler colonialism.

Olden et al. (2005) go further in their analysis between the analogous aspects of biotic and cultural homogenization, arguing that the spread of both introduced species and socioeconomic structures (via settler colonialism, imperial domination, or assimilation) decreases the overall diversity of human cultures. This parallels what others have said about European colonialism's effect on the global economic and ecological relations that structure the lives of a large portion of the human population, with global capitalism, resource extraction, and Western governance expanding throughout the world. The parallels and linkages between cultural and biotic homogenization are indeed important and provide insight into the interrelatedness between nature and culture. With the current situation and discourse surrounding global climate change, caused by a combination of European industrialization, extraction and consumption of fossil fuels, proliferation of European agricultural practices, and deforestation, it's important to point out the direct relation to the colonization of the rest of the world by Europe and its settler colonial progeny.

There is some caution to be taken with comparing biotic and cultural/sociopolitical homogenization, particularly when discussing their impact on Indigenous communities. Cattelino (2017) again reminds us of the three major ways that this equivocal discourse can follow and retrench historical ideologies of settler colonialism. Namely, settler society co-produces nature and Indigenous

people, rendering them both as lacking agency as well as limiting their ability to change/adapt without losing authenticity (always defined by settler society) or claim to land (Cattelino, 2017). The alarmist warnings of loss of native species and native peoples or their cultures also constructs Indigenous people within the settler popular, scientific, and political narrative as at risk of disappearing or already disappeared (Tuck and Yang, 2012) (Cattelino, 2017).

These critiques of collapsing biotic and cultural homogenization into the same process are important interventions in the conservation biology and ecological discourse surrounding ecological degradation. Rather than focusing on preserving biotic diversity for its own sake, regardless of its well-acknowledged benefits and ecological implications (Alyokhin, 2011), a decolonial ethic of ecological degradation, invasive species, and homogenization must center the knowledge and collective agency of Indigenous peoples (Cattelino, 2017). To prioritize cultural diversity and preservation, often with a static view of Indigenous cultures, over Indigenous sovereignty and collective agency would further a pattern within American discourse that renders Indigenous peoples and cultures as static, unchanging and of the past. What homogenization, biotic and cultural, does provide is a biological and ethical impetus for studying, managing, and preventing/undoing ecological degradation related to settler colonialism and, perhaps more importantly, supporting politically the sovereignty of the Indigenous nations whose land we occupy.

Towards a Decolonial Ecology: Two Case Studies in Restoration Ecology

As has been said throughout this paper, conservation and ecological restoration in a settler-colonial context raises certain historical and political tensions. This is because the Indigenous land we live on is both the site of the ongoing settler colonial disruption of occupation and its main subject of concern. Similarly, this disruption is enacted upon both the environment and all of its inhabitants. The collaborative colonization of the Americas is by necessity tied to the collaborative degradation of native ecological communities (including human populations). Therefore, the possibility of a decolonial ecology, rather than one that retrenches settler colonial occupation, is dependent on its ability to support the assertion of Indigenous sovereignty and increase tribal communities' control over their land. To examine the tensions and complicated relationship between settler colonialism and ecological restoration, this section will look at the restoration of American bison in the Great Plains of North America and the restoration of Pacific Salmon in the Pacific Northwest.

Though pre-contact bison population estimates vary widely, it is believed that North America was once home to between 25 and 75 million bison (McDonald, 2001). This number was reduced to less than 1000 by 1890, following the rapid expansion of European-American settlement (McDonald, 2001). Historians like Dunbar-Ortiz have explained that much of the rapid decline of bison populations can be attributed to the intentional outcomes of American Federal government and military policies of colonial warfare during the Indian Wars, cutting Indigenous tribes' access to food and other materials through mass extermination (2015). This

violence is downplayed or ignored in the land management and ecological literature, which attributes bison populations' decline to "both Indian and Euro-American actions" and drought, habitat degradation, competition from nonnative species, and introduced disease (White, 1991).

McDonald (2001) focuses on a relevant cause of bison herds' "dwindling": hunting and habitat destruction for domestic cattle ranching. Like brown trout, cattle are an introduced species that has become nearly ubiquitous around the world, following the settler colonies that relied on the domesticated bovids for food, materials, and agricultural labor. Domesticated animals tend to only become classified as invasive species when they become feral and establish significant populations that impact the native habitats they invade (for example, feral pigs in the American south and southwest). However, the replacement of bison herds by cattle and other settler-introduced livestock can be understood as a homogenizing process, with the replacement of an ecologically and culturally important native species with a common one.



Figure 9- Reintroduced bison on the Wind River Reservation in Iowa. From wayoflife.com.

Reintroduction and conservation efforts have been relatively successful in terms of population numbers. By 1999, there were more than 300,000 bison worldwide (McDonald, 2001). However, McDonald notes that the majority of these were on private ranches while a very small portion lived on public or tribal lands. Of these, a very small portion is managed as wild animal herds, with the majority treated as industrial animals on their way to domestication. This has led to a change in behavior and physiology through evolution and reduction of genetic diversity via bottleneck effects. McDonald also makes an important point that the raising of bison as a livestock animal, replete with feedlots and artificial selection, essentially negates the benefits and purpose of restoring an ecologically important grazing species in the Great Plains grassland ecosystems (2001).

These ecological considerations of bison restoration also interact with political and economic ones of the Great Plains. A confluence of private, state, federal, and Tribal interests and claim to land along with differing management practices creates a complicated setting for ecological conservation. Indigenous tribes have stressed the spiritual, cultural, and ecological importance of bison and the need to respect them and their position in the Great Plains community (McDonald, 2001). Meanwhile, private settler ranchers have argued against the reintroduction of bison because of their grazing competition with cattle and interference with lucrative mining and oil extraction operations. Federal and state governments and their constituents have intervened with the intention of conserving public lands “for all Americans” and managing bison herds as well as predators like wolves through culling or reintroduction (McDonald, 2001).

The politics of bison herd restoration are also tied up in an American West imaginary that romanticizes settlement, the frontier, and the cowboy aesthetic and history of the region. Like the land that they inhabit, bison (along with Indigenous communities and cultures) become entangled within that imagery of the American West, positioning them as part of a shared American identity. This, Tuck, Yang, and other Indigenous scholars inform us, is the settler inheritance that maintains settler colonial claims to sovereignty over the land. Rather than restoring bison for their own ecological and spiritual purpose, settlers conserve them as part of the cultural and biological wealth that they have claimed.

The alternative to this motive has been proposed by Indigenous communities in the Great Plains region, with McDonald (2001) noting tribal bison herd management's emphasis on interdependence and spiritual relationship between human, bison, and their shared environment. Tribes have implemented these with tribal-owned enterprises like the InterTribal Bison Cooperative (McDonald, 2001). Many scientists and environmental conservationists have concurred, calling for the restoration of wild populations of bison rather than in commercial and industrial ranching settings. However, the question of land is ever present. One of the putative solutions to bison restoration in the Great Plains is the Million Acre Project, a project based on the notion (introduced by biologists) that the Great Plains ecosystem needs one million acres of protected land for a "safe zone" where wild animals can take refuge, closing the land off to grazing and hunting, including that of Indigenous communities (McDonald, 2001). Meanwhile, McDonald (2001) observes that the

InterTribal Bison Cooperative has had great success with educational and cultural initiatives, but has been unable to secure land for tribal-led bison restoration.

Other tribal communities have employed a different strategy for combining ecological restoration and tribal sovereignty efforts with the assertion of treaty rights. Here in the Indigenous territories known as the Pacific Northwest of the United States, tribes have sought to protect one of the most important ecological and spiritual community members: salmon. Members of the *Oncorhynchus* genus are native to the region's lake, river, and ocean systems and have co-evolved with Indigenous people of the region for thousands of years (Ween and Colombi, 2013). In their comparison of land management regimes of river systems with significant Indigenous populations and threatened salmon populations in Norway and Oregon, Ween and Colombi (2013) provide a discussion of how Indigenous knowledge and sovereignty informs ecological management projects and their success.

Before European and American colonization, it is estimated that the Columbia River sustained a population of around 700,000 Indigenous people speaking 11 different languages (Ween and Colombi, 2013). The cultural and spiritual relationship and importance of this relationship cannot be understated for tribes like the Nez Pearce. The violence of the disruption of salmon is equally important to consider. Starting in 1850 with the first European-American settlers' arrival in the area, the populations of salmon in the region's river systems significantly declined. Settlers fished commercially, built hydroelectric dams, logged forests crucial to maintaining ecosystem cycling, and released toxic mining waste, reducing the salmon population (Ween and Colombi, 2013). Other actions

like overexploitation of beavers for pelts (whose dams serve as an important habitat component for juvenile salmon) and conversion of marshlands into farmlands also had a detrimental effect on salmon in the region.

One important development in the relationship between the Pacific Northwest tribes and the settler society that dominates their land is the establishment of treaties. Though the more than 500 treaties entered between Indigenous tribes and the United States government have nearly all been broken by the United States (Dunbar-Ortiz, 2015), treaties still ensure tribes access to certain lands, benefits, and activities. This includes hunting and fishing, with many treaties including a stipulation that Indigenous signatories retain their long-held right to fish certain rivers and other bodies of water. The Columbia, Duwamish, Elwha and other important rivers in the region are included in the treaties signed by Pacific Northwest tribes. However, there is more than one way to break a treaty. Tribes have pointed out that treaties promising fishing rights are of little use if the fish populations and the ecosystems that support them are degraded via dam construction, industrial pollution, or settler overfishing. In this case, ecological restoration and conservation becomes necessary for asserting treaty rights.

In response to the need to restore treaty-protected natural environments, the Northwest Indian Fisheries Commission was formed in 1974 following the US Supreme Court victory that reaffirmed treaty-protected fishing rights (nwtreatytribes.org, n.d.). Before that, Washington State broke treaties by preventing Indigenous people from fishing on their traditional lands and arrested those who defied the state law as part of a civil disobedience campaign. The

Northwest Treaty Tribes is an effort by the Commission to support tribes in asserting their treaty rights, establish and manage hatcheries to ensure salmon population robustness, and restore river ecosystems. Recently, the Northwest Treaty Tribes has been a central part of the effort to protect Pacific salmon



Figure 10- Northwest Treaty Tribes crew members from the Lummi tribe removing spilled Atlantic salmon and returning native Pacific salmon to the Puget Sound. From crosscut.com.

populations from threats, including from pollution and the introduction of commercially grown Atlantic salmon (as shown to the left in figure 9), a nonnative species that has been found to predate juvenile fish and introduce

genetic deformities into the native populations.

Protecting native salmon populations and restoring their heavily polluted and transformed ecosystems has involved a combination of legal advocacy, education and awareness raising, hatchery enterprise management, and ecological research. The 20 member tribes collaborate in these various projects as well as consult with state and private scientists. This is not unique to the Pacific Northwest tribes, as many Indigenous nations and tribes collaborate with settler scientists for conservation of tribal lands and natural resources. However, it is the explicit purpose of asserting treaty rights and restoring of tribal sovereignty that makes room for a decolonial ethic of ecology. Here the contributions and methodologies of

ecology can be repurposed not for the study of settlers' new domain (Tuck and Yang, 2012) but for the holistic study and, more importantly, interaction with the natural environment and all of its inhabitants.

There are still some considerations and concerns to be addressed in this example. The employment of treaty rights for protection and restoration of natural environments does not automatically translate to repatriation of land. In fact, the United States settler state has expressly claimed total sovereignty over the lands within its territory, holding in trust the land it "reserves" for Indigenous tribes. It has also unilaterally ended tribes' ability to enter and negotiate treaties (law.cornell.edu, n.d.). In addition, many tribes are not even recognized by the US settler state and either do not have an existing treaty or have one that has been broken and therefore do not have a land base, like the Duwamish tribe of the lands today known as Seattle.

And while the collaboration between Indigenous tribes and government scientists is commendable and speaks to the potential usefulness of ecology and conservation ecology in decolonial projects, it is important not to reproduce the patterns discussed earlier. Settlers must not position themselves as either superior caretakers or managers of the land nor work to ensure our own settler futurity (Tuck and Yang, 2012). We also must remember that Indigenous peoples have managed and cohabitated in these lands since time immemorial with their own epistemologies, sciences, and methodologies, and that Western ecology is not necessarily indispensable in the proper management of these lands. These two assertions are likely to be uneasily received by the scientific community, but they

are critical to centering decolonization and Indigenous sovereignty rather than settler desires and futurity. When settler colonialism is understood as one of the contexts of the ecological degradation that we observe in the world around us, it follows that the solution is not ecological restoration for its own sake, but for addressing and undoing the harms of colonization.

Conclusion

Though not a complete or exhaustive survey of the environmental history of the American continents pre- and post-colonization, it is hoped that by now it is clear that the colonization of the last 526 years has had profound ecological as well as sociocultural impacts. Whether that be from mass extinction of native species due to overexploitation, or introduction of now-ubiquitous species that change the very structure of the soil, settler colonialism has radically altered and disrupted the ecological relationships of this continent much like it has with Indigenous communities'. The study of this relationship between settler colonialism and the ecological degradation that enabled and results from it is complicated both theoretically and ethically, with ecological discourse falling within hegemonic narratives of settler colonialism and the sheer complexity of the ecological systems that it seeks to understand.

In attempting to describe, explain, and respond to the ecological alteration of this land, conservation scientists and ecologists have put forth theories of invasion, homogenization, and ecological equilibrium and adaption. Some focus heavily on the plant and animal species that have come to invade, reshape, and replace native

species' communities. This focus, too, is complicated and made problematic by the ways that settlers position themselves as native to the land they have colonized, even with their discourses of prevention, management, and eradication of invasive species. Others have noted that settlers utilize plant, animal, and microbe species in their project of settler colonialism, in a way similar to how species collaborate to invade a novel ecosystem when they have developed in a shared bioregion and within shared ecological relationships or functions. Some of these have been intentional introductions and mass extinctions; others have been facilitated by co-evolutionary or cultural traits such as disease-resistance or agricultural practices.

What should be clear is that settler colonialism and its resultant spread of both cosmopolitan species and cultural practices/ideologies cause profound changes on the world. The homogenization of cultures and biotas threatens not only the cultural and biological diversity that makes specific bioregions unique but also the world's ability to respond to disturbances such as climate change or epidemic. (Olden, 2006)(Olden et al., 2005). In order to address the complex linkages, the analogous and nonanalogous aspects between settler colonialism and biological invasion, we must turn to the work and leadership of Indigenous and non-Indigenous scholars who have sought to study, challenge, and undo settler colonialism. Will invasion ecologists and conservation biologists be able to prioritize Indigenous communities' and nations' epistemologies, methodologies, and indeed desires, even if those don't directly align with the accepted practices and goals within settler ecology?

The field of ecology, along with its scientists, technologies, and methodologies, has much to offer to projects of ecological restoration and preservation in service of decolonization. What is crucial, though, is a willingness on the part of settler scientists to critically examine not only the ecological effects of their occupation of Indigenous land, but also their own positionality as settlers on this land. And in developing a decolonial ethic to guide our study of the ecology of this land, we must consistently and critically examine the ways that our approach to solving the problem roots us to this land, retrenching the settler colonial structures that shape our existence here. Much like natural ecosystems, there is no going back to a more pure or idyllic past. We must, however, embrace the chaotic and uncertain nature of decolonization on its own terms, and grasp the ivy at its root and allow the forest to grow anew. But even this is to make a metaphor of decolonization. So instead, I invite you to engage deeply first with the actual desires of decolonization, as a project for deep justice, and reflect on what it requires of us ecologically as well as socially.

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