A Strangely Familiar Forest:
Conservation Biopolitics and the Restoration of the American Chestnut

DISSERTATION

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Abstract

Once a dominant canopy tree in Appalachian forests, the American chestnut (*Castanea dentata*) was rendered functionally extinct by an invasive blight fungus (*Cryphonectria parasitica*) in the early twentieth century. A century after the arrival of the fungus, blight-resistant chestnuts are now being produced through backcross breeding and genetic transformation, with the ultimate aim to restore the species to its former dominance in eastern North America. Despite restoration’s goal of reinvigorating an historic species, nothing about the chestnut’s demise and resurgence can be considered purely natural but is instead socioecological all the way down, forged through power relations among human and nonhuman actors, from fungal pathogens to plant geneticists, and from biotechnology corporations to hypoviruses.

This dissertation problematizes and contextualizes ongoing efforts to save the American chestnut from functional extinction, explicitly challenging the view of ecological restoration as a politically-neutral process by which ecosystems are returned to an ideal or improved state. Drawing on ethnographic and archival research, I argue that the restoration of the American chestnut is a biopolitical project in which the species is divided, bred, modified, immunized, and *made to live* through racialized technologies and discourses. Efforts to protect and restore the American chestnut are not—and indeed were never—solely about the conservation or improvement of species and ecosystems but are also about the construction and defense of national natures.
This research also finds that what counts as ecological restoration and biodiversity conservation are under radical revision, driven by novel biotechnologies as well as by the widespread recognition that we live in the Anthropocene—a new epoch in which humankind is a dominant earth system force. In identifying key areas of friction within chestnut restoration, I argue that the ‘messiness’ of the movement is emblematic of the complex and contested process of making nature live in the Anthropocene, a time in which science and conservation are increasingly future-oriented yet remain gripped by concepts, norms, and practices established around a pre-given nature. More broadly, this dissertation demonstrates that biopolitical technologies, strategies, and logics do not come to a grinding halt at the edge of taxonomic divisions but instead are fundamental to the doing of science and the management and conservation of nature.
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Chapter 1: Introduction

“Are you up to helping? Will you commit to a leg of the race to, literally, save a species from extinction?” (Case 2007a, p. 267)

“Will they be American chestnut trees? They were, after all, born in the U.S.A.” (Anagnostakis 2007, p. 228)

Once a dominant canopy tree in Appalachian forests, the American chestnut (Castanea dentata) accounted for 25% to 40% of the hardwood tree population at the turn of the twentieth century (Keever 1953). In some areas the species was even more abundant; in East Tennessee, an estimated 50% of all stems in the mountain forests were chestnuts (Ashe 1911), and in southwestern Virginia single-species stands were not uncommon (Lutts 2004). The chestnut was not only ecologically important but also economically and culturally valuable. Early pioneer settlers who were “tough enough or desperate enough to brave the hardships of carving out a homestead in the middle of the wilderness were rewarded by a companionable ally: a tree of seemingly limitless largesse” (Freinkel 2009, p. 19). Timber was used by settlers for split-rail fences, log cabins, barns, furniture, and instruments, and the nuts themselves were a key source of food for people, livestock, and wildlife. By the turn of the twentieth century, the chestnut had become a commercial timber source for the burgeoning forestry industry, and its tannic acid was increasingly extracted for use in leather making.
All of this changed, however, in the early 1900s when an invasive fungus was accidentally introduced to U.S. from East Asia. First noticed in the New York Zoological Park in 1904, the chestnut blight fungus (*Cryphonectria parasitica*) spread rapidly throughout the tree’s native range, leaving only a few scattered standing dead “ghost trees” where four billion giants once stood (Keever 1953). By the 1940s, the blight had rendered the species functionally extinct, meaning that the population is no longer viable. Yet chestnuts can still be found as understory shrubs in some eastern forests today, as the species can resprout from the still-living roots of trees killed by the blight. As these sprouts age, however, they inevitably become re-infected with the blight fungus and die back long before reaching maturity (Paillet 2002). In this way, the American chestnut is facing functional rather than total extinction. Gridlocked by blight, it lives but cannot make new life.

Over a century has now passed since the arrival of the chestnut blight, and the species remains as lively and significant as ever, immortalized in countless cultural references, from a Barbara Kingsolver novel (*Prodigal Summer*) to a Dolly Parton tune (“O Chestnut Tree”). The American Chestnut Foundation (TACF), founded in 1983, is working diligently to ward off extinction by backcrossing the American chestnut with the blight-resistant Chinese chestnut (*Castanea mollissima*) to produce a tree that is 15/16 American and 1/16 Chinese (Hebard 2004). TACF’s backcrossed chestnuts (termed the Restoration Chestnut 1.0) have now been planted on public and private land, including at several culturally and politically important sites: the White House, the Flight 93 National Memorial, the birthplace of Abraham Lincoln, and Dollywood, to name a few (Figure 1).
Researchers affiliated with TACF’s New York state chapter are taking a much different approach: using biotechnology to insert new genes into the species to induce resistance to the blight. Yet another group, the American Chestnut Cooperators’ Foundation (ACCF), is breeding large surviving American chestnuts to produce a tree that is blight resistant but purely American, with no genetic material from foreign chestnut species. Still others are targeting the blight itself, attempting to weaken the fungus by spreading a hypovirus throughout the population.
Despite the incongruities, these groups all share a common goal: restoring the American chestnut as a dominant forest species in its native range of eastern North America. Unlike some restoration projects, chestnut restoration has not become an epic public political battle but has instead proceeded fairly uneventfully. Within the movement there exist a number of important struggles and conflicts over breeding procedures, safety concerns around transgenic trees, and targeted sites for tree planting, but by and large the species’ restoration has been met with enthusiasm and optimism, tinged with a slight hesitancy toward genetic transformation (Heinrich 2013; Jabr 2014; Weisberg 2012; Zimmer 2014). A positive environmental narrative at a time when such stories are increasingly scarce, the American chestnut has been called an “icon of hope for our children to look to” (Rutter 2007, p. 261) and an “American dream that is close to becoming a reality” (Case 2007b, p. 3).

With redemption close at hand, the chestnut has also become of interest to advocates of de-extinction, who aim to re-animate, re-wild and restore extinct or functionally extinct species to their former habitats using biotechnology (e.g. Brand 2014). De-extinction entered the conservation lexicon following the March 15, 2013 TEDx DeExtinction event organized by Stewart Brand and Ryan Phelan of the Long Now Foundation, after which debates ensued about the ethics, techniques, costs, and viability of de-extinction (Brand 2014; Ehrlich 2014; Pimm 2013; Swain 2013). The chestnut has been implicated in such debates as a relatively tame and thus far successful example of de-extinction—a gateway species that opens the door for the revival of the
passenger pigeon (which depended on chestnuts for food), the great auk, the dodo, the thylacine, and even the woolly mammoth.

**Dissertation objectives**

Despite restoration’s goal of reinvigorating an historic species, nothing about the chestnut’s demise and resurgence can be considered purely natural but is instead socioecological all the way down, forged through power relations among human and nonhuman actors, from fungal pathogens to plant geneticists, and from biotechnology corporations to Appalachian farmers. This perspective explicitly challenges the conventional view of ecological restoration as a politically-neutral process by which ecosystems are returned to their ideal state. It is from this point of departure that I problematize and contextualize ongoing efforts to save the American chestnut from functional extinction, focusing on both the American nation and the region of Appalachia, the heart of the tree’s range, ecologically, culturally, and economically.

Chestnut restoration raises important questions about the complexities of conservation and restoration in the genomic era, the construction and defense of national natures, and the avenues by which ideas about racial and biological difference come to shape scientific knowledge and practices around nature. Together, these themes signal a broader ambition of this dissertation: to begin to flesh out the emergent biopolitics of knowing, protecting, and producing nonhuman species in the Anthropocene. Using the chestnut as a case in point, I interrogate the messy, somewhat ironic, and always political business of restoring novel life forms, where species, habitats, and ecosystems are
intimately connected to and in part produced by social processes, but constantly escape their control. More specifically, I argue that the restoration of the American chestnut is a biopolitical project in which the species is divided, bred, modified, immunized, and made to live through racialized technologies and discourses.

This biopolitical logic that undergirds restoration manifests in nature-society relations in materially significant ways, for example in the widespread acceptance of the population as the proper scale at which to study and cultivate nature, in justifications for interventions into nature in the name of health, resilience, and diversity, and in the surveillance and management of flows of nonhuman bodies across national borders. In biopolitics we also find a logic of biological difference that connects environmental and racial projects. The case of the American chestnut simultaneously demonstrates and extends this biopolitical link between nature and racial difference, as racialized ideas about Appalachian and American whiteness have played and continue to play key roles in blight control and restoration discourse and practice.

**Conceptual approach**

This dissertation is situated at the intersection of nature-society geography, social studies of science (STS), and biopolitics. More specifically, I link Foucauldian perspectives on biopower with ideas about the production of science/nature, the Anthropocene, and race and nature. In so doing I demonstrate that biopolitical technologies, strategies, and logics do not come to a grinding halt at the edge of taxonomic divisions but instead are fundamental to the doing of science and the
management and conservation of nature. In the following pages I develop this approach to understanding the restoration of the American chestnut by first detailing Foucault’s perspectives on biopower and biopolitics and more recent work that expands on these ideas. I then work through a series of themes—the production of science and nature, the Anthropocene, and race and nature—to consider how biopolitical theory, when brought into conversation with insights from STS and nature-society geography, can shed new light on the production and restoration of novel yet historic species.

**Biopower and biopolitics**

This research draws on Foucault’s writing on biopower and biopolitics to explore how nonhuman nature is managed and optimized through a mode of power that is “bent on generating forces, making them grow, and ordering them” (Foucault 1990, p. 136). Emerging in modern states in the seventeenth and eighteenth centuries, biopower refers to power/knowledge formations that aim to foster, promote, and improve life, in contrast to modes of power that threaten death to preserve the power of a sovereign over his territory (sovereign power). Biopower is thus the power to “make live and let die,” while sovereign power is the right to “take life or let live” (Foucault 2003, p. 241). Whereas sovereign power is manifest through the seizure of goods, territories, bodies, and ultimately life itself, biopower’s political technologies are disciplinary (anatamo-politics) and regulatory (biopolitics). Anatamo-politics and biopolitics are indeed mutually constitutive rather than opposing forces (Mansfield 2012a)—both a vital part of the broader power “that has taken control of both the body and life or that has, if you like,
taken control of life in general—with the body as one pole and the population as another” (Foucault 2003, p. 253)

Biopolitics refer to the management of life at the level of the population, the nation, or the race. Through biopolitics, states began to exert power at the level of the population as a whole, using techniques such as statistics on birth and death rates and disease infection rates to establish norms and bring biological life under the purview of law (Foucault 1990, 2003). The ultimate goal of such technologies is not merely to govern or manage man-as-species but also to promote life; biopolitics (and biopower more generally) represent a “positive and productive form of power” (Dillon and Reid 2001, p. 49), in which life is examined, assayed, classified, and made to live. But in order to protect and promote life, the population must be secured against irregularities and threats, and distinctions must be established between normalcy and aberrance, between biological threats and advantages. As such, making life live involves and indeed necessitates devaluing and diminishing life forms that are viewed as potentially threatening. Not only must biopower distinguish between good and bad; it must also “maximize the good circulation by diminishing the bad” (Foucault 1990, p. 18). At this moment of distinguishing threats from advantages, violence is justified; threats and disadvantages must be allowed to die in order to protect and promote the future of life.

Biopolitics, nature, and the life sciences

Foucault grounds his theory of biopower and biopolitics in the particular historical and geographical context of France in the eighteenth to twentieth centuries, considering
how human populations were governed, transformed, and made to live. Here I deploy biopolitics in a different context to suggest that nonhuman nature is also the object of biopolitical concern, and that biopower is intensified, activated, and transformed through the study and management of nonhuman nature. Linking biopolitics with recent post-humanist perspectives on nature, this brief section lays the foundation for a more in-depth consideration of biopolitics and biodiversity conservation in the following chapter.

Recent developments in the life sciences—and particularly the digital and molecular revolutions—have come to shape how biopower works through governing, fostering, protecting, altering, and killing human populations (Braun 2007; Cooper 2008; Dillon 2007; Dillon and Reid 2001, 2009; Raman and Tutton 2010). Dillon and Reid (2001), for example, show how the rise of “complexity” in the life sciences informs contemporary biopolitics: equilibrium can no longer be assumed, order is now “mutable and dynamic” (p. 44). They term the resultant biopolitics “recombinant biopolitics” (p. 44)—centered on the means by which life constantly recombines, evolves, and adapts to meet the needs and demands of a changing world:

As a consequence, ‘bodies’ and ‘populations’ are becoming today something altogether different. While genetic science makes it possible to have trans-species exchanges and life-forms, third order cybernetics conceives of living systems in terms of machinic assemblages comprised of both organic and inorganic matter… Stable taxonomy and mechanical predictability are, thus, displaced by what is best described as ‘being-in-formation’, where code, information and network are increasingly becoming the prevailing terms of art and non-linearity is regarded as the norm. (Dillon and Reid 2001, p. 54)

In drawing attention to recent scientific discourses on the “astonishing fecundity, mutability, motility, and sheer creative transformation” (p. 54) of life, Dillon and Reid
argue that the character of biopower and biopolitics is shifting to manage human populations and bodies in new ways (e.g. through network-centric warfare).

What I call attention to here is the crucial relationship between the life sciences, biopower/biopolitics, and material nature itself. In considering how ideas about nature have shaped social and political knowledge-practices, Dillon and Reid (2001, 2009) stop short of interrogating the natural world and scientific knowledge production in the context of biopower. This can be supplemented by bringing in recent work on nature-society relations that links Foucauldian biopower with a post-humanist emphasis on the agency of nonhumans (Hinchcliffe and Bingham 2008; Holloway et al. 2009; Lorimer and Driessen 2011). These emerging perspectives suggest that biological life forms are active agents that shape and are shaped by the exercise of power. Yet biological life can never be fully integrated into social relations as the “complexities of matters [make] governance and rule frighteningly unpredictable” (Hinchcliffe and Bingham 2008, p. 1534). Thus biopower is not something that acts upon a powerless, homogenous nature, but rather a set of relationships through which nature and society co-produce one another. In the case of the chestnut, this suggests that breeding and genetic interventions are not merely manifestations of some broader biopolitical urge to optimize, improve, and immunize, but rather are themselves the messy realities that constitute biopolitics (Rutherford 2007).

Recent work on biopolitics and nature also underscores Dillon and Reid’s argument that scientific developments may signal the emergence of new forms of biopower. Biotechnology, for example, is altering nature-society relationships in key
ways, allowing for the production of transgenic organisms, the sequencing of entire genomes, and the identification of genetic markers to denote the likelihood of certain phenotypes (e.g. a genetic marker for “tasty meat” in cattle) (Holloway et al. 2009). Things that were previously unknowable, incalculable, or unimportant—for example, whether a hybrid Chinese-American chestnut seed would produce a tree with leaves, nuts, and stature identical to the American species—now enter into human-nonhuman relations as part of the “panoptic nature of the green project” (Rutherford 2007, p. 295) and quickly become taken for granted as common sense conservation approaches. Yet while biopolitical theory provides a way to think through the processes of producing species, calculating genetic diversity, and making life live, it has less to add about the material power relations at work in the production, circulation, and application of scientific knowledge about nature. Here I turn to insights from nature-society geography and STS.

*Nature and science: social, material, political*

STS and nature-society geography contribute to this research a view of science and nature as fundamentally social, material, and power-laden. While STS tends to emphasize the micro-level processes at work in scientific knowledge production, nature-society geographers have most often focused on science as an instrument of power, enabling certain forms of nature while precluding others (particularly under the tent of political ecology). There is, however, growing cross-disciplinary interaction between STS and geography (e.g. Goldman et al. 2011; Lave 2012), and here I bring them together to consider how nature and science are co-produced in the process of making the chestnut
live. Understanding science as inherently social, active, and political compels us to consider the different approaches to restoration (e.g. genetic transformation versus backcross breeding) and the varied biopolitical assumptions on which they are based. It also requires an awareness of how different socio-political contexts not only produce different knowledge claims but can also lead to different chestnuts, different forests, and different worlds.

In broadest terms, much geography and STS scholarship has demonstrated that both nature and science are social to their very cores, yet are simultaneously irreducible to the social (Bakker and Bridge 2006; Castree 2005; Castree and Braun 2001; Haraway 2003; Jasanoff 2004; Pritchard 2011; White and Wilbert 2009). Haraway (1988) has argued that science cannot be performed in a purely objective manner; it is always situated, despite the god trick of Western science that insinuates a detached omniscient observer. Political ecologists have also gone to great lengths to demonstrate that nature and environmental science are not apolitical but are produced through webs of connection in which social structures and politics writ large shape particular material outcomes and the narratives used to explain them (Robbins 2004; Rocheleau 2007). More recently, ideas about materiality and the “mongrel nature of the world” (Bakker and Bridge 2006, p. 16) have been percolating in both STS and geography, through concepts like hybridity (Latour 1993; Whatmore 2002), the more-than-human (Braun 2005; Whatmore 2006); cyborgs (Haraway 1991), naturecultures (Haraway 2003), vibrant matter (Bennett 2010), and technonatures (White and Wilbert 2009), among others. Such concepts have also been spurred by and have taken up to varying degrees scientific discourses about
emergence, thresholds, plasticity, complexity, and relationality (as is also the case for recent work on biopower, as discussed above), demonstrating that nature is far more than what we think, say, and do with it.

Yet while much has been accomplished by establishing that the materiality of nonhuman nature matters, this turn has also provoked critique in both STS and nature-society geography. In a recent issue of Social Studies of Science, Paxson and Helmreich (2014) write that post-humanist and materialist accounts of nature “often veer toward universalizing metaphysical claims about the nature of ‘matter’ as such and also, at times, take scientific truth claims about the world at face value—a move that we consider a step backward for STS” (p. 169). Paxson and Helmreich (2014) go on to argue that recent work in this vein “accepts science-made rather than science-in-action” (p. 169). Woolgar and Lezaun (2013) similarly urge that materiality “needs to be understood as the contingent upshot of practices, rather than a bedrock reality to be illuminated by an ontological investigation” (p. 326). This critique underscores one of the main contributions of STS to this project: that the materiality of nature is a contingent achievement, and that scientific attention to this materiality is always social. Whereas Dillon and Reid (2001) stop short of critiquing the actual formation of knowledge in the digital and molecular revolutions in their account of contemporary biopolitics, STS reminds us that the production of science is no less power-laden than its circulation and application. Further, it underscores that nature and science are co-produced: it is not just that certain knowledge claims enable people to alter nature in particular ways. Rather, the material production of nature is inseparable from the construction of knowledge claims;
scientific methods, theories, and facts are at once catalysts for novel natures and outcomes of the very natures they produce.

In geography, critiques of recent work on materiality and nonhuman nature has been slightly different. Rather than being concerned with taking scientific claims at face value, geographers have often posed the question: ‘So what?’ Much research among geographers has sought to demonstrate that social and biophysical processes are intertwined in materially significant ways, but fewer have considered how power works through co-production—through what underlying processes and with what social and ecological implications. Bakker and Bridge (2006), for example, call the hybrid and quasi-object “rather blunt analytical devices” (p. 16), and suggest a broader focus on how and why particular entities or processes are gathered together and with what tensions or inconsistencies. Similarly, Braun (2006) asks, “But is it enough to describe these networks, or to show their complexity?” (p. 647) He urges research to interrogate “the underlying processes through which particular… assemblages of nature and society are produced” (p. 647), rather than merely describing the enrollment of various materialities in complex relational alliances and networks. So while recent critiques in STS remind us that science itself is contingent, social, and power-laden, nature-society geography (and particularly political ecological perspectives) suggests that describing material productions of nature is not sufficient—we must also attend to how these natures work in the world and why they matter.

In light of this, this dissertation does not aim to demonstrate that the American chestnut is more-than-human, hybrid, or zombie. It is indeed all of these things. What is
key here is not that the chestnut is co-produced but instead how co-production proceeds and with what effects. In other words, this dissertation explores the complex politics at work and the myriad scientific truths at stake in one seemingly simple and straightforward ecological restoration project, and in so doing brings to the STS and nature-society geography literatures explicit attention to the modes of biopower through which nature and science are co-produced. I now turn more specifically to recent work that engages with the idea of the Anthropocene. I do this to further develop the argument that the [re]making of the American chestnut is constitutive of the messy biopolitics of conservation in a time of uncertainty and surprise.

Welcome to the Anthropocene

In 2000, atmospheric chemist Paul Crutzen and biologist Eugene Stoermer offered the term ‘Anthropocene’ to describe a new geological epoch in which humans hold a central role in shaping earth system processes (Crutzen and Stoermer 2000). The crux of their argument was that the Holocene gave way to the Anthropocene around the time of James Watt’s invention of the steam engine (1784), leading to the rapid rise of atmospheric concentrations of greenhouse gases. Since 2000, the notion of the Anthropocene has been used as both an empirical argument and a framework for thinking about environmental change (Robbins and Moore 2013). Here I emphasize how social scientists (primarily in nature-society geography, STS, and cognate fields) have understood the present epoch as a time of both change and continuity.
The Anthropocene is the age of people, to be sure, but it is also the age of novel ecologies, no-analog states, nonlinearity, and non-equilibrium systems—all concepts that challenge common conceptions of the biophysical world as stable, predictable, and balanced. As such, the Anthropocene has come to refer not only to an age dominated by human activity, but also to broader scientific models of earth systems—from the scale of the genome to the globe—as emergent, provisional, and open. For example, in their discussion of writing multispecies ethnographies in the Anthropocene, Kirksey and Helmreich (2010) state that “what counts as living, working, and communicating are under radical revision in the biosciences” (p. 548). And indeed what counts as conservation is also under radical revision. The restoration of the American chestnut—and the broader emergence of de-extinction within the conservation agenda—is emblematic of this ostensible openness of the Anthropocene, a time where uncertainty frames action as a moral obligation yet leaves the specifics of that action up for debate (Dalby 2011).

It is in the context of the Anthropocene that environmental sociologist and STS scholar Matthias Gross (2010) has written about science, restoration, and ecological design. Gross details the role of ignorance and surprise in science and ecology, integrating them within the idea of the experiment. He argues that scientific developments in the ecological and life sciences have not led to greater certainty and control but instead have amplified ignorance and unexpected dynamics, not least because “new knowledge creates new options without delivering secure criteria for handling them” (Gross 2010, p. 5). For Gross, experiments in ecological restoration and design
serve as a productive response to this situation, allowing society to venture into the
unknown while recognizing that scientific knowledge is not—and can never be—free of
uncertainty. It is in this context of an experimental Anthropocene that new conservation
practices like de-extinction, re-wilding, assisted migration, probiotics for endangered
species, and designer ecosystems, among others, have emerged as possibilities. Such
projects are embedded within an [incomplete] shift in scientific culture away from using
the past as a prescription and toward the idea of an unpredictable future full of “yet-to-be
explored possibility” (Paxson and Helmreich 2014, p. 3).

When these ideas of uncertainty, surprise and ignorance are brought into
corverstation with biopower and biopolitics, we begin to see how the Anthropocene both
justifies and challenges existing modes of biopower. On one hand, it encourages
biopolitical strategies of risk management, insurance, networks fighting networks, and
interventions into species’ genomes, yet on the other hand it suggests that the target of
management—the biohuman itself—is itself also a potential threat to life (Dalby 2013).
Further though, Yusoff (2013) writes that “the nomination of the Anthropocene institutes
a reminder that the biopolitics of life has a more expansive mineralogical geography that
needs attention” (p. 780). While this research on chestnut restoration is not particularly
mineralogical, it does issue a broader corollary to Yusoff’s point: the politics of life are
not limited to the biohuman but involve a wide array of organisms and materialities. In
addition, the Anthropocene suggests that restoration and de-extinction—drawing on
Gross (2010)—are by no means reversions to a previous time but are instead biopolitical
experiments through which nature and science are continually reshaped in ways that are
never fully controllable: “it is not that life has been totally integrated into techniques that govern and administer it; it constantly escapes them” (Foucault 1990, p. 143).

Race and nature

The final piece that I bring to this framework is in some ways the most crucial, in that it is a significant departure from the majority of work on nature, science, and biopolitics. By linking biopolitical notions of race and racism with racial formation and ideas about race and nature, I am able to consider how chestnut restoration structures and is structured by racial formations and logics, and more broadly how nature and race are articulated together within discourses about landscapes, nation, and identity. This inclusion serves the dissertation in two ways: first, by explicitly connecting ecological and biopolitical logics of biodiversity, purity, and death with racial logics of difference (as seen in chapter two), and second, by exploring how chestnut restoration is shaped by ideas of American exceptionalism, white national heritage, and Appalachia as both racially ideal and inferior (a task I begin in chapter five).

Foucault (2003) invokes race as a biopolitical technology for distinguishing between advantageous life, which should be maximized or made to live, and threatening life, which must be diminished or allowed to die. Death is brought into the fold as a means to foster life: “the enemies who have to be done away with are not adversaries in the political sense of the term; they are threats, either external or internal, to the population and for the population” (Foucault 2003, p. 256). This process of differentiating between threats and advantages involves the activation of racism as a way
to “fragment the field of the biological that power controls” (2003, p. 255). Racism therefore operates in an evolutionary sense, allowing and necessitating the death of some in order to improve, strengthen, or purify the whole of life. These ideas have been expanded on by Ladelle McWhorter (2009), who, in her genealogy of race, uses biopolitics to argue that contemporary racism is not reducible to issues of skin color but also encompasses broader concerns with biological abnormality—understood in a Foucauldian sense as threats to the norm. Evolution as a science was and remains central to the development of new forms of state racism that aimed to protect and promote the native body politic while eliminating or reducing threats. This sets the stage for the first way race enters this research: through attention to differentiation among nonhuman life and the mutual constitution of ideas of race and abnormality, ecological science, and the biophysical world.

In concert with this biopolitical perspective, work on race and nature also provides a lens through which to consider how chestnut restoration is racialized and why it matters: it seeks to intervene in and improve a species but also a region and even a nation, working at least in part through “logics of racial difference” (Moore et al. 2003, p. 22). This perspective is implicitly rooted in racial formation, which refers to the dynamics by which racial categories are shaped through social, economic, and political forces, and in turn how these categories then shape racial meanings in U.S. society (Omi and Winant 1994). This perspective understands race as unstable and socially defined yet pervasive. Along these lines, Moore et al. (2003) demonstrate how nature becomes
articulated with race and nation, and how they together work to reproduce particular social arrangements, racial meanings, and truth narratives.

Two other examples from nature-society research that link race and nature are Mansfield’s (2003) discussion catfish imported to the U.S. from Asia and McCarthy and Hague’s (2004) analysis of the cultural politics of claims to Celtic identity in the American West. Mansfield (2003) makes connections between the biophysical world, nation, and race in showing how catfish from Vietnam’s Mekong River are represented as dirty, inferior, and impure in contrast to the supposedly clean and pure catfish from the Mississippi Delta. McCarthy and Hague (2004) mobilize ideas about race in a different way, exploring how the Wise Use movement in the U.S was racialized as rural whites laid claim to a racial identity in their efforts to gain control over natural resources. I call attention to these two examples specifically because they demonstrate first that distinctions about nature are fundamentally racialized, and second that nature itself plays a key role in the construction of racial identities and meanings.

Like the Wise Use movement and the catfish industry, the American chestnut and its native range are “a vast terrain for the exercise of power” (Moore et al. 2003, p. 1). Nature, nation, and race come together most visibly through the nationalities assumed by the native American chestnut tree and its invasive East Asian enemy, but they also converge around questions about who should be the proper citizen subjects of this nature, and what troubled landscapes and populations (both human and nonhuman) are to be improved through restoration. The movement relies on making distinctions between ‘strong’ trees that exhibit blight resistance and ‘weak’ trees that succumb to the blight,
but it also relies on the notion that the tree needs to be ‘American’—it needs both to possess the familiar aesthetics of the American species and to evoke specific memories and images in the minds of its fellow countrymen. Further, though, the restoration effort is racialized through social technologies which “make people into subjects of… nature. Individuals come to recognize themselves as embodiments of racial essence and natives of particular landscapes” (Moore et al. 2003, p. 16). Along these lines, I consider who the proper citizens of the chestnut seem to be and how restoration is tied to Appalachia’s historical identity as a region that is simultaneously both the national ideal and a depraved inferior, suggesting that the privilege to make live—to establish a certain nature as a ‘national nature’—is fundamentally related to racial formations of whiteness.

Theorizing restoration as making life live

The central argument of this dissertation is that the production and restoration of the American chestnut are deeply biopolitical and racialized projects—in contrast to apolitical accounts of ecological restoration as a process by which ecosystems are returned to an ideal natural state. Augmenting a lens of Foucaudian biopower with additional ideas about race, nature, science, and the Anthropocene, I demonstrate that the remaking of the American chestnut reflects the messy biopolitics of knowing, protecting, and producing nature in a time of uncertainty and surprise. This perspective responds to critiques in STS and nature-society geography about a lack of attention to the politics of material productions of nature/science, in part by thinking through how race and racial formation are implicated in the practices and discourses of ecological restoration. Even
more significantly, this dissertation contributes to the literature on biopower sustained attention to nature and ecological science as key sites through which the politics of life and death are constituted. I now turn to the story of the chestnut itself, providing an overview of the ecology of the species, its cultural and economic importance, impacts of the chestnut blight, and efforts toward restoration. In so doing I highlight what it is about the American chestnut in particular that makes it ideal for asking and answering questions about the ways in which nature, race, and science come together in making life live.

**Social and ecological history of the American chestnut**

American chestnuts are often extolled for their ecological dominance in pre-blight forests of eastern North America, held up as a superior competitor and climax canopy species. Yet this dominance was itself a relational achievement, a product of the interactions of Native American and early Euro-American settlers with the landscape. Studies of chestnut pollen abundance, for example, indicate that Native Americans encouraged chestnut sprouting and establishment in the southern Appalachians through the use of fire (Delcourt and Delcourt 1997). The species became even more dominant following European settlement (Brugham 1978; Paillet 2002), in part through the spouting of chestnuts in cut-over forests, but also as settlers deliberately planted trees and tended chestnut orchards in the forest (Zon 1904; Ashe 1911; Russell 1987; Lutts 2004).

While chestnuts grew from Maine to Georgia and west toward the Mississippi River, they were largest and most abundant in mid-elevation Appalachian forests from
Pennsylvania to Georgia (Ashe 1911; Russell 1987), reaching heights of over 120 feet (Buttrick 1925; Anagnostakis 1987) (Figure 2). The species is known for its ability to grow on rocky ridges, but also thrived on hillsides, in mid-elevation coves, and at lower elevations in the northern extent of the range. They often dominated on marginal agricultural lands and particularly in soils too sandy or acidic for farming, although growth was limited in areas with high clay or lime content (Ashe 1911; Buttrick 1915; Detwiler 1915; Russell 1987). At times chestnuts grew in nearly single-species stands (particularly in deliberately managed chestnut groves), but they also were commonly found alongside various types of oak, red maple, and tulip poplar (Schibig et al. 2005).

Contrary to popular belief, chestnut populations were already in decline in the southern part of the range prior to the onslaught of the blight. The species’ range had previously extended well into the Piedmont, but by the mid- to late nineteenth century the range was contracting because of widespread infection with *Phytophthora cinnamomi*, a fungus that causes root rot. By the turn of the twentieth century, the *Phytophthora* fungus had infected and killed nearly all American chestnuts growing in the Piedmont regions of Virginia, the Carolinas, and Georgia (Russell 1987). Unlike the blight fungus, which kills the tree’s aboveground mass but leaves its roots intact and alive, *Phytophthora* attacks and kills the tree from the roots upward, leaving no possibility of regeneration. Trees killed by the chestnut blight, conversely, reliably resprout from the still-living roots.¹

¹ At a site on Roan Mountain in northeast Tennessee, Ashe (1911) observed that 99% of chestnut stumps between three and five feet in diameter showed evidence of resprouting.
Thus, while the blight is a significant problem, restorationists also fear *Phytophthora*, and indeed some are even working to breed chestnuts that resist both types of fungi. This is especially important given the unpredictable realities of global climate change.

*Phytophthora* has traditionally only been a problem in the southern U.S., but scientists believe that the range has been increasing over the past several decades, likely due to warmer winters in the northeastern U.S. A Regional Science Coordinator with TACF explained, “The furthest north I know of it is central Maryland, but I have no doubt it will
soon cross the Pennsylvania border. Things are moving north, and it’s not just tree species—it’s pathogens, too” (Author interview 2012).

In a changing world, the blight fungus is just one of many threats that restorationists must counteract or control. Beyond blight and *Phytophthora*, chestnuts are also susceptible to severe damage from Ambrosia beetle and chestnut gall wasp, both of which were accidentally introduced to the U.S. from East Asia in the latter decades of the twentieth century (Rieske and Cooper 2011). Ambrosia beetle is particularly disconcerting for restorationists as it often kills young trees, and the current method of control (the chemical Permethrin) is resource-intensive and a potentially hazardous neurotoxin. While efforts to breed trees that are blight resistant have been relatively successful thus far, these other threats are increasingly of concern. As one TACF member expressed: “With Ambrosia beetle, gall wasps, and *Phytophthora*, who has time to worry about the blight?!?” (Author interview, 2012)

*Economic and cultural importance*

The chestnut was not only ecologically important but also economically and culturally important in early America. Its straight, rot-resistant wood was used for split-rail fences, railroad ties, telephone poles, furniture, instruments, veneer, and log homes and barns. Most of the chestnuts felled for these uses came from Appalachian forests; southern Appalachia (Tennessee, North Carolina, Georgia, and Virginia) supplied over 55% of the nation’s chestnut lumber in the early 1900s (Buttrick 1915). Chestnut timber also represented a significant part of the regional economy; in 1912, the estimated value
of standing chestnut timber in just three states (Pennsylvania, North Carolina, and West Virginia) totaled over $82.5 million (Anagnostakis 1987). In Tennessee alone Ashe (1911) estimated that the chestnut generated $1.6 million annually.

The tree was also used in the production of tannins for leather making; as of 1920, more than 25 chestnut extract plants were operating across six states: Tennessee, North Carolina, Kentucky, Pennsylvania, West Virginia, and Virginia (U.S. Tariff Commission 1921). At the plants, tannic acid was extracted from chestnut wood chips and then sold to tanneries within the U.S. or exported to Europe. Often the remaining wood chips would then be used to make pulp for paper production in a process called “double dipping” (Owen 2005). When the chestnut blight occurred, it initially resulted in an economic boom for the chestnut extract industry, as there were huge numbers of dead or dying trees that had to be removed and used immediately. This boom, however, was rapidly followed by bust and most extract plants had ceased operations by 1950 (Owen 2005).

As a prolific hard mast producer, the chestnut served as a food source for livestock, wildlife, and people. The nuts were so valued in the forests of the Blue Ridge that settlers thinned undergrowth and selectively cleared other trees to produce stands of pure chestnut that functioned as orchards (Lutts 2004). Though privately owned, mountain forests were effectively treated as common property in much of Appalachia, where animals ranged and people collected nuts and other commodities for personal consumption, trade, or sale. As transportation networks gradually reached rural Appalachia in the early twentieth century, chestnuts became a source of cash income for semi-subsistence farmers, many of whom collected nuts from the “chestnut commons”
and traded or sold them to merchants who would transport the nuts to urban centers in the Northeast (Lutts 2004). Yet even as railroad and road networks enabled such an economy, they also materially threatened it. As mountain forests became more accessible, logging and mining companies acquired and rapidly cleared large tracts of land, thereby initiating the enclosure of the de-facto commons in many areas. The final end of the chestnut commons, however, would occur with the arrival of the chestnut blight (Lutts 2004).

Arrival of blight

The blight was first observed in the U.S. in 1904 when a stand of chestnuts in the native forests exhibit at the New York Zoological Park started displaying symptoms of infection: yellowish-orange bark cankers, wilting leaves, and dying branches. Initially foresters were stymied by the infections, but in 1905 mycologist William Murrill isolated the fungus and tested its impact by inoculating healthy chestnut saplings and observing the results (Freinkel 2009). But although the fungus had been identified, there was no cure or treatment for blighted trees. Dispersed by wind, insects, mammals and people, fungal spores infect trees by entering through small, often invisible wounds in the bark. As the infection grows, it girdles the tree and cuts off any circulation of nutrients and fluids beyond the canker. Infected branches can die within weeks and entire trees within a few years (Anagnostakis 1987).

Despite the best attempts of Murrill and others, the blight spread at a rate of up to 600% per year throughout the chestnut’s range from southern Maine to Georgia and west
toward the Mississippi River (Lutts 2004). Cicada outbreaks in the 1910s may have hastened its spread, as spores could easily enter trees through holes in the bark that cicadas make when they deposit their eggs (Lutts 2004). In addition, the blight likely benefitted from the new infrastructural connections between Appalachian forests and urban centers of the Northeast and Mid-Atlantic, as blighted wood was transported by railroads, leading to new centers of infection. By 1929 nearly all chestnuts in the Great Smoky Mountains were infected, and a decade later 85% were dead (Lutts 2004). By 1950, the blight had driven the species to near-extinction, leaving only a few scattered standing dead “ghost trees” where four billion giants once stood (Keever 1953).

**Cultural and economic impacts of blight**

The blight was a “social and economic disaster for mountain communities” (Lutts 2004), though not all people and not all communities were impacted uniformly. In southwestern Virginia, the blight arguably destroyed the semi-subistence economy and forced rural residents into wage labor. Not only did the blight signify a loss in food and direct income for farmers, it also made the raising of hogs more expensive and difficult. Previously hogs had free-ranged on in chestnut forests, but now farmers were required to purchase feed for their animals as other nut crops were not sufficiently abundant or nutritious (Lutts 2004).

In other parts of Appalachia the damage to the timber and chestnut extract industries were as significant as the loss of nuts. In western North Carolina, many farmers became wage laborers in the 1930s and 1940s as a large temporary workforce was needed
to clear and process blighted chestnuts (Lord 2004). But very quickly the industry collapsed; there were no more chestnuts to exploit. In 1951, Champion Fibre Company of Canton, North Carolina closed their extract plant, citing the blight as the reason:

The end of the story has been written not by choice but by necessity. More than a decade ago a blight attacked and killed the chestnut trees. Since then Champion’s Extract unit has continued to utilize the dead trunks that stood throughout the mountains like so many monuments to the past glory of the chestnut. (quoted in Lord 2004, p. 37)

William Banks, a western North Carolina man who worked alongside his father in the lumber business in the early to mid-1900s, recalled searching the hillsides for remaining chestnut wood in the years following World War II. He wrote that “the upbringing and education of our children were anchored on [the chestnut timber industry]” and that “the loss of the chestnut was the greatest tragedy that ever occurred in the Appalachian Range” (Banks 2005, p. 20). The blight not only contributed to economic distress in the region but also fundamentally altered many people’s relationships to and views of the forest landscape. Banks, for example, equated the blight with a sense of hopelessness and futility:

As I watched its demise with dismay in my early life, it created a mental image of the delicacy of our forests that has never faded. That image is as bright today as it was in my youth. And it grows year by year, as I see sprouts of chestnut spring from an old stump, only to grow a few years and then die. (2005, p. 20).

Beyond its direct effects on communities, the blight also served as a tangible representation of broader changes in rural Appalachia and America in the early-to-mid twentieth century, including industrialization, out-migration, and increased poverty. The tree’s demise is often told as part of the narrative of the downfall of rural Appalachian subsistence life. In some cases, the chestnut and its blight are even suggested as both
cause and potential solution for social, economic, and environmental problems that continue to plague Appalachia. As historian Ralph Lutts (2004) writes, “It may be that the gut-wrenching experience of the death of the American chestnut stands in memory for an entire framework of social and economic change” (p. 517).

Appalachian forests post-blight

The blight also dramatically impacted the structure, composition, and function of chestnut forests. Large woody debris from dead trees immediately increased in streambeds, with negative consequences for aquatic invertebrate and fish populations (Ellison et al. 2005). A decline in cavity nesting birds also occurred. On a longer time scale, the blight fundamentally altered nutrient cycling and decomposition rates, leading to larger amounts of leaf litter deposited on the forest floor (Ellison et al. 2005). Such a seemingly small change has profound consequences for the ways forests respond to climate and may be linked to the recent increase in mesic species like maple and beech in Appalachian forests. As chestnuts died, other species ascended to dominance, specifically chestnut oak, Northern red oak, white oak, and hickories, though these changes varied by microclimate and site conditions (Keever 1953; McCormick and Platt 1989; Elliott and Swank 2008). Currently, however, many oak-hickory forests that succeeded oak-chestnut forests appear to be gradually shifting to maple-beech forests (i.e. mesophication) (McEwan et al. 2011). In short, the post-blight forests of the eastern U.S. have changed, and continue to change, in often unexpected ways. Despite forecasts of forest loss and timber crises, Appalachian forests have regrown on both public and private land since the
early to mid-twentieth century, and wildlife populations that were at or near their nadir post-blight have also rebounded (e.g. black bear and white-tailed deer). Hence the landscape that the chestnut will be returned to is fundamentally different from the landscape of its former dominance.

The regrowth of forests has attracted rural population growth in some parts of Appalachia, as often-environmentally-minded amenity migrants head, quite literally, for the hills (Jones et al. 2003; Gosnell and Abrams 2009). But although the region’s forests have regrown and wildlife has returned, there are still many threats to Appalachian forests and the ecosystem services they provide, including both native and invasive pests and pathogens, climate change, both wildfires and fire suppression, coal mining, natural gas extraction, and exurban development. Importantly, the chestnut is often presented in terms of the ecosystem services the species provided in the past as well as those it might potentially provide in the future, if restored. These include the provisioning of timber, food for wildlife and people, habitat, and biomass as a form of renewable energy, regulatory functions such as carbon sequestration and erosion control on mined land, and cultural services such as recreation, educational opportunities, and preservation of heritage. In this way the species is put forth as at least a partial solution to Appalachia’s economic and environmental troubles. If the loss of the chestnut signified poverty, out-migration, environmental degradation, and inequality, its restoration has come to symbolize the regreening of Appalachian forests and the recapturing of lost ecosystem services.
**Restoring the chestnut**

Chestnut restoration is close at hand. TACF has bred apparently blight resistant trees and is gradually planting them at strategic sites throughout the species’ native range. Meanwhile the New York state chapter of TACF has successfully produced transgenic chestnuts that also appear to resist the blight. These trees are currently being tested and must pass through a regulatory approval process before being widely planted. Forest pathologists are continuing to experiment with hypovirulence, a technique that involves infecting the blight fungus with a virus to weaken it, which has been fairly successful in Europe, where the blight affects European chestnut (Castanea sativa) trees. Finally, efforts are also underway to breed large surviving American chestnuts to retain and improve the blight resistance of the few remaining individuals. In the next several pages, I introduce the different techniques used in chestnut restoration, demonstrating that the organisms and relations that are being fostered through this restoration project are fundamentally novel—even as they are designed to be historic. Here, making life live does not mean safeguarding and protecting a pre-existing life but rather involves fundamentally re-shaping life.

*The American Chestnut Foundation (TACF)’s backcross breeding program*

In the decades immediately following the discovery of the blight, the U.S. Department of Agriculture (USDA) and collaborators engaged in experimental breeding and planting of chestnuts, with the goal of finding or producing a blight-resistant chestnut by crossing the American chestnut with the Japanese chestnut (Castanea crenata),
Chinese chestnut, European chestnut, and the Allegheny chinkapin (*Castanea pumila*). But after roughly thirty years of unsuccessful attempts, the USDA eliminated funding for chestnut research in the 1950s, and most foresters and breeders abandoned the notion of a blight-resistant chestnut. Around 1980, University of Minnesota plant geneticist Charles Burnham revived this goal and proposed the use of a crop breeding technique known as backcross breeding to produce a blight-resistant chestnut (Willeke 2013). Burnham believed that by repeatedly backcrossing the American chestnut with the naturally blight-resistant Chinese chestnut, breeders could produce a blight-resistant chestnut with all of the other characteristics of the American species.

In 1981 Burnham and collaborators officially founded The American Chestnut Foundation (TACF), and in 1989 they established their first breeding orchard on the Wagner farm outside of the town of Meadowview in southwestern Virginia, later expanding to over 150 acres by purchasing nearby farms (Figure 3). Although the founders of the organization estimated that backcross breeding would not be completed until 2040 (Willeke 2013), the first generation of presumably blight-resistant BC$_3$F$_3$s, which are ‘15/16 American’ and ‘1/16 Chinese’, were first successfully bred in 2005. This ‘Restoration Chestnut 1.0’ has been test planted on Appalachian national forest land, land owned by pulp and paper companies, and former minelands, among other sites. The seeds were first accessible to longtime members and donors. As more and more generations of BC$_3$F$_3$ (colloquially called B$_3$F$_3$s) are produced, they have gradually been more widely distributed, although they are not currently allowed to be grown commercially or sold, as per the terms of a hotly-contested Germplasm Agreement that
TACF eventually adopted in 2003. The goals of these initial plantings are to ensure both that the trees can indeed survive infection and that they look and act no differently than the traditional American chestnut species. Ultimately, the objective is to plant blight-resistant chestnuts throughout the tree’s native range to re-establish it as a dominant canopy species.

Figure 3: TACF's Glenn C. Price Research Farm in Meadowview, Virginia (picture courtesy of Virginia chapter, www.vatacf.org)
**TACF-NY’s genetic transformation program**

While TACF as a whole is committed to using backcross breeding to save the species, the New York state chapter of TACF (TACF-NY) is using biotechnology to produce a blight-resistant transgenic chestnut. This approach has received lukewarm reception from national foundation leaders, in part because it is controversial and seemingly less natural (Freinkel 2009), but in recent years TACF and TACF-NY have begun to collaborate to a greater degree. At the 2013 TACF Annual Meeting, for example, current TACF President Bryan Burhans emphasized that as in war, every tool must be used, including genetic transformation technologies. Similarly, State University of New York College of Environmental Science and Forestry (SUNY-ESF) researcher Dr. Bill Powell (affiliated with TACF-NY) stated that biotechnology and breeding are like a fork and knife—two different tools that can work together toward a single aim.

Like backcross breeding, the genetic transformation approach has taken decades to achieve desirable results. While the technology allows rapid genetic modification of the chestnut genome, the methods involved are complex and have required extensive experimentation. As of 2013, transgenic chestnuts have been successfully produced using genes from a variety of sources, most notably a gene from wheat that induces blight resistance. Supporters of this approach herald it as an “noble cause for transgenic trees,” and emphasize that the genetic engineering of “heritage trees” like the American chestnut should be well-received by the public and regulatory agencies because it is motivated by “restoration rather than commercial profit” (Merkle et al. 2006, p. 116). While it is not yet certain that the transgenic chestnuts will indeed be both blight-resistant and
ecologically competitive, the trees are already being paraded as an example of the successful and safe use of genetic and genomic technologies for reviving extinct species (e.g. Powell 2013).

_Hypovirulence: virus versus fungus_

The third main approach to American chestnut restoration targets the blight fungus rather than the tree itself. Instead of attempting to increase the resistance of the tree, hypovirulence involves infecting the blight fungus with a virus that weakens it such that the tree can survive infection. Hypovirulence was initially discovered in Europe, where it was applied as a mass treatment for European populations. Despite its success in Europe, hypovirulence has been more difficult to achieve for American chestnuts. Because viruses spread fairly slowly throughout the fungal population, the blight fungus has been able to evolve in response. This remains a vital area of research for many plant pathologists, and although hypovirulence has not yet been successful in controlling the blight, it has effectively slowed infection in some isolated chestnut stands outside the species’ native range (MacDonald and Double 2005).

_American Chestnut Cooperators’ Foundation (ACCF): pure American chestnuts_

A second non-profit organization, the American Chestnut Cooperators’ Foundation (ACCF), is working to develop a blight-resistant all-American chestnut using traditional plant breeding techniques. Founded by researchers at Virginia Polytechnic Institute and State University (Virginia Tech), the ACCF has focused on identifying
sources of resistance from large surviving American chestnuts (LSAs). In other words, this group favors a pure American chestnut that does not include any genetic material from other species. The small number of survivors has limited ACCF’s success, although their identification of American trees that exhibit some degree of blight resistance may prove useful in backcross breeding as well.

**Research strategy and methods**

Looking at chestnut restoration through a framework inspired by biopolitics, nature-society geography, and STS, makes possible a series of arguments regarding the construction of scientific knowledge, the production of racialized natures, and the complexities of conservation in the recombinant, biopolitical, and unpredictable Anthropocene. In this introduction I connect these themes under the broad argument that chestnut restoration is a profoundly racialized and biopolitical endeavor, in which making a species live ultimately means producing it anew.

This work necessitates a strategy that addresses the messy relations within and between species without recourse to totalizing explanations or mere description. As demonstrated by the varied ways in which the chestnut is being materially altered, the species itself is not a fixed or coherent entity but rather a gathering together of multiple realities. Geographers working under similar assumptions have used a variety of research strategies, including interviews, ethnography, participatory action research (PAR), participant observation, and ecological field methods, to better understand nature-society relations. Although these methods are often associated with particular worldviews, they
do not necessarily have built-in ontological principles. Both interviews and soil sampling, for example, can be performed and communicated in ways that map onto theoretical frameworks as divergent as critical realism and feminist post-structuralism.

This perspective on research methods is informed by critical physical geography, an emerging field of environmental research that explicitly engages with methods and theories derived from both human and physical geography (Lave et al. 2014). While this dissertation is not necessarily a critical physical geographic work, it has required that I participate in a number of scientific endeavors, among them collecting data on chestnut abundance along the Appalachian Trail and planting male-sterile chestnuts in Ohio’s Dysart Woods. I do not attempt to present and interpret actual data on chestnut growth and ecology from these experiences; I do, however, consider these experiences data in themselves, and I link my participation in scientific research with more common ethnographic methods of interviews, participant observation, and analysis of archival documents. In so doing I seek to appreciate the multiplicity of social and ecological relations represented by the chestnut in its different forms, as well as the “pluralization of causes” for the chestnut’s restoration (Foucault 2000, p. 227).

**Semi-structured interviews**

Between 2010 and 2013 I performed semi-structured interviews with 58 individuals. The purpose of these interviews was to move beyond totalizing discourses about chestnut restoration by generating evidence regarding the many actors, practices, representations, and material outcomes involved with restoring the American chestnut. I
therefore selected a variety of interview subjects, among them plant geneticists, ecologists, and pathologists, restoration volunteers, donors, foresters, land managers, TACF staff members, recreationists, landowners, longtime Appalachian residents, and newer migrants to the region. I made connections with subjects at TACF meetings, by blind emails, and through the recommendations of prior interview subjects. Not all interview subjects were TACF members or specifically involved in chestnut restoration. The goal here was not to obtain representative samples of particular groups but rather to grasp the spectrum of views on the chestnut’s restoration and to begin to evaluate the consequences associated with particular modes of restoration (e.g. genetic modification versus backcross breeding). This approach to interviews connects directly with the idea, widely accepted in STS and poststructuralist political ecology, that multiple truths exist, compete with, and complement each other. Rather than seeking out common themes in order to make a single generalization about how and why the chestnut is being restored, this research instead purposefully seeks out both discrepancies and similarities between interviewees.

I did not follow the same format for all interviews; rather, I tailored questions to particular individuals and allowed interview subjects to dictate the direction of the conversation when appropriate. In interviewing TACF staff, for example, I asked numerous questions about the organization’s past and present challenges, while I often focused more broadly on environmental issues when interviewing landowners and community members who were not necessarily directly involved in restoration. The lengths of interviews also varied tremendously. I spent less than thirty minutes with some
individuals and multiple days with others. Interviews were audio recorded, transcribed and analyzed to determine key themes. Although I rely on evidence (i.e. quotes) from interviews to varying degrees in each of the four substantive chapters, the dissertation as a whole is implicitly informed by these in-depth conversations around chestnut restoration.

Participant observation

Although interviews provide information about what a range of actors think and say about chestnut restoration, they do not provide direct evidence of material practices and outcomes. Therefore, this research coupled participant observation with interviews to explore the connections and contradictions between discourse and practice, and to understand the specific everyday processes by which chestnuts are transformed and restored. I performed participant observation in a variety of settings in seven states (New York, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia). My experiences ranged from attending TACF meetings to observing biotechnology laboratory practices to touring chestnut breeding orchards (Appendix A). I selected sites for participant observation based on information received from several e-mail listservs related to chestnut restoration and events publicized on the TACF website. I became a dues-paying member of TACF in 2010; as a member I receive frequent email and mail updates from the organization about upcoming events. Being a member also allowed me reasonable access to other members and gave me credibility when communicating with TACF scientists and staff.
Beyond these formal attempts at participant observation, I also spent time in several rural Appalachian communities, frequented area businesses, and conversed informally with area residents and tourists. By relying on the “spontaneity of everyday interactions” (Gesler and Kearns 2001, p. 40), I was able to develop more nuanced understandings of the role of the American chestnut in Appalachian and American culture and of broader social and environmental change in Appalachia. As Lorraine Dowler (2001) claims, “If quantitative methods imply detachment and minimal knowledge of individual subjects, then participant observation implies attachment, involvement, and intense contact with them” (p. 157). I found this to be particularly true in the chestnut community—and it is indeed a close-knit community. Restoration meetings often double as potlucks, and the same core group is present at a variety of TACF events. It was a pleasure to join the chestnut community, yet I also found it challenging to simultaneously take part in and critique restoration practices. Ultimately, however, this role allowed me entrance into the restoration world, introduced me to individuals I would not have met otherwise, and provided insights that I could not or would not have come up with on my own.

Archival and documentary analysis

In addition to interviews and participant observation, I also analyzed key texts related to chestnut blight, breeding, and restoration and conservation and restoration science more broadly. Building on Fairclough’s (2003) notion of texts as “elements of social events” and Foucault’s (1980) ideas about discourse and truth-telling, I consider
these texts as infused with social relations and constitutive of multiple, often conflicting, social structures and power/knowledge formations. I am interested both in the specific messages put forth by texts and the processes by which particular discourses gain power and are designated normal, natural, and true (Foucault 1990, 2008). Further, I consider all texts in relation to their broader social context: this includes attention to the relationships among texts (intertextuality) as well as the relationship between particular texts and other social, political, or ecological circumstances.

I draw on evidence from historical documents as well as more recent texts. The third chapter of this dissertation, for example, relies heavily on documents produced and published around the time of the initial blight infection in the early 1900s. These include publications and reports of the USDA, the Federal Horticultural Board, the Pennsylvania Chestnut Tree Blight Commission, the American Breeding Association, and the American Genetic Association. These resources are used to dissect the historical and national identity associated with the American chestnut, under the assumption that archival documents—and particularly those associated with or produced by the state—are not politically neutral but instead actively shape the meaning(s) and heritage of the nation (Hannam 2002). I also analyzed daily newspapers from both past and present to better understand how the chestnut blight and the tree’s restoration have been perceived and portrayed in different places and times.

More recently produced texts that I draw from include: meeting minutes of TACF, organizational newsletters and publications, oral histories collected by TACF, and scientific publications on the American chestnut and conservation and restoration
science. Importantly, these documents are used for two ostensibly incongruous purposes: first, to gain a clear and precise (“factual”) understanding of the trajectory of the chestnut blight and restoration, and second, to interrogate the claims put forth by the texts and unpack the social relations they communicate and produce.

**A species in motion**

By putting data from interviews, participant observation, and archival documents in conversation with each other, I attempt to set the American chestnut into motion, considering it not as a fixed and coherent entity but instead as a gathering together of a multitude of meanings and materialities. These methods address both the material and discursive work performed through chestnut restoration, typical of the recent trend in poststructural research toward exploring both representation and practice, or what Lorimer (2005) has referred to as more-than-representational. The methods used here complement one another in that they allow for connections between broad narratives, such as the idea that the chestnut will improve Appalachian forests and economies, and more specific material practices, such as the planting of chestnuts on former strip mines and the stakeholders involved in the process. The intent therefore is to seek out *lateral connections* (Foucault 1998) between chestnut restoration practices and broader discourses, such as those about race, nature, purity, and Appalachian identity.

At the same time, however, some discourses and practices associated with chestnut restoration conflict, problematizing the idea that discourse and practice map directly onto one another. The chestnut’s revival is a result of *both* connections and
contradictions, and thus it is imperative to allow frictions to emerge. I use the term friction here to describe the general idea of tension or discord as well as the more specific particularities, differences, and contingencies that enable or empower certain material realities while altering or excluding others (Tsing 2005). In considering such frictions, this research recognizes that multiple outcomes are produced as chestnut restoration articulates unevenly across space, time, and axes of difference (race, class, regional identity, etc.)

Here, contradictions in findings do not undermine research results as they might in a research design based on triangulation, but are instead important results themselves (Elwood 2010). For example, by interviewing actors involved with genetic modification and considering who might benefit from a transgenic chestnut, one might conclude that the chestnut restoration effort is merely a publicity ploy or accumulation tactic for biotechnology corporations and the pulp and paper industry. And while this may indeed be part of the story, studying chestnuts in other settings, such as trees planted at a 9/11 memorial, challenges this totalizing explanation and begs a more nuanced understanding of the reasons for and consequences of restoration.

In sum, the goal of this research design is not to identify a single cause or consequence or dominant discourse of chestnut restoration. Rather, it is to seek out multiple explanations for and consequences of the re-animation of this storied species. In so doing this dissertation provides a detailed—though partial—account of the scientific practices, lived experiences, material outcomes, and underlying logics associated with
one seemingly straightforward production of nature: the messy, racialized, and biopolitical process of making the American chestnut live.

**Dissertation structure**

Following this introduction, chapter two expands in scope to examine modern conservation science as a biopolitical project. Drawing on Foucauldian biopower, I re-narrate the development of conservation science in the U.S. as a form of liberal biopolitical rule. With its emphasis on making nature live, conservation marks a shift away from a sovereign form of rule that emphasized subduing and controlling nature; today, nature is ruled not by the sword but by science. This chapter argues that conservation is biopolitical not just in that it moves from controlling individuals to statistically managing populations and species, but also in that it extends the racialized logic of abnormality in its core notions of biological diversity and purity. Using backcross breeding of the chestnut as an example, I show how nonhuman populations are intervened in, secured, and optimized toward the aim of biodiversity conservation.

In the third chapter, I further explore the connection between the management of nature and the governance of human populations. Using archival evidence, I show that the America evoked through early twentieth century discourses about the chestnut blight portrayed a nation at risk of erosion and contamination, a nation that required the weeding out of the undesirable to protect and promote its native nature and citizenry. This logic resurfaces in today’s chestnut movement, as exemplified in the Plant a Tree at Flight 93 project. The key argument of the chapter is that blight eradication and chestnut
restoration are as much about defending the nation state and shaping people into desirable citizens as they are about ecological improvement. Making nature live, in the case of the chestnut, was and remains a deeply nationalistic project.

While chapter three focuses on the history of the chestnut and its implications in the present, chapter four demonstrates that de-extinction is messy, heterogeneous, and biopolitical. Through an analysis of scientific knowledge-practices around backcross breeding and genetic transformation, I identify key areas of tension that animate ecological science in the Anthropocene. Without recourse to a pure and unadulterated nature, scientists and restorationists have come to negotiate the terms of chestnut restoration along new lines, and particularly around issues of: (1) ‘health’ in the wake of emergent threats, (2) the transformative role of science and challenges to objectivity and authority, and (3) competing genetic knowledge-practices. This messiness is emblematic of the complex and contested process of de-extinction in Anthropocene, a time in which science and conservation are increasingly future-oriented and open to multiple possibilities, yet remain gripped by concepts, norms, and practices established around a pre-given nature.

The fifth and last substantive chapter explores the restoration of the American chestnut in the specific context of Appalachia, with particular attention to how racialized, place-based imaginaries inflect discourses and practices of restoration, and how narratives about the past are materialized on the landscape through chestnut plantings. Even as ecological restoration turns toward the future—away from historical benchmarks and toward an unpredictable Anthropocene—chestnut restoration remains premised upon
stories about the past—both about Appalachian degradation and isolation and about Appalachia as the pioneer roots of the nation. In this chapter I suggest that chestnut restoration functions as a commemorative act, a nostalgic re-imagining that constructs Appalachia as a landscape of memory for the white American nation, a medium through which discourses about national identity and racial heritage circulate.

The dissertation concludes by bringing together themes from the individual chapters—the contradictions of conservation science, the avenues by which ideas about racial difference come to shape science, the construction of white national natures, and the complexities of restoring nature in the Anthropocene—toward my broader claim: that the restoration of the American chestnut is a biopolitical project in which the species is divided, bred, modified, immunized, and made to live through racialized technologies and discourses. Here I also return to my conceptual framework, underscoring how this research sheds new light on conservation and restoration in the Anthropocene and the dynamic relationship between race, nature, and science.
Chapter 2: Making nature live, letting species die\textsuperscript{2}

“How can the biologist's voice be decisive in conserving biodiversity? We must respond to the crisis as the geneticist has to the challenge of mapping the human genome. We must muster human resources, define goals, develop a set of guidelines, raise funds and work within a tight timetable, rather than lose more ground through indecision.... I realize my challenge is asking the earth of biologists, but it is the biology of the earth, after all, that is at stake.”


As the idea of a biodiversity crisis gained traction in the 1980s and 1990s, the expectations for and of ecologists shifted toward action, prescription, and defense of life. The newfound missions for conservation were to promote life (synonymous with biodiversity), halt or slow extinction, and ensure that particular species continue to live and evolve. In a sense this new mission represented an extension of the preservationist logic at work in the U.S. environmental movement of the early twentieth century, in which discourses about American landscapes increasingly emphasized the protection of nature and the cultural and national importance of unique natural landscapes. Modern conservation science, however, extended this preservationist logic in new directions,

\textsuperscript{2} A version of this chapter was co-authored with Becky Mansfield and published as: Biermann C, and Mansfield B, 2014, “Biodiversity, purity, and death: conservation biology as biopolitics” Environment and Planning D: Society and Space 32(2) 257-273
incorporating the wholesale protection and promotion of the biology of the earth writ large (Western 1992).

This chapter examines modern conservation science through the lens of biopower, which Foucault conceptualized as the power to “make live and let die” (Foucault 2003, p. 241). I posit not just that biopower is a useful analytical tool for understanding governance of human-nonhuman relationships but that failure to understand how nonhuman life has been the object of biopolitical concern risks privileging scientific knowledge and management as purely objective and apolitical—that is, as outside the reach of power. Here, I re-narrate core conservation knowledge, practices, and policies in the U.S. as a form of liberal biopolitical rule. With its emphasis on making nature live, conservation science marks a shift from a sovereign form of rule that emphasized subduing and controlling nature. I focus on key concepts in conservation biology, such as populations, evolution, extinction, and biological diversity and purity, to demonstrate that acts of truth-telling about nature occur within, and are necessarily shaped by, the context of liberal biopolitical rule. By truth-telling I refer not to the discovery of objective facts but rather to the ways in which particular ideas about nature are designated normal, natural, and true through the circulation of scientific discourses (Foucault 1990, 2008).³

In particular, this chapter shows that modern conservation science is shaped by a biopolitical logic that emphasizes distinctions between biological kinds and develops

³ Regimes of truth or veridiction provide rules by which ideas are verified or falsified (Foucault 2008, p. 36), and understanding the conditions under which certain statements are valued as true, as well as the effects of those truths, are key aspects of Foucault’s political critique of knowledge. Here we discuss the ways in which conservation biology’s key concepts, or “rules of the game,” are permeated with a biopolitical logic and sense of urgency that legitimates certain ideas, actors, and actions while rendering false or disempowering others.
Interventions based on these distinctions—a logic that also informs racial, biological distinctions among humans. Ideas of abnormality and normality are produced and reproduced through racial projects, most of which are not racist per se but nonetheless engage in racial signification (Omi and Winant 1994). In other words, biopolitical strategies rely on “logics of racial difference” (Moore et al. 2003, p. 18) to delineate between their target population and others. Even as such sharp biological distinctions (i.e. between races) are called into question when applied to human populations, distinctions between biological kinds are generally deemed both appropriate and scientific when applied to nonhuman populations. Conservation science is literally built upon distinctions between life forms, as it is these distinctions that constitute biodiversity and therefore must be defended and maintained.

In the next section, I review the concept of Foucauldian biopower and discuss emerging scholarship on the biopolitics of nature. I add to this literature an explicit emphasis on racial differentiation and biological aberrance, arguing that understanding the let die part of biopolitics requires greater attention to the categorization of bodies. I then turn to conservation science to consider the underlying biopolitical logic and truth discourses of the field. Expanding on four themes—populations in crisis, evolution and its future orientation, extinction as death that is necessary for life, and diversity as purity—I illustrate key assumptions, concepts, and practices (statistical and material) that work to secure biodiversity. The final section briefly discusses the implications of contemporary conservation’s biopolitical logic, including the continued relevance of sovereign power in biopolitical nature-society relations.
Toward a biopolitics of nature, society, and race

According to Foucault, the emergence of biopower—the power to “make live and let die”—in modern states in the seventeenth and eighteenth centuries marked a gradual and incomplete shift away from sovereign power, or the power to “take life or let live” (Foucault 2003, p. 241). Sovereign power was commonly manifest through the right of seizure: “of things, time, bodies, and ultimately life itself; it culminated in the privilege to seize hold of life in order to suppress it” (1990, p. 136). This authority over life and death—this right to literally seize and suppress life—is justified by the need to defend the sovereign against any and all threats. It can be an “indirect power,” as when the sovereign conscripts subjects to war, thereby “exposing their life” without directly taking it; it can also be a “direct power,” as with state-sanctioned punishment, which can include death (1990, p. 135). Sovereign power continues to exist today, though permeated with new social meanings and justifications. Importantly, sovereign power does not necessitate a ruler in the traditional political sense of the word. The sovereign is also the slave owner (Oberprantacher 2010), the head of the family, and, as demonstrated here, the American pioneer who possesses the “right of the sword” over nature.

Biopower, too, is power over life and death, but while sovereign power is manifest through seizure, biopower attempts to manage, even foster, life itself at both the level of the individual (anatomo-politics) and the level of the population (biopolitics) (Foucault 1990). Anatomo-politics refer to technologies of the self that discipline bodies and behavior; such disciplinary technologies are not imposed upon individuals from
above, but rather arise from complex networks of institutions, discourses, and practices, of which the individual is a key part. Biopolitics refer to the nondisciplinary management of entire populations, nations, or races. Through biopolitics, states began to exert power at the level of the population, using techniques such as statistics on birth and death rates and disease infection rates to establish norms and bring biological life under the purview of law. In *Society Must Be Defended* (2003), Foucault writes, “the new nondisciplinary power is applied not to man-as-body but to the living man, to man-as-living-being; ultimately, if you like, to man-as-species” (p. 242). The point is not that anatomo- and bio-politics are completely separate, indeed they are mutually constitutive (Mansfield 2012a), but that biopolitics is about generalizing rather than individualizing. Human beings are viewed through this lens as a “global mass that is affected by overall processes characteristic of birth, death, production, illness, and so on” (Foucault 2003, p. 243).

Biopolitical strategies seek not necessarily to use death as a means of control but to bring death into the fold, to accept it as part of life and to account for it through the calculus of demography: “Death was no longer something that suddenly swooped down on life—as in an epidemic. Death was now something permanent, something that slips into life, perpetually gnaws at it, diminishes it, and weakens it” (Foucault 2003, p. 244). Death is always present in life, and to *make live* does not mean to avoid death altogether but rather to manage death at the level of the population. In a biopolitical regime death is transformed into a rate of mortality, which is open to intervention and management. This transformation erases the fact that not all life is equally promoted. In this way, biopolitical technologies that aim to manage, protect, and promote life have at their core a
profound ambivalence toward life itself. I return to this ambivalence below, drawing on scholarship on the role of race in differentiating the life being fostered. Before doing so, I bring the nonhuman into these questions of biopower and life.

**Biopower and nonhuman life**

Most scholarship on biopower refers to power/knowledge relationships that target *human* populations, but recent literature has begun to put biopower into conversation with several variants of post-humanism, including actor-network theory (Latour 2005; Law and Hassard 1999) and feminist studies of science (Haraway 2003, 2008). This emerging literature, most of which focuses on human-animal relations, suggests that we have an anemic understanding of biopower if we look only at human life (e.g. Hinchcliffe and Bingham 2008; Holloway et al. 2009; Lorimer and Driessen 2013; Rutherford 2007, 2011; Shukin 2009). This scholarship not only shows that biopower enrolls the nonhuman in diverse and dynamic ways, but also that biopower is a set of relationships through which nature and society co-produce one another. For example, Holloway and colleagues call for “the formulation of more relational conceptions of biopower in which people work on nonhuman others as part of their work on themselves” (2009, p. 398). In other words, efforts to improve or optimize nonhuman nature—whether through cattle breeding (Holloway et al. 2009; Lorimer and Driessen 2013), protesting timber harvests (Braun 2002), or materially and discursively enrolling the honeybee in the U.S. “war on terror” (Kosek 2010)—are often connected to efforts to improve the individual and collective self. At the same time, biological life is not merely a “terrain for the exercise of
power” (Moore et al. 2003, p. 1) but also an active agent that can never be fully integrated into social relations. Foucault himself states that “it is not that life has been totally integrated into techniques that govern and administer it; it constantly escapes them” (1990, p. 143). Life is therefore a source of resistance to dominant forms of power/knowledge. In this sense, Foucault’s view of biological life as constantly escaping technologies of power is strikingly similar to the post-humanist emphasis on the agency of nonhumans. Together, these perspectives underscore that the messy realities of the material world are not impediments to the circulation of power; rather, it is in these messy realities that biopower is constituted (Law 2004; Rutherford 2007).

Including nonhuman nature in discussions of biopower raises key questions regarding conservation and management of nature. So doing challenges both the preservationist logic that nature is an inherently valuable external realm that must be protected by humans from humans and the capitalist logic that nature is a set of commodities with exchange values determined by the free market. That is, extending biopower to consider human-nonhuman relations allows us to understand the preservationist and capitalist logics not merely as opposing forces but as connected through the vast networks in which power circulates. In particular, considering the role of nonhuman nature in relations of biopower offers geographers a way to work through “the panoptic nature of the green project” (Rutherford 2007, p. 295). Certainly it is not new to say that environmental projects are not innocent of power relations, as this has been a

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4 The unpredictability of life, however, can take many forms, not all of them positive. As Melinda Cooper demonstrates in her discussion of biotechnology and capitalism, attempts to foster and improve human life have been based upon a simultaneous “depletion, extinction, and devaluation of living possibilities” (2008, p. 49).
central message of political ecology (e.g. Hecht and Cockburn 1990; Kosek 2006; Turner 1993). But looking at conservation through the lens of biopolitics makes possible a series of new questions regarding the truth discourses, underlying logics, and calculative technologies by which distinctions among humans and nonhumans are “made, and made meaningful” (Mansfield 2003, p. 332). Who is able to assess, manage, and protect nature, and through what techniques are different forms of nature made both legible and lively? How do the truths experts tell about nature relate to truths told about people?

Such questions are exemplified in Rafi Youatt’s analysis of biologist E.O. Wilson’s proposed global biodiversity census (Youatt 2008). Youatt argues that the biodiversity census, and particularly its emphasis on identifying yet unknown neotropical species, justifies the panopticism of global biodiversity conservation and draws on colonialist discourses of exploration, discovery, and mastery of nature, despite its emphasis on protection rather than domination. Through the biodiversity census and its processes of identification, collection of specimens, and subsequent research, nonhuman nature is packaged neatly into discrete species, a designation that paves the way not only for conservation but also for commodification and capitalization. Youatt (2008) explains: “Postmodern capitalism may protect nature materially even as it commodifies it semiotically, as in the case of protecting the Amazon rainforest for its pharmaceutical potentials” (p. 398). By analyzing biodiversity conservation using a framework that combines biopolitics with the post-humanist attention to the nonhuman, Youatt treats the biodiversity census as a form of biopolitical calculation. As with the rise of demographic statistics described by Foucault, nonhuman life is grasped in terms of distinct populations
to be counted and managed as statistical entities; in other words, we see clearly the biodiversity census as a form of biopolitical *making live*.

**Biopower, race, and nature**

Less clear in analyses such as Youatt’s, however, is the ambivalence toward life mentioned above, in which death is brought into the fold as a means to foster life. Understanding the *let die* part of biopolitics requires additional analytical tools regarding the differentiation and categorization of bodies. In their biopolitical critique of liberalism and war, Michael Dillon and Julian Reid argue that promoting the emergence of life involves “assaying life since not all life is equally productive of life and, indeed, not all life is productive of the kind of life which promotes life” (2009, p. 87). That is, biopolitical rule must not only arbitrate the classification of life into species and populations, but also decide “whom to correct and whom to punish, as well as who shall live and who shall die, what life-forms will be promoted and which will be terminated” (2009, p. 87). These decisions rely on distinctions between normalcy and aberrance, between biological advantages and threats. But not only must biopower distinguish between good and bad, it must also “maximize the good circulation by diminishing the bad” (Foucault 2007, p. 18). The division between what must be maximized, or made to live, and what must be diminished, or allowed to die, is based not on inherent value of an organism but rather on its supposed relation to the population. Foucault (2003) explains: “The enemies who have to be done away with are not adversaries in the political sense of
the term; they are threats, either external or internal, to the population and for the population” (p. 256).

Foucault explicitly calls this process of differentiation “racism,” which he defines as “the break between what must live and what must die… [It] is a way of fragmenting the field of the biological that power controls” (2003, p. 254-5). Indeed, race is not only the fragmentation of the biological, but, drawing on ideas of evolution, such fragmentation is about biologically improving life as a whole: “racism justifies the death-function in the economy of biopower by appealing to the principle that the death of others makes one biologically stronger insofar as one is a member of a race or population, insofar as one is an element in a unitary living plurality” (2003, p. 258). In her genealogy of race Ladelle McWhorter expands on this, explaining that racism in its modern incarnation is “racism against the abnormal,” the fundamental concern of which is not skin color but abnormality more broadly (2009, p. 42). Racism is “a set of power relations that produce effects we call anti-Semitism and white supremacy. But racism is not identical with and exhausted by attitudes and actions that hurt people of color or Jews, as so many people suppose. It encompasses these phenomena, but it also exceeds them” (McWhorter 2009, p. 34). The construction of race is hinged on a broader notion of biological abnormality, which is conceptualized as threats to the norm. Racism is therefore about reducing these threats, whether through complete eradication or, more likely, through forms of management, calculation, surveillance, and punishment. It seems, then, that the theory of evolution was central to the development of biopolitics; it was used to underwrite new forms of state racism, which sanctioned death in order to
protect life. Race becomes the technology for distinguishing between biological normalcy and threat.

The role of race in differentiating nonhuman life has received limited attention, and not all of it in biopolitical terms (see Baldwin et al. 2011; Brechin 1996; Kosek 2006; Mansfield 2012b; Moore et al. 2003). I focus here on the mutual constitution of ideas of race and abnormality, ecological knowledge, and the biophysical world to argue that conservation science, as it developed in the twentieth century, is fundamentally rooted in these racialized notions of evolutionary fitness that separate biological advantage from aberrance. Clearly conservation is biopolitical in that it shifts from controlling individuals to statistically managing populations and species. Even more so, it is biopolitical in that it extends the racialized logic of abnormality and death in its core notions of biological diversity, evolution, and extinction.

**Conservation biology: the biopolitical science**

The emergence of conservation biology as a crisis-oriented discipline in the late twentieth century marks a significant shift in the American relationship with “nature.” Today’s conservationists by and large aim to foster and protect the diversity of nonhuman life, taking as their object not individuals (e.g., trees, charismatic animals, or geological formations) but populations, communities, and species. In colonial and early America, by contrast, nature was commonly viewed as something to be seized, possessed, and exploited (Nash 2001). Landscapes of the New World were perceived as vast, dangerous, or, at best, useless, and settlers moved to conquer, tame, and improve them by clearing
forests, hunting predators to near extinction, and forcing native people westward—all acts of seizure and sovereignty both over nonhuman nature and over those humans understood to be outside of the American body politic. We see in the moment of westward expansion the culmination of sovereign power in “the privilege to seize hold of life in order to suppress it” (Foucault 1990, p. 136).

By the late nineteenth century, as forests were cleared, prairies plowed, and Native American tribes defeated (in short, as there was less wilderness left to conquer), a new biopolitical desire to make nature live began to surface alongside sovereign control. In the emerging Romantic understanding, nature took on new salience, as a small but significant minority of Americans began to view it as sublime, sacred, and an essential part of American national identity (Nash 2001; Runte 1987). Acclaimed natural landscapes such as the Grand Canyon, Yosemite Valley, and the geyser basins of Yellowstone served as proof of American exceptionalism, and although their preservation paved the way for the modern environmental movement, the early logic of this movement was one of “monumentalism, not environmentalism” (Runte 1987, p. 29). At the same time, conservationists such as Gifford Pinchot advocated a utilitarian and consumption-based approach to managing and stewarding natural resources for national development (Knight and Bates 1995). In these ways, the initial steps toward biopolitical environmentalism were not a departure from sovereign power but rather an expansion of it, exemplifying Bruce Braun’s claim that “the government of ‘life’ has revealed itself to be intimately related to the exercise and extension of sovereign power” (2007, p. 8).
By the mid-twentieth century, the overt justification for the protection of nature had shifted away from American exceptionalism and toward ecological health and integrity (e.g. Leopold 1949). Ecology as a science developed to focus on interactions between organisms and their environments; with concepts such as ecosystems and the balance of nature, it became the central science associated with environmentalism (Worster 1994). Conservation biology grew out of this intertwining of ecology, as a science, and the American environmental movement. The ‘official’ formation of conservation biology as a discipline is cited as early evening on May 8, 1985, at the end of the Second Conference on Conservation Biology in Ann Arbor, Michigan. An informal motion established the Society for Conservation Biology (SCB) along with a new academic journal Conservation Biology (Sarkar 2009). Those instrumental in establishing the discipline sought to separate themselves from scientists who perceived the environment as a set of natural resources to be protected for human consumption (Sarkar 2009; Soulé 1985). Whereas scientists in the natural resources and forestry worlds generally sought to manage a small number of highly valuable species (high-yield timber species, wild fisheries, etc.), conservation biologists aimed to protect all species based on two somewhat conflicting ideas: the idea that nature has intrinsic value extending beyond its utility to human society, and the idea that nature’s diversity might someday be valuable to human society, even if it is not yet (e.g. to adapt agricultural crops to climate change) (Soulé 1985). Thus, the organizing principle is that it is not enough to know nature; one must also use that knowledge to effectively manage and even foster the diversity of life. Even as scientific knowledge is always shaped by dominant
social metaphors (Law 2004; Sismondo 2010; Worster 1994), conservation biology is distinct from many other fields in that conservation biologists are explicit that their task is not merely to uncover facts but also to develop recommendations and take action (Soulé 1985).

The “right of the sword” over nature has not been replaced per se but has been permeated by a new right to “make live and let die,” manifest as the right and duty to catalog life at the level of the species, organism, and genome, make nonhuman species live, and preserve certain visions of nature, all while allowing abnormal or “debilitated” genes, individuals, and populations to die off (Soulé 1985, p. 731). Biopower has not come to replace sovereign power, and the biological materiality of nature remains firmly tied to its political and social dimensions (Braun 2007). Indeed, intervention into biological processes has both complemented and complicated human—and particularly capitalist—exploitation of nature. Ultimately, however, the random element of life can never be fully brought into the realm of management, as the “complexities of matters [make] governance and rule frighteningly unpredictable” (Hinchliffe and Bingham 2008, p. 1534). In other words, life—both human and nonhuman—constantly escapes control, and to promote and protect life means to acknowledge the dynamism and inherent unpredictability of biological processes. Hinchliffe and Bingham (2008) explain that the challenge of securing life is a “paradox, where the need for control is also the need for an absence of control” (p. 1547). This paradox lies at the root of conservation biology and associated fields.
Conservation biology's core concepts

Biodiversity: populations in crisis.

Conservation biology emerged in tandem with the now commonplace concept of biodiversity (Takacs 1996). According to Michael Soulé, one of the field’s founders and most prominent practitioners, the purpose of conservation biology is to “provide principles and tools for preserving biological diversity” (1985, p. 727). In this way conservation biology is a crisis-oriented discipline. The concept of biodiversity, and the idea that a biodiversity crisis was well underway, represents conservation biology’s first and arguably most central truth discourse about the ‘vital’ character of living beings, a key feature of biopower (Rabinow and Rose 2006). Using an array of authorities, from photographs of tropical deforestation published in National Geographic (e.g. O’Neill 1993; White 1983) to ecologists who had witnessed species declines firsthand at their field sites, the idea of biodiversity as simultaneously essential and imperiled was made legible and upheld. Framed as a matter of biopolitical urgency, this problematization of a biodiversity crisis is shot through with sovereign claims to truth and objectivity, as scientists become authorized not only to speak for nonhuman nature but also to identify and wage war against the actors and actions—both human and nonhuman—that threaten the future of life.

For conservation biologists, the crisis of biodiversity loss does not refer to individual organisms, but to gene pools, populations, species, and ecosystems. Indeed, the welfare of organisms is considered to be far beyond the purview of the field, and
intervening at the level of the individual is only acceptable when such intervention will benefit the population at large.

It may seem logical to extend the aversion of anthropogenic extinction of populations to the suffering and untimely deaths of individuals because populations are composed of individuals. I do not believe this step is necessary or desirable for conservation biology. Although disease and suffering in animals are unpleasant and, perhaps, regrettable, biologists recognize that conservation is engaged in the protection of the integrity and continuity of natural processes, not the welfare of individuals… Evolution, as it occurs in nature, could not proceed without the suffering inseparable from hunger, disease, and predation. (Soulé 1985, p. 731, emphasis added)

This passage establishes the primacy of the population, a hallmark feature of biopolitics. Managing individual nonhuman lives is meaningless in responding to the crisis of biodiversity loss; individual lives only acquire meaning when they advance the long-term wellbeing of the broader population or are essential to sustaining key biological processes, especially evolution.

*Evolution: prescriptive futures*

Evolution represents a second main truth discourse of conservation biology in that it is considered the engine fueling biological differences. Without evolution, there is no biodiversity, there is no life. As Soulé (1985) writes, “Assuming that life itself is good, how can one maintain an ethical neutrality about evolution? Life itself owes its existence and present diversity to the evolutionary process. Evolution is the machine, and life is its product” (p. 731). But evolutionary processes occur at the scale of the population over many generations, reinforcing the idea that nature is best managed at the level of general phenomena. By classifying populations as evolutionarily significant units (ESUs), for
example, scientists give conservation priority to groups of organisms within a species that share a common evolutionary heritage, have unique adaptations, and may eventually diverge significantly from the remainder of the species (Crandall et al. 2000; Moritz 1994; Ryder 1986).

In this way conservation biology is explicitly future-oriented and prescriptive: it seeks to make some ecological futures possible while precluding futures that are less lively and less diverse. Biopolitics, too, focuses on the possibilities of the future—both good and bad—in order to both prevent negative scenarios and formulate populations that can withstand and rebound from such scenarios. Foucault (2007) describes biopolitical strategies toward famine and resource scarcity issues as “basically focused on a possible event, an event that could take place, and which one tries to prevent before it becomes reality” (p. 33). He exemplifies this point through the idea of a town plan: a town plan should not be developed to provide immediate and short-term perfection, but should “open onto a future that is not exactly controllable, not precisely measured or measurable” (p. 20). Key here is that in neither case does the recognition that the future is open, unpredictable, and potentially dangerous discourage intervention; rather, it is this openness that actually necessitates prediction, measurement, and control.

This paradox lies at the heart of biopolitics and conservation science. By fostering biodiversity and encouraging evolution and natural selection, conservation biologists aim to protect and preserve the integrity of the nonhuman world. At the same time, however, conservationists are compelled to intervene in the dynamics of populations in order to maximize “evolutionary potential” (Soulé 1985) and ensure the long-term viability of
extant populations or species. In short, conservation science aims to control life—all the while delineating between biological threats and advantages—in order for life to proliferate freely. It is this delineation between evolution as threat and evolution as advantage that has proven particularly challenging for conservation biologists studying human-impacted ecosystems (Kinnison et al. 2007; Mace et al. 2003; Schlaepfer et al. 2005; Stockwell et al. 2003; Western 2001). Despite Soulé’s insistence that evolution is good, conservation biologists continue to grapple with “the issue of whether the evolution of adaptations to disturbance and degraded habitats is sometimes beneficial or something to be rigorously avoided” (Ashley et al. 2003, p. 115). When its habitat is fundamentally altered or a new species is introduced, a population might adapt rapidly to the changes through what has been termed contemporary evolution (Stockwell et al. 2003); conversely, these same selection pressures might also cause a genetic bottleneck, a decline in population, and potential extirpation (Schlaepfer et al. 2005; Western 2001). The same agents that drive evolutionary change through selection can therefore also bring about extinction. It is one of the key tasks of conservation biology to determine when selection, and the subsequent loss of genetic variation, is beneficial and therefore should be encouraged, and when it is hazardous to populations and should be prevented (Kinnison et al. 2007).

**Extinction: death to improve life**

As the opposing force to evolution, extinction involves the reduction of biological diversity and the loss of populations, species, or taxa. Most conservation organizations,
media outlets, and environmental activists frame extinction as entirely negative—even catastrophic—with an implicit recognition that it is caused by humans. Conservation biologists generally share this view of extinction as a crisis to be averted, but with one major caveat: on an evolutionary timescale, extinction is inevitable and can at times be neutral or even positive, if populations and gene pools that are poorly adapted to their environment are replaced by well-adapted populations and gene pools (Primack 2010; Rolston 1985; Soulé 1985). Extinction destroys life but in doing so makes new life forms possible:

To the conservation biologist, there is little positive to be said about extinction. From an evolutionary perspective, however, extinction is a double-edged sword. By definition, extinction terminates lineages and thus removes unique genetic variation and adaptations. But over geological time scales, it can reshape the evolutionary landscape in more creative ways, via the differential survivorship of lineages and the evolutionary opportunities afforded by the demise of dominant groups and the postextinction sorting of survivors. The interplay between the destructive and generative aspects of extinction… remains a crucial but poorly understood component of the evolutionary process. (Jablonski 2001, p. 5393)

This view of extinction is remarkably similar to the way death is conceptualized in modern biopolitical strategies and fields such as demography and public health (Bashford 2006). Such fields have become so engrained in western thought that it is now common sense that death is inevitable, that it is part of life, and that it cannot be prevented or fully controlled on an individual level. At the level of the population, however, death is transformed into mortality rates, disease infection rates, age class structures, and population pyramids. So it is with extinction—conservation scientists aim not to avoid extinction altogether but rather to account for it through statistics on extinction rates, speciation rates, species turnover, and minimum viable population sizes, among others.
The purpose is not to altogether avoid death and extinction, but rather to manage it at the level of the population: to ensure that untimely extinctions are minimized and to promote evolution and speciation to counterbalance extinctions.

While background extinction events—which are considered normal and inevitable—represent an essential part of evolutionary history, mass extinctions are primarily of concern to conservation biologists. At present “the Tree of Life… is being pruned by extinction very much more rapidly than it is regrowing” (Mace et al. 2003, p. 1708). Whole taxonomic groups are believed to be at risk of extinction due to human-related factors (habitat loss, species invasion, etc.). Conservationists increasingly recognize that saving all threatened species from extinction is impractical, and many have come to accept conservation triage as necessary (Bottrill et al. 2008; Wiens et al. 2012). Like in emergency medicine, conservation triage involves using criteria to assess priority and make life or death decisions, not about human beings but about the futures of entire species. There are disagreements about how to prioritize taxa: some conservationists support using evolutionary histories to “indicate which taxa and which places are currently most active in the growth of the Tree of Life, and which may therefore be particularly important to conserve” (Mace et al. 2003, p. 1709), while others prefer that ecological functions guide decisions of life or death. Either way, the ongoing biodiversity crisis and finite conservation funding necessitate that some species be allowed to die so that others can have life. In the biopolitical logic of conservation science, triage is “just smart decision making” (Bottrill et al. 2008, p. 649).
Biological diversity: purity and threat

The emphasis on the dynamic relationship between evolution and extinction in order to maintain biodiversity brings to the fore racialized concepts like biological purity and diversity in conservation science. Modern conservation strategies extol diversity on a variety of levels, from genetic diversity to species diversity to ecosystem diversity (Primack 2010). Yet this emphasis on difference is undergirded by seemingly conflicting ideas about biological purity and ideal types of nonhuman bodies.

On the level of species, measures of biodiversity such as species richness, or the total number of species present in a community, rely on the idea that species are pure categories that can be easily and objectively defined, most commonly on the bases of morphology, genetic distinctiveness, or reproduction of fertile offspring. Despite this assumption of purity within species, recent studies have shown that the genomes of many species are more impure and plastic than previously recognized, and that gene flow is not terribly uncommon between species with different morphologies (Mallet 2005; Mayr 1942). Estimates suggest that hybridization and potential introgression (gene flow marked by repeated backcrossing between hybrids and one parent species) occur naturally in roughly 25% of plant species and 10% of animal species (Mallet 2005). Yet many conservation scientists still insist on the relative purity of species and the need to defend that purity from threats that “may compromise the genetic integrity of native taxa” (Largiadèr 2007, p. 275). Further, gene flow across species challenges the biological species concept and the long-held idea that species exist in the wild as reproductively isolated groups of organisms (Largiadèr 2007). Gene flow is particularly concerning
among native and introduced species, because introgression may cause native populations to be genetically assimilated into non-native populations, resulting in no “pure” native organisms and ultimately species extinction (Huxel 1999; Levin et al. 1996; Rhymer and Simberloff 1996). In these ways, impure bodies are seen not as enhancing but as threatening to biodiversity.

At the same time, however, maintaining and promoting genetic variation is a key goal of conservation biology, and gene flow—whether within species or among different species—is the primary mechanism through which genetic variation is fostered. Genetic variation is a key factor in adaptive evolution and resilience to environmental change (Dowling and Secor 1997; Largiadèr 2007; Rieseberg 1997), yet gene flow can also reduce the genetic distinctiveness of populations and the likelihood of future adaptation (Kinnison et al. 2007). There exists, then, a tension between fostering diversity in the long-term and protecting the purity of distinct species or populations. The movement of genes across the landscape represents both biological threat and advantage, producing diversity but simultaneously threatening the distinct types that constitute such diversity.

**Conservation science for conservation planning: securing biodiversity**

These four themes—populations in crisis, evolution and its future orientation, extinction as death that is necessary for life, and diversity as purity—come together in key conservation techniques (statistical and material) that serve to secure biodiversity through racialized population-based strategies that foster life by selectively managing death.
Statistical modeling of extinction risk.

Especially important are efforts to track and manage extinction through statistical techniques that model possible ecological outcomes. Such methods include population viability analysis (PVA), which assesses the risk of extinction for a given population over a particular time period. It does this most basically by incorporating demographic, environmental, and genetic stochasticity into a population model that is unique to the target species. The first PVA was developed by Mark Shaffer, when he was a doctoral student in the mid-1970s, to determine the minimum number of grizzly bears (*Ursus arctos*) needed to sustain the population in Yellowstone National Park a century into the future (Shaffer 1981); the method continues to be refined, especially as the long-term ecological data needed to train models are increasingly available. Critics say its accuracy is suspect, arguing that it is impossible to incorporate the range of future possibilities in modeling, and further, that the amount of data needed to produce meaningful models is unrealistic for most species (Coulson et al. 2001; Reed et al. 2002). Despite critiques, PVA continues to be an oft-used tool in the conservation toolbox, as it is one of the main technologies through which the abstract concept of extinction risk is made calculable, knowable, and therefore governable.

Extinction in PVA is implicitly already at work, already encroaching on the population long before its last member dies off—just as death is conceptualized as gnawing at and infiltrating human life. Because extinction is always imminent (facilitated by humans, of course) conservation biologists must perform analyses such as PVA to secure at-risk populations and prevent them from succumbing to internal or external
threats. The management decisions made using the results of PVAs are future-oriented, concerned not with managing a population in its present state but with ensuring that its health and population numbers are sustained well into the future—a future which is widely recognized as dynamic, nonlinear, and downright scary (Gilpin and Soulé 1986). Indeed, it is this notion of a frighteningly unpredictable future that both necessitates and damns biopolitical conservation techniques such as PVA. In an ever-changing world, PVA’s mission is futile; it can never succeed in accounting for all of the factors driving population change, yet such analyses must continue to be performed in order to prevent as many unfavorable outcomes as possible. Today, PVAs are performed in accord with numerous international and federal policies and programs, including the National Forest Management Act of 1976, the Endangered Species Act of 1973, and the International Union for Conservation of Nature (IUCN) Red List of Threatened Species, as scientists aim to bring extinction into the fold and make species live, despite changing habitat conditions and environmental and demographic stochasticity.

“De-extinction:” scientific breeding to jumpstart evolution and manage purity

But what happens when PVAs indicate that a population’s days are numbered? Or when conservation science and policy fail to promote life such that a highly valued species ceases to evolve and becomes functionally extinct? For some, the answer is de-extinction (Sherkow and Greely 2013; Stone 2013). Given the appropriate expertise and technologies, extinction is increasingly considered not only manageable but also reversible. Importantly, de-extinction does not solely consist of bringing long-extinct
species back to their former habitats (i.e. through genetic engineering). It also means fighting extinction with evolution: to jumpstart the engine of evolution and thereby promote the emergence of life. This more prosaic form of de-extinction is exemplified in the movement to restore the American chestnut through backcross breeding. By breeding blight-resistant trees that are 15/16 ‘American’ and 1/16 ‘Chinese’, scientists attempt to force rapid evolution in a population that has been evolutionarily stagnant for the past century. The president of TACF explained:

What we’re trying to do with the backcross breeding program is be able to reintroduce a tree—an American chestnut—that has the right genetics so that it can start evolving again… If we don’t have the maximum amount of genetic diversity, the tree won’t be able to evolve over time. So, we’re trying to reintroduce a tree that really has no finish line. With each generation, there will be constant selection—natural selection—for better and better trees, and at the same time, we’ll be working with our breeding program to try to improve the quality of the trees we put back out there. But ultimately Mother Nature is going to use natural selection to evolve these trees back… The trees have—although not extinct—have functionally ceased evolution. They cannot evolve anymore. What we’ve got to do is jumpstart evolution again and allow these trees to evolve over time. (Author interview, 2012)

The de-extinction of the American chestnut highlights several key aspects of the biopolitical nature of conservation science. The project is entirely future-oriented yet there is admittedly “no finish line.” Such is the case for all of biopolitics, as the inherent dynamism of living matter—the “emergency of emergence” (Dillon and Reid 2009, p. 89)—means that life can never be fully brought into the purview of science or law. Related to this is the idea that stagnation—lack of adaptation and evolution—is a severe threat to life. After the arrival of the chestnut blight fungus in the U.S. in the early 1900s, nearly all of the mature American chestnuts in eastern North America were eventually infected and killed by the fungus (Freinkel 2009). The fungus is understood to be a
problem not simply because it has killed so many trees, but also because it has effectively prevented the population from evolving to develop some degree of blight resistance. In other words, the fungus is a threat to the emergence of life—and particularly the American chestnut’s life—and must be overcome to allow for an optimal future in which the chestnut continues to evolve.

This then raises the questions of who or what is worthy of living—what kinds of biological diversity are promoted in conservation projects, and what kinds are not? Chestnut breeders initially force gene flow between the American and Chinese species to increase the genetic diversity of the American species and impart the gene(s) for blight resistance from the Chinese species to the American species. Diversity, here, is a biological advantage. At the same time, breeders attempt to make subsequent generations of chestnuts as genetically, functionally, and aesthetically close to the American species as possible. As a plant scientist explained, “Ideally you’re not going to be able to tell that it’s 1/16 Chinese. The Chinese genes should be so diluted that you can’t tell by looking at it. They’re trying to breed any wonky characteristics, undesirable traits, out of the trees” (Author interview 2012). So while promoting overall species diversity through the restoration of the American chestnut, scientists also aim to purify the species, eliminating as much as possible the contaminating Chinese traits. In short, this conservation project seeks to prevent extinction and increase genetic and species diversity, yet still aims for the purest species possible—a state that not only can never be reached but also likely never even existed. Protecting species’ purity in the name of diversity is seen in myriad other conservation efforts involving a variety of taxa, such as native tortoises in the
Galápagos Islands (Hennessy 2013), trout in the Rocky Mountains (Allendorf and Leary 1988; Haak et al. 2010), and the endangered Mexican wolf (*Canis lupus baileyi*) along the U.S.-Mexico border (Decker 2013; Wayne and Hedrick 2011).

It is this idea of purity within diversity that most explicitly connects ecological notions to ideas about racial difference. Indeed “species and “races” as concepts both rely on a biological logic that attaches difference to the body, whether that body is a tree, a tortoise, or a person. In both racial biology and conservation science, purity and diversity are cast as uncomplicated terms despite their tremendous complexity. Diversity is not an objective concept; rather, diversity is highly plastic and can rapidly shift from a threat and to an advantage. In biopolitical terms, Dillon and Reid (2009) argue that liberalism is committed to destroying some diversity in the name of a livelier, more diverse future. As this chapter has demonstrated, this commitment remains relevant when considering nonhuman populations. I make these comparisons here not to suggest that conservation science has a hidden racial agenda or that biopolitical strategies are all one and the same, but rather to make obvious that concepts like race, species, and biodiversity are entangled in biopolitical notions of biological difference, abnormality, and emergent life.

**Conclusions**

The project of making life live is manifest far beyond the social world. It extends into relations between humans and other species and the production of conservation knowledge, practices, and policies. While the discourse of scientific progress insinuates that our knowledge of the biophysical world is objective, apolitical, and increasingly
accurate over time, I have shown that conservation science is a form of power that generates particular truth claims in the name of fostering life. We see the rise of biopower, and downplaying of sovereign power, in American society’s relations with the natural landscape over the past century. Nature is no longer ruled by the sword, but by science; the wild natural landscape is no longer tamed but instead protected, improved, and even produced. With concepts such as biodiversity, evolution, and extinction at its core, modern conservation science aims to increase the integrity and adaptability of nonhuman populations; it aims to enhance genetic diversity, ensure that birth and death rates remain stable, and protect populations from dangerous environmental or demographic stochasticity. This requires that “security mechanisms… be installed around the random element inherent in a population of living beings so as to optimize a state of life” (Foucault 2003, p. 246). The “security mechanisms” this chapter has described include statistical tools such as population viability analysis and material practices of backcross breeding and deliberate introgression to improve a population’s chance of survival. Crucially, these efforts to increase the integrity of nonhuman life are bound up with notions of diversity-as-purity that share a genealogy with modern notions of race and racism. In the logics of conservation and race, life produces biological diversity, conceived as variety of biological kinds; within that diversity exist kinds that foster ongoing life, which therefore should be maximized, and kinds that are a threat, which are conceived as abnormalities that should be let die. The mixing of kinds is at once an enhancement of diversity and a threat to its very basis.
This racial logic points to a contradiction in contemporary conservation rhetoric. On the one hand, conservationists, including conservation biologists, explicitly value not only *human* life but *all* life; all life has intrinsic value and must therefore be protected (Youatt 2008). This is seen as a brake on exploitation and transformation of nature. On the other hand, the racial logic of abnormality inherent in conservation science *requires* judgment about what parts of nature to make live and what to let die in the name of making live. Not all life has intrinsic value—only those parts of life that foster ongoing emergence of life. This biopolitical logic is often used to justify the immediate exploitation of nature and/or people. Indeed, the idea of an ongoing ecological crisis has been used to “legitimate yet further technocratic interventions, to further extend the state and corporate management of biological life, including the continuing reduction of humanity to bare life and nature to mere resource, and to stifle ecological politics as such” (Smith 2011, p. xvi). Intervention into ecosystems or nonhuman populations in the name of ecological ‘health’ is now commonplace, as seen, for example, in President George W. Bush’s Healthy Forests Initiative, which opened National Forest land to logging in the name of reducing the threat of high-severity wildfires. It is here, too, that we see the continued relevance of sovereign power in 21st century nature-society relations. Rather than being fully replaced, sovereign power is now permeated with the logic of biopower, and together they underwrite exploitation of life in the name of fostering life today and for the future.

This is especially true as conservation intersects with the new sciences of genomics and biotechnology. Scientists are now producing new transgenic organisms,
sequencing genes, and identifying genetic markers for unique desirable and undesirable traits. These sciences open up new ways of knowing organisms, criteria for ‘optimizing’ populations, and calculations of genetic diversity, all of which can lead to new forms of biopower. Such interventions come to be viewed as “common sense” through the circulation of genetic discourses—e.g. it is only common sense for a conservation organization that aims to restore a plant population to calculate the genetic distance between individuals in the population, so as to generate enough genetic diversity for the population to adapt to different environments without suffering inbreeding depression or genetic drift. The intention is not to dismiss conservation approaches such as this, but to show that acts of truth-telling about nature become common sense because they occur within, and are necessarily shaped by, the context of liberal biopolitical rule. In other words, despite being considered politically neutral and scientifically objective, conservation science is biopolitical: it is the science of both make live and let die.
Chapter 3: Securing American forests from the scourge of blight

The chestnut blight fungus established itself on the North American continent with such little fanfare that to this day no one is certain exactly where it came from, when and where it first arrived, and whether the blight epidemic was caused by a single source or multiple introductions. What is known is this: sometime between 1876, when Japanese chestnuts were first imported to the U.S., and 1904, when native chestnut trees in New York City began to show signs of infection, the inconspicuous fungus gained passage from overseas, most likely hidden in the bark of imported Japanese chestnut nursery stock. After its initial discovery at the New York Zoological Park in 1904, the blight spread rapidly throughout the chestnut’s range; by 1909 infestations were recorded in New York, Connecticut, Rhode Island, New Jersey, Pennsylvania, Delaware, Maryland, and Virginia (Metcalf and Collins 1909). By the 1920s, the blight had reached the southern Appalachians, where chestnuts were larger, more abundant, and more valuable than anywhere else in their range.

Not only was the fungal culprit admitted to the country without documentation or inspection, but its spread was actually facilitated by scientists and plant breeders clamoring for novel nut- and fruit-bearing plants. From 1876 onward, plant breeders and horticulturalists, Luther Burbank among them, imported first Japanese chestnuts and
European chestnuts and later Chinese chestnuts with the hopes of establishing a commercial market for the trees (Powell 1898). These foreign chestnuts were among many species enthusiastically introduced at this time to augment “the agricultural wealth of the nation,” in the words of David Fairchild, the first head of the USDA’s Office and Seed and Plant Introductions (Fairchild 1906, p. 180). The collection of foreign plants and seeds by federal agencies began in earnest in 1839 by the U.S. Patent Office and reached its zenith in the first decades of the twentieth century in the USDA’s “golden age of plant hunters” (Lemmon 1968). Introduced species were distributed to elite agricultural societies and molded into new forms by farmer-breeders; these introductions of foreign species and land races to the American landscape proved crucial to the rise of industrial capitalism and U.S. empire building (Kloppenburg 1988). Yet even as the introduction, cultivation, and improvement of foreign species generated wealth and power, foreign species also at times materially threatened the nation.

Some immigrant species proved useful, others useless, and still others destructive. Accidental introductions of harmful non-natives—the chestnut blight fungus, the San Jose scale, and the Japanese beetle among them—eventually resulted in a sea change in American attitudes toward foreign species (Pauly 1996, 2008). The devastation wrought by these invaders became emblematic of the dangers posed by foreign bodies; the chestnut blight, for example, quickly became embroiled in wider societal debates over immigration, race, and eugenics in early twentieth century America. Discourse and imagery about the blight smacked of warfare and defense. It was a “silent enemy” that took no prisoners, attacking “all chestnut trees alike, whether in a millionaire’s park or a
farmer’s woodlot” (“Mysterious blight,” 1910). Its spores shot out into the air like “a miniature regiment of soldiers with automatic rifles” (“Chestnut blight plant,” 1913), and it required from scientists and legislators a commitment to “repel the invader, using every means known to science and practical experience” (Pennsylvania Blight Commission 1912b, p. 17). Even as the war against blight appeared futile, the chief of the USDA’s newly-created Office of Forest Pathology, Haven Metcalf, plainly advised, “This is the… great lesson to be learned from the invasion of the chestnut bark disease. It is too late to exclude this undesirable citizen; but we can at least redouble our efforts to see that no others get a foothold on this continent” (1913, p. 18). This America evoked by Metcalf and others was a nation at risk of erosion and contamination, a nation that required the weeding out of the undesirable citizen to protect and promote its native body politic. From the beginning, responses to the blight were linked to profound anxieties about the fate of the American nation.

**Argument and outline of chapter**

This chapter draws on historical evidence from scientific publications, policy documents, and newspaper articles to lay bare the social and intellectual subsoil from which the blight emerged as a national threat. I argue that blight control and chestnut restoration efforts are not—and were never—solely about the conservation of nature, but are also about the construction and defense of racialized national natures. As a national nature, the American chestnut is not merely symbolic of the nation but is a species whose very materiality has been shaped and re-shaped by the “hands of American plantsmen”
(Detlefsen and Ruth 1922, p. 305). This chapter conceptualizes nationalistic or xenophobic responses to the blight as part and parcel of the broader biopolitical imperative to “make live and let die” (Foucault 2003, p. 241)—to amplify and improve the nation at the expense of those life forms deemed outside of it. This biopolitical objective overlaps with and indeed emerges in part through the imperial project and its need for porous boundaries; crossing these boundaries simultaneously are bodies—both human and nonhuman—representing promise and threat. We see these porous boundaries at work in blight control and chestnut restoration, as life forms representing advantage and threat are differentiated in an effort to simultaneously improve and defend the nation and its native nature.

From this framework two more specific points emerge. First, efforts to secure American forests from the scourge of blight occurred in the midst of a “pervasive sense of imminent degeneration on all sides” (Allen 2013, p. 34), at a historical moment marked by national anxieties over immigration, race, eugenics, conservation, and the loss of frontier and agrarian cultures. These anxieties blended together forcefully and further justified the need for government involvement in blight eradication, forest management, and conservation more broadly. In similar fashion, already potent concerns about foreign bodies and threats to racial purity drew strength from the devastating material realities of the chestnut blight. As evidenced by nativist environmental discourses and the shared logics of plant and racial improvement projects, making the American chestnut live was also about defending a particular vision of the ideal American nation as white and agrarian.
Yet the case of the American chestnut demonstrates that links between race and environmental projects are not merely historical relics which have been rectified by the increasingly objective sciences of restoration and conservation. Efforts to restore the species today continue to be shaped by ideas about American exceptionalism and racial differentiation, though these efforts are also embroiled in new anxieties about terror and the changing status of the U.S. in the global economy. Wrapped in the language of biopolitical urgency, restoration remains a project of make live and let die, a deeply racialized and nationalistic project in which the protection of nature is bound to the security and defense of the nation.

In the next section, I discuss recent work on the cultural politics of exotic species. Adding to this literature an explicitly biopolitical emphasis on race, nation, and nature, I argue that nativist or xenophobic reactions to exotic species can be seen as emerging from the biopolitical imperative to make live and let die. Turning to the history of conservation in the U.S., I demonstrate that early environmental concerns were often undergirded by a nationalism premised on racial differences. I then focus more specifically on the story of the American chestnut and the devastating blight, discussing three themes—the blight as national enemy, anxieties around the immigration of foreign plants and people, and the shared logics and histories of plant breeding and racial improvement (eugenics). Following this historical discussion, I examine recent chestnut plantings at a 9/11 memorial (Flight 93 National Memorial), illustrating how contemporary anxieties about the nation continue to be materialized on the landscape through restoration practices.
Cultural politics of exotic species

The presence or absence of xenophobia and nativism in invasive species science and policy has been debated at length (Pauly 1996; Peretti 1998; Sagoff 1999; Subramaniam 2001; Simberloff 2003; Olwig 2003; Wong 2005; Coates 2007; Warren 2007). Much of this literature has focused on uncovering rhetoric of fear, warfare, or racism in invasion biology and environmental management, past and present. Some of the clearest evidence of xenophobia in native/non-native plant distinctions comes from Nazi Germany, where the Reich Central Office for Vegetation Mapping sought to “cleanse the German landscape of unharmonious foreign substance” (Tüxen 1939, quoted in Gröning and Wolschke-Bulmahn 1992). With regard to the U.S., Pauly (1996) has suggested that the regulation of plant movement in the early twentieth century was similarly racially motivated and fueled by nativism despite claims to scientific objectivity. He particularly argues that within the early twentieth century USDA there existed two camps: ecological cosmopolitans, who sought to introduce as many exotic varieties as possible to the U.S., and biological nativists, who sought to exclude, as much as possible, all living material from other nations. Pauly goes on to suggest that early twentieth century anti-immigration policies and legislation designed to limit introduced species were motivated by similar nativist politics. Lending further credence to this argument is Shinozuka’s (2013) account of the demonization of Japanese beetles and Japanese bodies as “deadly yellow perils” in the 1920s and 1930s.

Other work on the cultural politics of species suggests that xenophobia and nativism are not merely historical artifacts but remain salient in invasion biology, policy,
and discourse today (Tsing 1995; Peretti 1998; Subramaniam 2001; Mansfield 2003; Warren 2007). Contemporary warfare against alien species and the associated preoccupation with natives are considered by Subramaniam (2001) symptoms of “a campaign that misplaces and displaces anxieties about economic, social, political, and cultural changes onto outsiders and foreigners” (p. 34). In particular, economic changes wrought by globalization—most notably de-industrialization, the outsourcing of jobs, and the rise of China as a political economic force—feed into modern-day xenophobic and nationalistic views of nature. In some cases discourses around invasive species are both racialized and gendered; Tsing (1995) illustrated how rhetoric about Africanized bees makes distinctions between Africanized bees as “potential rapists” (p. 128) in contrast to the domesticated stable family units of the European-origin honeybee.

Yet despite the proliferation of work demonstrating the persistence of xenophobia in discourses of native/non-native species, a number of prominent invasion biologists have rejected these claims as oversimplifications (Simberloff 2003; Richardson et al. 2008). Simberloff (2003) counters Pauly’s (1992) claim that USDA scientists of the early twentieth century were influenced by the pervasive nativism of the period, arguing that there is no evidence that scientists were driven by anything but the desire to protect ecosystems and economies. While nationalist discourses may be present in some representations of nonhuman species, Simberloff emphasizes that nationalism is not equivalent to xenophobia and should not be cast as such. Further, the material ecological ramifications of many exotic species are seen as proof that efforts to restore natives and
eradicate or prevent invasives are scientifically grounded and not merely a “covert form of nativism, racism, xenophobia, or worse” (Simberloff 2003, p. 181).

Such reactions, while compelling, tend to focus on exculpating individual scientists from accusations of nativism or xenophobia. This chapter broadens the focus away from individual ideologies and toward the racialized logics and histories that undergird American relations with nature (Brechin 1996; Gerstle 1999). In addition, claims that conservationists were and are concerned primarily with material ecological and economic impacts of exotic species rely on a false separation of the economic and material from the cultural and political. In the case of the chestnut, concerns about economic consequences of the blight arose in relation to racial and political economic anxieties about the future of the nation and therefore cannot be reasonably divorced from these issues. In short, efforts to eradicate the blight and restore the chestnut are not—and indeed were never—solely about the conservation of ecologically or economically valuable natural resources, but are also about the delineation and subsequent protection of particular human populations as the ‘nation’ and particular nonhuman populations as ‘national natures.’ Here, I bring Foucauldian ideas about biopower and biopolitics into this conversation to develop this argument.

**Biopolitical perspectives on nation and nature**

Geographers and political ecologists have by now established that the management of nature, from front lawns (Robbins 2007) to forests (Kosek 2006), is profoundly linked to the management of human populations. More specifically,
relationships with nonhuman nature are increasingly studied through a Foucauldian lens that casts the management and protection of nature as an expression of biopower, or the right to make live and let die (Foucault 2003). In the previous chapter, I demonstrate how conservation science employs a racial, biopolitical logic that necessitates differentiating biological kinds that foster life from those that serve as a threat to ongoing life. These insights provide the theoretical starting point for this chapter, which considers the chestnut blight epidemic as an instructive moment in the steps toward biopolitical conservation in the United States. Responses to and management of the blight were typical of the interconnectedness of sovereign power and biopower in early urges toward environmental conservation; making nature live, in the case of the chestnut, was and remains a deeply political and racialized project.

Two theoretical claims associated with biopolitics are key to understanding how nature, nation, and race come together in blight control and chestnut restoration. First, in Foucault’s conception of biopolitics, the objective is not to control all of life, but rather to channel the dynamism of life and use it to improve the population and the nation, to “maximize the good circulation by diminishing the bad” (Foucault 2007, p. 18). Flows of bodies across national borders, for example, are both advantageous and threatening to the nation and its population—in the case of native/non-native species, foreign species represent opportunities for power and capital gain, but they also pose a threat to existing socio-ecological configurations. This conception of biopolitics raises questions about the apparent entrenched nativism in discourses around invasive species. A Foucauldian perspective suggests that racialized responses to nonhuman species are in part an
expression of liberal biopolitics, in which distinctions between ‘good’ and ‘bad’ life forms must be constantly made to protect, increase, and amplify the ‘good.’

Ideas about biopower and biopolitics are also helpful in theorizing the construction of national natures, which I define here as socio-ecological entities or configurations that are materially and discursively linked to nation and/or empire-building, citizenship, or national identity. By serving as a representation of the nation state, national natures help to delineate heritage and identity. When such natures are protected and made to live, a particular representation of the nation is upheld. In the case of the chestnut, the twin projects of blight control and chestnut restoration contribute to the establishment of a racialized white agrarianism as national heritage, an idea I return to throughout the chapter.

It is in this idea of national nature that we see the biopolitical imperative to make live converging directly with sovereign claims to authority and power. Foucault claims that as biopower and sovereign power intersect, urges to protect the race emerge: “the way biopower functions through… the old sovereign power of life and death implies the workings, the introduction and activation of racism” (Foucault 2003, p. 258). In the biopolitical act of maximizing the ‘good’ and diminishing the ‘bad’, humans and nonhumans that benefit the nation and contribute to the extension of power are brought into the fold, while forms of life that pose a threat to the continuance and safety of the nation are targeted as undesirable. In short, securing and improving the population requires a break between what must live and what must die, and it is in this break that race and nation become technologies for differentiating among both human and
nonhuman life forms. As biopower and sovereign power are yoked together, so too are race, nation, and nature. In the case of the chestnut, blight control and subsequent restoration were and remain deeply biopolitical, nationalistic, and racialized projects, in which the protection of nature is bound to notions of American heritage, national security, and racial differentiation. In the next section, I discuss the conservation movement of the early twentieth century, demonstrating that concerns about nature were often undergirded by a nationalism premised on racial differentiation, before moving on to consider more specifically how the chestnut blight and the American chestnut became viewed as national enemy and national nature respectively.

**Conservation, nationalism, and race**

While striking, aggressively patriotic reactions to the chestnut blight were not exceptional, as environmental concerns of the early twentieth century were often expressed alongside a racialized nationalism that envisioned the American nation as predominantly white and agrarian. Indeed both conservation and racial improvement projects were understood by many as “attempts to save as much as possible of the old America” (Grant, quoted in Spiro 2009, p. xiii), from native species like the American chestnut and the American bison (*Bison bison*) to the well-bred bloodlines of early pioneer settlers. Here, I explore links between conservation, nationalism, and race in early twentieth century America, showing that the protection of nature went hand in hand with the defense of a particular vision of the ideal Americans as white and agrarian.
By the turn of the twentieth century elites were increasingly calling for protection of the environment; American civilization was no longer immediately threatened by the perils of nature, and a biopolitical urge to make nature live surfaced (see previous chapter). But this emergent attitude toward nature was not a complete departure from ecological sovereignty but instead emerged from expressions of sovereign power. The creation of the National Park System, for example, was driven in part by nationalistic urges to establish an American culture and identity distinct from Europe (Runte 1997), and similarly, forest conservation was initially spurred not by ecological concerns but for the purpose of stewarding timber resources for national development (e.g. Pinchot 1910).

Theodore Roosevelt, who was president during the initial chestnut blight outbreak, illustrates this view of conservation as a nation-building project. In a 1908 speech on “Conservation as National Duty,” he emphasized that the nation’s future was dependent on stewarding natural resources: “We are coming to recognize as never before the right of the Nation to guard its own future in the essential matter of natural resources.” Yet conservation represented only one piece of Roosevelt’s greater mission to promote and expand the power of the nation state:

Let us remember that the conservation of our natural resources, though the gravest problem of today, is yet but part of another and greater problem to which this Nation is not yet awake, but to which it will be awake in time, and with which it must hereafter grapple if it is to live—the… patriotic duty of insuring the safety and continuance of the Nation. (Roosevelt 1908)

In this Progressive Era view, the conservation of nature was fundamentally a nation-building project. Protecting nature—from chestnut forests to big game populations—
meant strengthening the nation, promoting a particular national identity, and expanding the power of the state.

Further, the pervasive nationalism in early discourses of conservation was often grounded in notions of racial superiority, informed at the turn of the twentieth century by evolution and social Darwinism and by the 1910s increasingly by Mendelian genetics (Brechin 1996), a point I will return to in the context of chestnut breeding. With roots in Jeffersonian agrarianism and the frontier myth, this racialized nationalist discourse (espoused by Roosevelt, Gifford Pinchot, and numerous other early conservationists) saw conservation as a project of “home building for the nation” (Pinchot 1910, p. 21), with home generally being the American farm (Wohlforth 2010). Even as the nation was industrializing, urbanizing, and racially diversifying, early conservation rhetoric focused on the white American farmer—the successor to the pioneer settler—as the central hope for perpetuating a morally, intellectually, and physically superior American race (Roosevelt 1908, Pinchot 1910, Ellsworth 1960):

> Our country began as a nation of farmers. During the periods that gave it its character, when our independence was won and when our Union was preserved, we were pre-eminently a nation of farmers. We can not, and we ought not, to continue exclusively, or even chiefly, an agricultural country… But the farmer who owns his land is still the backbone of the Nation; and one of the things we want most is more of him… [H]is attachment to the soil… is the principal spring of his steadiness, his sanity, his simplicity and directness, and many of his other desirable qualities. He is the first of home-makers… The object of the great Conservation movement is just this, to make our country a permanent and prosperous home. (Pinchot 1910, p. 23)

While cities represented moral and racial degeneration, unbridled immigration, lack of sanitation, and the exploitation of nature, the American countryside came to represent cultural stability, a civilized relationship with nature, and strength fostered by strenuous
work and well-bred bloodlines (Peterson 1990). For Roosevelt and Pinchot, conservation was not only about the protection and wise use of nature, but was also about promoting a particular vision of the ideal American citizen and landscape as agrarian.

In particular, the settling of the frontier, the taming of wilderness, and the defeat of Native Americans were seen as evidence of the strong bloodlines of white northern and western European immigrants. The mixing of blood among early immigrants was thought to have advanced traits of hardiness, virility, and morality in the population, thereby creating a superior American race (Gerstle 1999). Espoused by Roosevelt, this view of the American race exemplifies a nationalism based on racial differentiation, in which “certain kinds of boundary crossing would damage the racially superior character of the American nation” (Gerstle 1999, p. 1281), while other types would improve and strengthen the nation. By linking national identity to race, the state comes to be the “protector of the integrity, the superiority, and the purity of the race” (Foucault 2003, p. 81). At the same time, through discourses of conservation, nature and the environment became key sites through which these ideas about race and nation circulated in the early twentieth century. I now turn to the chestnut blight, demonstrating that nationalist sentiments repeatedly surfaced around blight eradication and control—responses that were part and parcel of the emerging biopolitical emphasis on differentiating between advantage and threat in an effort to defend and improve the nation and its nature.
Blight as National Enemy: The Pennsylvania Blight Commission (1911-1913)

When the chestnut blight arrived on American soil, it quite literally attacked the very heart of the emerging environmental movement. Evidence of blight first appeared in 1904 in the native forests exhibit at the New York Zoological Park, one of the earliest successes for conservationists. By promptly infecting over 1,400 American chestnuts and stymying the Park’s chief forester (Freinkel 2009), the chestnut blight foretold dramatic threats to the nation’s forests and illustrated the need for a national conservation movement to protect America’s iconic landscapes and natural resources. Further, the fungus arrived at a time rife with anxieties about the future of the nation—anxieties which were often articulated in the contexts of nationalism, racial identity, urbanization, and agriculture. Given this climate, the blight was viewed as a threat not only to the nation’s forests but also to its future. It thus became a moral, national imperative to secure forests from the scourge of blight: an “absolute necessity for concerted action of the friends of forestry and forest conservation to avert a threatened crisis” (“The Chestnut Blight,” 1914, p. 101).

In response to this crisis, Pennsylvania Governor John Tener established the Pennsylvania Chestnut Tree Blight Commission in June 1911, tasked with controlling the spread of the fungus and saving the nation’s chestnut forests. The commission waged “active warfare against [the] parasitic disease” (Pennsylvania Blight Commission 1912b, p. 59), and although it was based in Pennsylvania, members saw the blight as a national threat and rallied support from scientists, politicians, conservationists, and plant breeders across the country. In 1912, the commission convened a national Chestnut Tree Bark
Disease Conference in Harrisburg, Pennsylvania to discuss methods of blight control and to encourage other states to contribute funds or manpower to the cause (Figure 4). The proceedings of the conference illustrate that the initial responses to the blight were not merely of ecological or silvicultural concern but were profoundly linked to nationalism through rhetoric about warfare, American identity, might, and spirit.

Figure 4: Delegates and guests at the 1912 Chestnut Tree Bark Disease Conference (Pennsylvania Blight Commission 1912b)
In Governor Tener’s opening address, he framed blight control as national duty and warned of the grave consequences of apathy:

Unless this disease be stopped…it is certain that within a few years very few living wild chestnut trees will be found in America. It is, therefore, entirely in accord with the American spirit that we make every effort to destroy or check the advance of this blight. (Pennsylvania Blight Commission 1912b, p. 16)

As a threat to the nation, the blight was an undesirable and threatening citizen, a pathogen that must be controlled—if not removed—to protect native populations.

University of Pennsylvania botanist J.W. Harshberger envisioned the blight as a key instance in the history of conservation:

When we look back on the history of the conservation movement in the United States, this movement… will be held up as an example of a patriotic movement of the entire people in an attempt to prevent the destruction of our native forests, which are going all too fast. (Pennsylvania Blight Commission 1912b, p. 106-7)

Still others emphasized that the chestnut blight required a united national front: “We have national organizations, national parties, national co-operation to make a meal even, and now we have got to make a national organization to fight a tree enemy just as we would to fight a man enemy” (Smith, quoted in Pennsylvania Blight Commission 1912b, p. 148). From the beginning the blight fungus was infused with socio-political meaning; it was a “tree enemy” that must be checked for the sake of the nation and its native forests.

Blight control was not a question of knowledge or information, but one of national will, spirit, and moral fortitude. Waging war against the blight became not a choice but an obligation of citizenship:

It has been suggested that we should do nothing to counteract the ravages of the chestnut tree disease, because we are not fully informed as to how to proceed. That is un-American. It is not the spirit of the… great States that are represented
here, to sit down and do nothing, when catastrophes are upon us. (Pennsylvania Blight Commission 1912b, p. 20)

This idea of the blight fungus as a national enemy was further driven home by repeatedly likening its removal with past instances of Anglo-Saxon or American victory over enemies as far-ranging as the Spanish navy and sleeping sickness. Governor Tener, for example, equated the task of the Pennsylvania Blight Commission with the U.S. victory in the Spanish-American War:

As Admiral Dewey, you remember, at about the outset of our war with Spain was directed… to seek out the Spanish fleet and destroy it, so it might be said that the only direction given this Commission is to find this dread chestnut bark disease, and destroy it. (Pennsylvania Blight Commission 1912b, p. 18)

Similarly, a scientist working on a treatment for the blight equated his mission with the tenacity of the “white man”—the “rebel in nature”—in conquering disease in Africa:

I do know this, that [research toward a cure] is something that ought to be encouraged, just as much as when the sleeping sickness in Africa killed a million of the tribes of Africa. The white man did not say, "Let them die" but rose up, as a man, the rebel in nature, and said "I will not die, but I will destroy that which is destroying me." And I am taking that position now. We are trying to see if there is not something that can be done to destroy the chestnut tree blight. (Pennsylvania Blight Commission 1912b, p. 191)

Through these metaphors of warfare and disease, the blight fungus was established as a national enemy—whether its origins were foreign or not, it lay far beyond the confines of the population. For the Pennsylvania commission, it became an American duty to scout for blight, to perform tree surgery (Figure 5), and to weed out the undesirable citizen and protect the nation’s native populations. As the blight was demonized, the American chestnut itself was elevated from ubiquitous forest tree to threatened symbol of the old America.
Immigrants, aliens, and foreign stock: Policing porous boundaries

Yet while the blight fungus was framed as a national enemy and an “undesirable citizen” (Metcalf 1913, p. 18), the nativist impulses at work in chestnut blight control, as well as the broader plant quarantine movement, were neither pure nor complete. Scientists and horticulturalists often simultaneously displayed a fear of foreign bodies and a desire for potentially valuable and exotic varieties from far corners of the world to augment the health, wealth, and power of the American nation. Reactions to the blight—
and in particular the controversy over its origins and subsequent efforts to regulate plant movement—highlight that the biopolitical project of securing nature and the nation is not about “locking up life processes” (Dillon and Neal 2011, p. 15) but about allowing, regulating, and channeling the circulation of bodies. While initial responses to the blight emphasized warfare and the complete closure of borders, discourses around blight control evolved to promote control rather eradication, and management of circulation rather than complete exclusion. This new emphasis relied on distinguishing between undesirable and desirable specimens—allowing those specimens that might benefit the nation, economically or otherwise, to pass through the nation’s porous borders as a way to cancel out the “inherent dangers of this circulation” (Foucault 2003, p. 65).

This is not to say that scientists and horticulturalists welcomed or even accepted foreign bodies. Indeed the blight tapped into the anxieties of many Americans about the economic and biological risks posed by both human and nonhuman immigrants, as exemplified by discussions around the possible origins of the fungus. Was it simply a native species that had existed in North America for centuries, only to spread rapidly as native forests fell into unsanitary and unhealthy conditions? Or was the blight an alien from afar, a foreign pathogen that had crossed oceans alongside the huddled masses? While scientists were initially divided on the blight’s origins, over time support grew for the foreign-born hypothesis. In 1908, Haven Metcalf, chief of the USDA’s newly-created Office of Forest Pathology, noticed that Japanese chestnut trees appeared to be less affected by the blight than their American and European counterparts. He therefore hypothesized that the fungus had been introduced from Japan, likely arriving by way of
Japanese chestnut nursery stock which had been imported and planted in the New York City area beginning in 1876 (Metcalf 1908).

Still others remained unconvinced that the blight was Asian. At the 1912 Pennsylvania conference, a number of participants speculated that the fungus may have come from Italy rather than Japan, and was introduced and spread by the many Italian immigrants that had settled in New York. A paper presented at the conference by William Farlow, a Harvard mycologist, stated that “the fresh fungus… recalled a specimen I had seen in an Italian collection, and on looking it up and comparing it microscopically with the fresh material, I found the two to be identical” (Pennsylvania Blight Commission 1912b, p. 71). He argued that the chestnut blight was not a heretofore unknown species but was instead Endothia radicalis, a fungus that commonly grew on chestnuts in northern Italy. Lending support to this theory was the fact that many Italians had settled in the Bronx neighborhoods directly surrounding the New York Zoological Park, where the blight was first identified. Indeed Italians were already viewed as a threat among conservationists, as groups of immigrants had previously engaged in armed conflict with park employees after illegally hunting songbirds on the park grounds (Hornaday 1913, p. 101-2). At the Pennsylvania Blight Commission conference, University of Pennsylvania botanist J.W. Harshberger reinforced Farlow’s hypothesis that the blight was of Italian origin:

Professor Farlow suggested that the chestnut blight came from Italy. A friend of mine, a botanist in New York City, said that he had often noticed that around the settlements of Italians in the neighborhood of New York and Brooklyn, and Jersey City, these smaller settlements that the Italians made outside the city, that the trees always died or were killed, and he thought there was some relation between the death of the trees and the settlement of Italians nearby. So he
suggested rather a curious name for this malady which attacked the trees—he said it was a form of ‘Dagoeatis.’ So perhaps, if Professor Farlow’s views are correct, the trees which were killed on Long Island suffered from a form of ‘Dagoeatis.’ (Pennsylvania Blight Commission 1912b, p. 107).

In this anecdote, the introduction of the blight is attributed to Italian immigrants who presumably tracked disease wherever they settled. Harshberger even quips that the blight might be called “Dagoeatis,” referencing “dago,” a common ethnic slur for Italians in the early twentieth century. This idea that the blight originated in Italy undoubtedly drew strength from xenophobic views of Italian immigrants as uncivilized, unclean, and harmful to the environment (Rome 2008). Conservationist and director of the New York Zoological Park at the time of the blight, William Temple Hornaday, exemplified this nativist perspective:

Italians are pouring into America in a steady stream… New York City now contains 340,000 of them… Wherever they settle, their tendency is to root out the native American and take his place and his income. Toward wild life the Italian laborer is a human mongoose. (1913, p. 101)

Here, the Italian immigrant represented a threat to both the native body politic and the native nature; the idea that the blight had come from Italy only reinforced anti-immigrant sentiment and served as a reminder to native born Americans of the dangers posed by foreign bodies, both human and nonhuman. Further, by associating the fungus with other undesirable immigrants, the American chestnut itself increasingly became viewed as a national nature.

But despite the evidence brought forth at the Pennsylvania conference, it was soon established that the blight was not from Italy and had come, as the USDA hypothesized, from East Asia. In 1913, plant explorer Frank Meyer was commissioned by
the USDA to find the chestnut blight fungus and bring more of it back to the U.S. for further examination (Fairchild 1913). On a previous mission six years prior, Meyer had come across chestnut trees growing in northeastern China (Shear and Stevens 1913). While the Japanese chestnut had been imported and grown in the U.S. for several decades, the Chinese chestnut species was yet unknown to American botanists. It took Meyer less than two months to find the blight fungus on Chinese chestnuts, and in June 1913, he reported back to David Fairchild, head of the USDA’s Office of Plant Introductions:

Dear Mr. Fairchild: Here I am sitting in a Chinese inn in an old dilapidated town to the northeast of Peking, between Tsun hu a tcho and Yehol and have been busy for several days collecting specimens of this bad chestnut bark disease and taking photos of same. It seems that this Chinese fungus is apparently the same as the one that kills off the chestnut trees in northeast America. (Meyer, quoted in Fairchild 1913, p. 297-8)

Identifying the blight’s origins further established it as a racial other and “serious source of danger” (Metcalf 1914, p. 13) for the nation, but it did nothing to halt the devastation it wrought on the forests of the eastern U.S. As Governor Tener of Pennsylvania remarked at the 1912 conference, “While… botanical history and pathology are of importance, the real thing is preparedness to repel the invader, using every means known to science and practical experience” (Pennsylvania Blight Commission 1912b, p. 17). No method, however—not cutting out every infection, not applying any healing salve—could stop the spread of the fungus, and attention rapidly moved away from the eradication of the foreign invader and toward regulation of plant movements and breeding to develop immunity.
The blight not only highlighted the threat that undesirable immigrants posed to the nation but also provided rationale for federal regulation of flows of plants and people across the nation’s borders. As the focus moved toward control, regulation, and prevention, Department of Agriculture scientists increasingly advocated for techniques such as temporary quarantines, the inspection of imported nursery stock, and large scale importation of foreign chestnuts for breeding. These biopolitical technologies aimed not necessarily to keep foreign material out of the nation, but to allow for it occur within particular confines, and even to use foreign chestnuts to improve the blight resistance of the American chestnut species. In the final report of the Pennsylvania Chestnut Tree Blight Commission (1914), Governor Tener lamented that the blight may have been prevented had there been thorough inspection of imported nursery stock:

Eastern Asia, the home of the San Jose scale, has been found to be also the home of the chestnut blight… There is no reason to doubt that it found its way to this country in the same way that the San Jose scale did, on nursery stock, and at about the same time, or perhaps somewhat later. Any system of strict inspection… could have kept it out of the country, but no such system was then in use. (Pennsylvania Blight Commission 1914, p. 9)

Metcalf and the USDA urged all states to pass laws “putting the chestnut bark disease on the same footing as other pernicious diseases and insect pests, such as peach yellows and the San Jose scale, against which quarantine measures are now taken” (Metcalf and Collins 1911, p. 13). Inspectors of imported plants were instructed to “take special care that no shipment, however small, escapes their rigid inspection” (p. 16), and nurserymen were advised to “watch continually and with the utmost care their own nurseries and orchards, and to destroy immediately by fire any trees that may be found diseased” (p. 101).
16). Still, chestnut nursery stock continued to be imported, and the goal of these new procedures was to secure—not stop—the circulation of plant material.

On the heels of the blight, Congress passed the Plant Quarantine Act in 1912, which established a Federal Horticultural Board and gave the USDA the power to initiate quarantines for particular plants and to regulate the importation of plants and plant products from other countries. As the Federal Horticultural Board explained, the blight was just one of “many undesirable immigrants that the American farmer must board and lodge forever. What the United States wants to do now, if it can, is shut the doors to their brothers and their sisters and their cousins and their aunts” (Federal Horticulture Board 1922 p. 20). Yet despite this nativist rhetoric of exclusion and closed doors, many among the USDA continued to support the introduction of as many foreign plants as possible, in an effort to augment the agricultural wealth of the nation (e.g. Fairchild 1906). What resulted from internal conflict at the USDA among ‘ecological cosmopolitans’ and ‘biological nativists’ (Pauly 1996, 2008) was an increasingly liberal and biopolitical emphasis on policing porous boundaries—not cutting off circulation completely, but distinguishing between desirable and undesirable specimens and excluding those that posed the most severe threat to the American farmer—believed by many to be the very core of the nation and the race, as discussed above. In other words, the nativism undergirding regulation of plant movement was neither pure nor complete, and scientists often displayed simultaneously a fear of and desire for foreign specimens.
Chestnut grower J. Russell Smith, later president of the Association of American Geographers, demonstrated this contradiction in a speech at the 1916 Meeting of the Northern Nut Growers Association:

As my experience with nut trees well shows there is little doubt that we are now in a period of great activity of plant enemies. They are indeed a by product of the splendid work now being done in bringing to us the crop plants of all parts of the world. Along with the Chinese and Japanese products which have already been so valuable and promise us so much more for American horticulture we have received the San Jose scale, the chestnut blight, and probably others will follow. (Smith 1916, p. 60)

According to Smith, to enjoy the agricultural and horticultural benefits of Empire meant to experience risk as well; foreign bodies could be both harmful and beneficial, and native bodies were not always worthy of protection. The circulation of promising and valuable plant material implied and even necessitated the circulation of “plant enemies.” This situation thus required the activation of new technologies of power, including risk assessments, plant inspections, and quarantines, designed to keep plant material flowing from the far corners of the world into the U.S. Such technologies allowed the USDA to channel flows of plants, to distinguish between threats and advantages, and to allow those specimens that might benefit the nation, economically or otherwise, to pass through its permeable borders while barring those that posed a potential threat.

This movement away from “locking up life processes” (Dillon and Neal 2011, p. 15) and toward the management of plant flows epitomizes Foucault’s description of biopolitics as letting things happen:

We see the emergence of a completely different problem that is no longer of fixing and demarcating the territory, but of allowing circulations to take place, of controlling them, sifting the good and the bad, ensuring that things are always in movement, constantly moving around, continually going from one point to

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another, but in such a way that the inherent dangers of this circulation are canceled out. (2003, p. 65)

In this view, maintaining flows—and even channeling foreign materials and bodies for the benefit of the nation—becomes a recognizable solution to problems like the chestnut blight, the San Jose scale, and other pernicious invaders. I argue that this liberal regulation of flows does not contradict the strongly racialized and nativist discourse around the fungus as a national enemy, but instead emerges with it, as continued circulation becomes part of the process of warding off, diluting, or building immunity to the invader.

**Breeding better bodies: Plant and racial improvement projects**

In this section I turn to early chestnut breeding efforts, demonstrating first that breeding chestnuts for blight resistance evoked a mixture of hatred, fear, and enthusiasm toward foreign bodies. Despite nativist and anti-immigrant rhetoric around the foreign plant material, the introduction of non-native chestnuts was crucial to early breeding practices and hopes for chestnut restoration. The act of breeding became viewed as a service to the nation, with breeders likened to “soldiers who campaigned with the armament of a plant breeder to defeat the blight” (Lord 2007, p. 26). In addition, this section explores the role of the American Breeding Association in supporting chestnut improvement, illustrating that plant breeding shared a history and a logic with racial improvement and eugenics projects in early twentieth century America. Rather than being politically neutral and scientifically objective, breeding a blight-resistant chestnut was from the beginning a racialized project.
Following the “sinister spread” of the Asian blight (Van Fleet 1916, p. 54) and the failure of the Pennsylvania Blight Commission, hopes for immediate control of the fungus waned. Attention shifted away from eradication and control and toward improving the immunity of the native American chestnut through breeding and hybridization. Yet to improve the tree such that it might exhibit resistance to the blight required breeding it with foreign species, including the Japanese and Chinese chestnuts. That such trees were from overseas did not appear to vex breeders significantly; their blight resistance rendered their foreignness desirable rather than threatening. They represented the foreign body at its best: a possible source of wealth that was both exotic and familiar, and their circulation would help to secure American forests from the scourge of the blight, promote commercial markets for chestnut timber and nut crops, and make the “eastern waste places blossom and yield a harvest” (Smith 1907, p. 230). Hence, the continued circulation of foreign species was a crucial part of nation and empire building and American economic expansion in the early twentieth century.

The discovery of the Chinese chestnut species and its ability to survive blight infection prompted even greater plant exploration in East Asia, as breeders desired new material with which to improve the American chestnut species. A *Journal of Heredity* report on chestnut breeding orchards in 1922 stated:

> Mr. J.F. Rock, the agricultural explorer, is now in China collecting all the species of chestnuts he can find there in order that this breeding material may be placed in the hands of American plantsmen, to be used for crossing with the native species to develop the new hybrid chestnut. (Detlefsen and Ruth 1922, p. 305)

Importantly, the purpose of chestnut breeding was rarely explicitly ecological; instead, it was framed as a way to improve nature to produce new agricultural or resource wealth.
for the nation; through breeding scientists would “accelerate one-hundred-fold the age-
long process of making ourselves new riches from new plants” (Smith 1907, p. 228). In
the skilled “hands of American plantsmen,” foreign species could be improved,
channeled, and ultimately exploited for the benefit of the nation. Without the continued
circulation of living material, such species would be unimproved and presumably value-
less. By passing through the nation’s porous boundaries, however, Chinese and Japanese
chestnuts became the raw material with which to enhance the immunity of the American
chestnut to the blight.

By the late 1910s, chestnut breeding orchards had been established by both expert
breeders as well as farmers, and most breeders were hopeful that improvement and
replacement of dying American chestnuts by a superior blight-resistant hybrid would
occur rapidly. USDA breeder Walter Van Fleet was also optimistic about chestnut
breeding as a profitable livelihood for American farmers: “Though greatly hampered by
the advent of the new disease, [chestnut breeding] thus makes its appeal as a highly
promising occupation. It appears probable that the chestnut in its most desirable form can
be saved” (1914, p. 25). The central task of the chestnut breeder was to “develop a race of
tall, hardy, blight-resistant individuals” (Graves 1947, p. 87) by separating “the
individuals possessing desirable qualities from those possessing undesirable and to
reproduce only the former” (Smith 1907, p. 227). Foreign chestnut species, particularly
the Japanese and Chinese, were thought to be inferior to the American species in their nut
crops, timber, size, heartiness, and appearance, but their value lay in their resistance to
blight. Of the Japanese chestnut, one breeder wrote that “almost without exception the
nights are undesirable… So worthless that a well-bred American hog will let them lie on the ground from September to Christmas” (Smith 1907, p. 228). But if breeders could separate the desirable blight resistance from the other undesirable characteristics of the foreign trees, they would theoretically be able to produce a superior, near-ideal specimen: it seemed that it would be “a simple task for the hybridizer to blend these strains and receive as a result a marketable nut, possessing all desirable qualities” (Smith 1907, p. 229). The colorful names given to these early chestnut crosses—‘Japan Giant,’ ‘Daniel Boone’, and ‘Paragon’—illustrate both the hopefulness of breeders as well as their desire to produce a strong, hearty, and near-perfect American tree.

These early attempts to breed superior chestnuts did not occur in isolation but were part of a broader impetus to improve species, populations, and races through the application of insights from Darwinian evolution and Mendelian genetics (Kimmelman 1983; Kloppenburg 1988). Chestnut breeding was one of numerous breeding projects taken up and advocated by the American Breeding Association, an organization created in 1903 by the Association of Agricultural Colleges and Experiment Stations. Willet M. Hays, the Assistant Secretary of Agriculture under President Theodore Roosevelt as well as the first president of the ABA, described the group as a “movement for improving the heredity of all useful living things” (Hays 1907, p. 3). For Hays and other ABA leaders and breeders, improvement through breeding was a moral undertaking, explicitly linked to conservation and protecting and promoting American agriculture and the wholesomeness of country life (Kimmelman 1983). The ABA (renamed the American Genetic Association in 1914) was also among the first national organizations to actively
promote eugenics research in the U.S.; in publications and meetings, practical agricultural research was regularly put into conversation with ideas about human breeding and racial improvement (Figure 6). As Edwin Black discusses in War Against the Weak (2008), eugenics as a radical human engineering program would “spring not from the medical schools and health clinics of America, but from the pastures, barns and chicken coops—because the advocates of eugenics were primarily plant and animal breeders” (p. 32).

Figure 6: The American Genetic Association's Journal of Heredity, Volume 5 (1914)
Historian of science Barbara Kimmel (1983) argues that the agricultural context of ABA not only provided eugenics with a scientific basis, but also bolstered support for racial improvement by linking it to a particular vision of the ideal nation as white, rural, and agrarian. If farms represented the home of the American race—as Roosevelt, Pinchot, and other prominent conservationists advocated—then the act of breeding was as natural and as moral as sowing fields, milking cows, or gathering chestnuts.

Just as desirable and undesirable chestnut specimens needed to be distinguished to allow the tree to survive the onslaught of blight, so too did human specimens need to be differentiated using Mendelian genetics to ensure the continuance of the American nation. In other words, chestnut breeding and racial improvement occurred in conversation with one another, as both emerged as biopolitical projects of securing life by channeling desirable genetic material while doing away with bodies that pose a threat to the nation and its nature. By extending the rules and goals of plant and animal breeding to societal improvement, eugenicists believed that a host of social problems such as poverty, illiteracy, disease, and crime could be tackled and resolved. In an article in the Journal of Heredity, Alexander Graham Bell explained the central role of the plant and animal breeder in the science of eugenics:

All recognize the fact that the laws of heredity which apply to animals also apply to man; and that therefore the breeder... is fitted to guide public opinion on questions relating to human heredity. Without power to control, he has power to advise; and the public generally will accept his statements as sound... What an opportunity for the members of the American Genetic Association to benefit the human race! (1914, p. 2)

Just as “seeds should be selected from the best individual representatives of a species” (Smith 1907, p. 225), so too should the breeder “promote the marriages of the desirable
with one another” (Bell 1914, p. 7). Of course, not all plant and animal breeders were eugenicists, and not all eugenicists believed that the methods of plant and animal improvement could be directly applied to the human race (e.g. Cook 1914). Still, the work of the ABA in promoting plant and animal breeding in conversation with eugenics illustrates that making the American chestnut live was indeed a deeply racialized, biopolitical, and nationalistic project that relied on distinctions between desirable and undesirable life forms in order to protect and enhance American nature, bloodlines, and the nation state.

Thus far this chapter has woven together ideas about biopolitics, race, and nation with a narrative about key responses to the chestnut blight, from the eradication efforts of the Pennsylvania Blight Commission to the breeding programs of the USDA. Through these discourses and practices of blight control, inspection of nursery stock, plant exploration, management of plant flows, and breeding, the American chestnut and the blight fungus came to serve as national nature and national enemy, respectively. The American chestnut came to be viewed as a species that “from pioneer days… was intimately connected to the American scene” (McKay and Crane 1953, p. 228), while the blight evoked fears that the nation and its “pioneer days” heritage were at risk of erosion and contamination, and thus required the weeding out of undesirable life forms to strengthen and defend the nation.

In the remainder of the chapter, I consider the lasting import of American chestnut in the twenty-first century through a discussion of ongoing restoration practices at the Flight 93 National Memorial. This example demonstrates the continued presence of
nationalism, fears of the foreign, and notions of racial differentiation in today’s chestnut restoration movement. In short, efforts to protect or restore the American chestnut are not—and indeed were never—solely about the conservation or improvement of species and ecosystems, but are also about the construction and defense of national natures.

**Chestnuts at Flight 93: Nation and nature in the twenty-first century**

More a century after the blight fungus arrived on American soil, the chestnut’s restoration is still a work in progress, but already the tree has come to serve as a redemption story, not only for the species itself but also for the American nation. Laced with a few Chinese genes, the American chestnut is now being widely planted throughout the tree’s native range in eastern North America. And although today’s restoration movement emphasizes biodiversity, wildlife habitat, and healthy and resilient ecosystems, undertones of nostalgic nationalism and racial thinking remain present, if understudied. For example, a member of the Pennsylvania chapter of The American Chestnut Foundation (TACF) recounted:

> Today we hear much about our dependence on fuels and goods from overseas. Buck [my horse] ran on oats, bran, hay and apples, all produced locally… The tools we used were made in America. The oil in the lamps was produced and refined in Bradford, PA. The chestnut trees were made in America. The only thing from overseas was the blight! (quoted in Bolgiano and Novak 2007, p. 16).

Conflating the blight with foreign influence and deterioration, this reminiscence links the American chestnut with a particular vision of the nation as rural, self-sufficient, and secure. This quote also reflects unmistakable nostalgia for the days and ways of old—for times and places where economies were locally oriented, where products were made in
America, and where people were intimately connected with the land. This link between
the chestnut and American heritage is not lost on scientists, as one forest ecologist and
Ohio TACF member explained:

The species does… symbolize something American. It is the American chestnut, and it’s played such a big cultural role, and there’s this view, if we can bring back the chestnut, we can bring back the good old days. We can fix something about America. (Author interview 2012, emphasis added)

Again this rhetoric hearkens back to the “good old days,” an America that was seemingly purer, simpler, and less at risk from foreign bodies.

This link between the chestnut and the American nation has become materialized on the landscape through a variety of biopolitical technologies and practices—from breeding to dilute the Chinese heritage of blight-resistant chestnuts (as I discuss in Chapter Four) to chestnut plantings at sites of particular cultural importance (e.g. the Flight 93 National Memorial, Abraham Lincoln’s birthplace, and the White House grounds). Here, I focus on the much-celebrated restoration of blight-resistant American chestnuts at the Flight 93 National Memorial in Shanksville, Pennsylvania. Over four days in late April 2012, over one hundred volunteers, myself included, gathered to plant 13,000 native tree seedlings—blight-resistant American chestnuts among them—at the site where United Airlines Flight 93 crashed on September 11, 2001 after passengers wrested control of the plane from three hijackers (Figure 7). The plantings explicitly served a dual purpose: first, to heal the land, which had been deforested, stripped of its coal, and reclaimed as a non-native grassland, and second, to heal the American nation in the wake of 9/11. While chestnuts were not the only trees planted, they were the crown species of the occasion, specially marked with orange tags.
and planted in the most promising locations. A forester in charge of the restoration project explained that the land needed to be touched by human hands. He did not mean this just metaphorically—literally, the ecosystem was in a state of arrested natural succession, he explained, and could not produce life on its own. To intervene would restore the integrity of the ecosystem and would allow it to grow and change—and to ultimately become a forest.

Figure 7: Volunteers at work during the Plant a Tree at Flight 93 event in April 2012 (photograph by author)
The seeds planted at the site, said Pennsylvania Governor Tom Corbett in a speech at the memorial, would represent “the resistance that [passengers] put up and helped to ensure our nation’s freedom” (quoted in Dennis 2013). Similarly, a former TACF staff member wrote in reflecting on the planting, “The subtle success story suggested by the American chestnut- disaster followed by eventual restoration- offers a quiet, compelling, positive addition to the many stories that are represented by this monument to the 9/11 victims and heroes” (Banker 2012). Here, the American chestnut tree, once threatened by foreign invaders but now presumably blight-resistant thanks to the ingenuity of American scientists, is explicitly linked to the security, protection, and recovery of the nation. Just as early twentieth century responses to the blight were as much about nationalism as environmentalism, so too are current projects like Plant a Tree at Flight 93 shaped by notions of American exceptionalism, racial differentiation, and national heritage.

By participating in the Flight 93 restoration project, citizens came to learn about the species’ blighted past and ongoing resurgence. Those I talked to portrayed the planting of native species at the memorial as a patriotic act:

I’m bringing [my children] to plant because it’s an opportunity to teach them about something tragic in our history by doing something good. I’ve taught them about 9/11, and they’ve heard of the chestnut blight in school… But it’s just stories to them. I want them to really understand how important these stories are to our country. (Author interview 2012)

Because of Flight 93, so that’s the least a person can do, okay? They made the ultimate sacrifice… I had chestnut trees down on my property. They were the American chestnut trees. I guess [the ones we planted today] are supposed to be a stronger type of tree. There has been a blight in the original tree, and now they want to replant the stronger seedling. What they gave us to plant had the specific
orange tag on it to highlight that it was the chestnut tree. So they can keep a good record of what’s happening to them as well. (Author interview 2012)

Here, the chestnut’s restoration is clearly understood to be more than an ecological undertaking—it is also practice of citizenship, an education in the struggles and triumphs of the nation and its nature, and a way to forge a shared sense of history and heritage.

Volunteers also recognized the dangers posed by undesirable foreign bodies like the blight fungus, hearkening back to USDA forest pathologist Haven Metcalf’s warning that we must see that no other foreign species “get a foothold on this continent” (1913, p. 14).

I like the idea of planting a chestnut… so that my son, my grandkids will enjoy it and see the beauty and have… a part of our heritage that was lost to the blight reclaimed and brought back… The American chestnut is distinctly American. It’s a beautiful tree. It would be nice to see it come back… But I think the chestnut tree, too, should always be a lesson in importing foreign trees. Part of the blight came in on the Chinese chestnut, and we have to protect our distinctly native species. (Author interview 2012)

These quotes demonstrate that through planting American chestnuts, citizens came to associate the tree with American heritage. Further, the planting served as a reminder, at least to one volunteer, that the project of securing nature is ongoing and requires constant attention to and regulation of flows of plant materials into the nation. More broadly, the planting of chestnuts at the Flight 93 National Memorial illustrates that links between race, nation, and nature are not merely historical relics which are now remedied by the increasingly objective and politically neutral sciences of plant breeding and ecological restoration. Indeed, efforts to restore blight-resistant American chestnuts today remain linked, materially and discursively, to notions of American exceptionalism and national heritage.
Conclusion

From the beginning, responses to the chestnut blight were shaped by profound anxieties about the fate of the American nation. Concerns about immigration, race, conservation, and the loss of frontier and agrarian cultures converged in discourses that portrayed the blight fungus as a national enemy and a threat to the nation’s nature and heritage. The America evoked in discourses around the blight was a nation at risk of erosion and contamination, a nation that required the weeding out of the undesirable citizen to protect and promote its native body politic, both human and nonhuman. This is the essence of biopolitics: distinguishing between desirable and undesirable bodies, and securing and improving the nation by diminishing those bodies seen as threats to the norm. Ideas of race and nation are activated here as crucial—but crude—technologies for distinguishing between what should be made to live and what should be allowed to die. In other words, nativist discourses and policies around exotic species arise from the need to differentiate between life forms that strengthen the nation and those that threaten it. The blight fungus becomes a national enemy, which must be managed if not eradicated, while the American chestnut itself is deployed as a national nature, a nostalgic symbol of early American culture and a racialized agrarian heritage.

But such mechanisms for differentiation are crude, in that “foreign” life forms are not always viewed as material threats to the nation, and are at times even heralded as the raw sources of national strength, wealth, and power that need to be protected. The story of the chestnut illustrates this bifurcated approach to exotic nature, as both ‘biological nativism’ and ‘ecological cosmopolitanism’ (Pauly 1996, 2008) were fundamental to
early chestnut blight control and breeding efforts. This suggests that nativist and cosmopolitan approaches to nature are not necessarily contradictory but are instead pieces of the broader biopolitical imperative to amplify the nation through the circulation and inclusion of beneficial life forms and the elimination of potential threats.
Chapter 4: A strangely familiar species in a brave new world

In March 2013, a group of scientists and conservationists convened at the headquarters of the National Geographic Society (NGS), where they shared Edenic visions of a future in which woolly mammoths, passenger pigeons, Carolina parakeets, European aurochs, Tasmanian tigers, and American chestnuts proliferated once again over the earth. Using techniques such as breeding, cloning, and genetic modification, the scientists presenting at this TEDx DeExtinction event aim to revive, restore, and re-wild extinct species, such as the passenger pigeon, or functionally extinct species, like the American chestnut. Longtime environmentalist and meeting organizer Stewart Brand explained at the event that de-extinction signals an emerging scientific paradigm with tremendous implications for conservation. While in the twentieth century scientific discovery consisted primarily of finding species, ecosystems, and genes and learning about their components, functions, and interactions, the main scientific discoveries of the twenty-first century would involve not finding life but making life (Brand 2013b). In biopolitical terms, conservation can no longer be satisfied with differentiating between pre-existing biological threats and advantages but must now actively fight against emergent threats by intentionally producing desirable natures.
In giving charismatic species a second chance at survival, de-extinction aims to atone for our own species’ past transgressions. Yet de-extinction differs from conventional understandings of restoration in that it involves some degree of tinkering with—or even recreating—the genome of the target species. In this sense, it is not merely habitats or ecosystems that are being restored and reshaped, but the biology of organisms themselves. Critics contend that the resultant organisms are at best hybrids and at worst mere placeholders, lacking the true reproductive compatibility, genetic diversity, evolutionary history, and learned practices of their kinds (Pimm 2013). But advocates of de-extinction projects argue that it is not species’ origins that matter: if it looks like a passenger pigeon and behaves like a passenger pigeon, then, proponents assert, it is a passenger pigeon, even if it has a slightly different genetic composition, and even if it fluttered out of a beaker (Figure 5) (Brand 2014). Hence de-extinction blends the logic of recovery and discovery, anticipating a future that is novel and experimental yet strangely familiar.

Touted as “conservation’s next frontier” by Smithsonian Magazine and the “mind-blowing idea of 2013” by the Washington Post, de-extinction is conservation in and for the Anthropocene, in which nature is intentionally produced while drawing attention to its very production (Robbins and Moore 2013, p. 14). As Lorimer (2012) has stated, the declaration that we are living in the Anthropocene (Crutzen 2002; Crutzen and Stoermer 2000) represents the “public death of the modern understanding of Nature removed from society” (p. 593). De-extinction, along with associated projects like re-wilding and assisted migration, are part of an emerging scientific culture of the Anthropocene, which
Robbins and Moore (2013) suggest is characterized by anxieties about both human transformation of the biosphere and about the value judgments and political assumptions inherent in science. In this chapter I expand on scientific rationalities of the Anthropocene through a discussion of the American chestnut. Emblematic of science in the Anthropocene, the project of making the American chestnut live is animated by frictions and blurred boundaries: between evolution and extinction, natural and artificial, and protection and production.

Figure 8: Reviving extinct species. In April 2013, National Geographic featured de-extinction as its cover story, depicting a woolly mammoth and other extinct species emerging from a beaker into the wilderness (National Geographic 2013).
As a species that is not fully extinct, the American chestnut represents a tempered version of de-extinction debates. Ousted from its role of “monarch of the forest” (Dennis 1910, p. 137) by an invasive fungal pathogen, the chestnut now functions as an understory shrub, a fundamentally different socioecological role than its prior position of beloved canopy and timber tree. Dead or alive, the charisma of the species is indisputable; it is a tree that followed American settlers from “cradle to grave” (Freinkel 2009, p. 26), and it has become a national symbol hearkening back to simpler days and ways of early America. Also unlike many other species targeted for de-extinction, the American chestnut is a plant, and as such, its transformation is less jarring for many supporters. As one chestnut supporter remarked, “It’s like making a better apple—people have been doing that kind of thing for centuries” (Author interview, 2013). Another advocate explained, “We’re not against anything; we’re for the chestnut. And who can be against the chestnut?” (Author interview, 2011).

It is in part this ostensible lack of conflict that has made the restoration of the American chestnut not only possible but also incredibly successful thus far, with trees that are presumed to be blight-resistant being test planted throughout the species’ native range. Its success can also be attributed to the use of multiple and divergent scientific techniques; rather than solely utilizing genetic engineering and clonal techniques—as do many other species revival projects—blight-resistant chestnuts are being produced through genetic transformation (in combination with cloning) and more traditional
breeding techniques based on classical Mendelian genetics. Yet while the species itself provides common ground, important frictions exist between these approaches and among the scientists and volunteers who enact them. Here, I draw on the concept of boundary objects (widely used in STS) to consider the dynamics by which these two approaches to de-extinction are established and articulate with one another. Far from being a cohesive and singular project, chestnut de-extinction operates as a boundary object (Star and Griessemmer 1989; Star 2010) linking diverse actors, methods, technologies, and scientific communities. Using this concept on a jumping-off point, this chapter documents restoration of functionally extinct species as a messy, heterogeneous process marked by the troubled technological enmeshment of people and nonhuman nature.

In so doing, I identify key areas of tension that animate scientific discourse and practice in the Anthropocene. Without recourse to a pure and unadulterated nature, scientists and restorationists have come to negotiate the terms of chestnut restoration along new lines, and particularly around issues of: (1) ‘health’ in the wake of emergent threats, (2) the transformative role of science and challenges to objectivity and authority, and (3) competing genetic knowledge-practices. While these issues are neither unique to chestnut restoration nor generalizable across all of science in the Anthropocene, they are illustrative of frictions that arise as species and nature-society relations are reconfigured

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5 This chapter focuses on backcross breeding and genetic transformation as these are the two most promising approaches at the moment. As discussed in the introductory chapter, other tools continue to be used in restoration efforts, including hypovirulence and the breeding of large surviving American chestnuts. Hypovirulence in particular has been an important research area for many TACF members, in concert with the organization’s focus on backcross breeding. Some even see hypoviruses as more promising than breeding in the long term: “As we learn more, I believe that hypovirulence will really be the true restoration of the American chestnut. This work is going to take a long time. It’s going to take time for the hypovirus to build in our forests at the quantity that it can really be effective as a natural biological control agent. So I think it’s a matter of time.” (Author interview 2012)
in socially, ecologically, and genetically divergent ways. If conservation in the
Anthropocene is about making life anew rather than safeguarding a static, historic nature,
then what chestnut restoration demonstrates is that while the current biodiversity crisis
necessitates action, what forms that action takes are up for grabs. The resultant struggles
entail biopolitical questions about how to promote ecological health and build immunity
to threats, what should be allowed to circulate freely, and who gets to make such
decisions using what knowledge-practices.

In the following section, I discuss recent work on nature-society relations in the
Anthropocene, situating de-extinction as a form of conservation that, despite its reference
to historic nature, grapples with an emergent, experimental, and uncertain future. Using
the concept of boundary object as a starting point, I then hone in on the two primary
approaches to chestnut restoration: the ‘traditional’ backcross breeding program,
informed largely by classical Mendelian genetics, and the genetic transformation
program, informed by more recent insights from biotechnology, molecular genetics, and
genomics. After briefly introducing each approach, I identify and discuss three key areas
of tension that animate science and restoration in the Anthropocene: ecological health,
scientific authority and normativity, and genetic knowledge-practices. The chapter
concludes by considering the broader implications of de-extinction as a conservation
practice produced in and for the Anthropocene.
Knowing nature in the Anthropocene

Over the past decade and a half, scientists have established and increasingly agreed that the earth system is now dominated by human influence to such an extent that we have entered a new geological epoch, the Anthropocene (Crutzen and Stoermer 2000; Crutzen 2002). The Anthropocene has been used as an empirical argument and a framework for thinking about environmental change, and it serves as both a challenge to and corroboration of human exceptionalism (Robbins and Moore 2013). The declaration of the Anthropocene has found points of articulation with disparate arguments, including environmentalist claims of the “end of nature” (McKibben 1989), as well as scholarly work around social nature (Castree and Braun 2001), assemblages (Ogden et al. 2013), invasive species (Davis et al. 2011), and anthropogenic biomes (Ellis 2011), among other concepts. Additionally, recent research in the biosciences and sociobiology (e.g. environmental epigenetics) has demonstrated that relationships between environments and bodies are not one-way but are dynamic and iterative (Guthman and Mansfield 2013). While these processes do not appear to be unique to the Anthropocene, what is unique is the seeming proliferation of new threats posed by human-induced environmental change (e.g. Langston 2011).

The Anthropocene is the age of people, to be sure, but it is also the age of novel ecologies, no-analog states, nonlinearity, and non-equilibrium systems—all concepts that challenge common conceptions of the biophysical world as stable, predictable, and balanced. Here I use the term ‘Anthropocene’ to refer not only to an age dominated by human activity, but also to broader scientific models of earth systems—from the scale of
the genome to the globe—as emergent, provisional, and open. If the Anthropocene was triggered by the realized threat of human activity, then what it symbolizes is that there is no turning back. We have arrived in the nightmares of the mainstream environmental movement, and the only way out is forward—a simultaneously cathartic and fear-inducing thought.

It is in this context that new conservation practices like de-extinction, re-wilding, assisted migration, probiotics for endangered species, and designer ecosystems, among others, have emerged as real possibilities. Such projects are part of a broader shift in the scientific culture of the Anthropocene away from using the past as a prescription and toward the idea of an open, unpredictable future full of “yet-to-be explored possibility” (Paxson and Helmreich 2014, p. 3). While restoration in the past tended to center on the recovery of ecosystems to a particular steady-state, the life sciences are increasingly identifying positive feedbacks, passed thresholds, and novel states. Humans have altered the earth to such an extent that Nature—as separate from society—is unreachable, if it ever existed (Robbins and Moore 2013). As such, the Anthropocene represents a humanizing of ecology, both at the level of matter itself and at the level of scientific culture, even as it represents a re-naturalizing of humanity (Grosz 2005; Yusoff 2013).

In some ways, the openness and blurred boundaries of the Anthropocene are liberating, as the attendant emphasis on unknowability and unpredictability challenges monolithic expert knowledges and makes way for new natures and new ways of knowing nature (Lorimer 2012). Hence the blurred boundaries of the Anthropocene have come to serve as a grand scientific experiment—a playground for new scientific practices,
discourses, and ever-changing environments. Yet simultaneously the Anthropocene provides new justification and acceptance for environmental interventions that differentially benefit and expose particular human and nonhuman populations (Ogden et al. 2013). In this vein, the novelty of our age and the proliferation of threats to life do not merely invite but rather necessitate novel and radical approaches to conservation. Such ideas have been prompted by scientific advancements in molecular genetics, genomics, and biotechnology, which have made possible new modes of relating between people and nature (e.g. Rossi 2013).

In this chapter, I further explore scientific culture of the Anthropocene, with the understanding that scientific knowledge is varied rather than homogenous, and that different scientific knowledge-practices—though they may lay equal claim to represent biophysical reality (Pedynowski 2003)—produce materially different natures. In the scientific playground of the Anthropocene, scientists and restorationists grapple with an emergent and uncertain future in multiple and divergent ways, though these differences are often erased through unifying concepts like ‘species’. Importantly, the declaration of the Anthropocene and its attendant emphases on novelty do not “render reductionist approaches mute” as “we are not at some moment in which ‘normal science’ has become passé” (Turner 2013, p. xix). And despite the Anthropocene’s insistence that earth systems are now inseparable from—and indeed dominated by—humankind, echoes of Nature continue to shape scientific discourse and practice, often resurfacing in conflicting and contradictory ways. I now turn to the case of the American chestnut, using the concept of boundary object as a way to conceptualize the messiness of de-extinction.
Chestnut restoration as boundary object

The project of American chestnut restoration serves as a boundary object residing between multiple scientific communities and discourses. Masked by the seeming unity of the species are complex and power-laden frictions—frictions that reveal much about the politics of science and nature in the Anthropocene. Introduced by sociologist Susan Leigh Star and philosopher of science James Griesemer and widely applied in STS and geography (e.g. Harvey and Chrisman 1998; Cohen 2012; Brand and Jax 2007; Goldman 2011), boundary objects are objects or concepts which are able to travel between different communities and groups by retaining a high degree of interpretive flexibility. In other words, they are “plastic enough to adapt to local needs and the constraints of several parties employing them, yet robust enough to maintain a common identity across sites” (Star and Griesemer 1989, p. 393). Boundary objects therefore allow groups and individuals with different aims, methods, and worldviews to collaborate without complete consensus. Groups may tailor the boundary object for their particular needs, but they are able to cooperate and communicate across difference by shifting back and forth between broader and more specific understandings. It is this malleability and capacity to move through different networks that make boundary objects politically tractable and ultimately successful (Brand and Jax 2007).

What I draw from the concept of boundary object is not merely an appreciation of the different interpretations of chestnut restoration but rather an attention to the multiplicity of scientific discourses and material practices that underlie formal and standardized top-down representations of restoration as a cohesive and uncomplicated
undertaking about a single, coherent biological life form—the American chestnut as a species. This multiplicity is emblematic of the complex and contested process of de-extinction in Anthropocene, a time in which science and conservation are increasingly future-oriented and open to multiple possibilities, yet remain gripped by concepts, norms, and practices established around a pre-given nature. I now turn to the two key approaches to chestnut de-extinction: backcross breeding and genetic transformation. These approaches are rooted in different scientific communities with their own unique research strategies, key concepts, and discourses. While de-extinction provides a common goal, important frictions exist between the two main approaches and among the scientists and laypeople who enact them. Both communities share a commitment to ecological health, science, and restoring a chestnut that is as close as possible to the original species. Yet these approaches suggest different biopolitical visions about what constitutes a species’ identity and how to build immunity and achieve healthy ecosystems in an ever-changing world. Further, what is depicted as “good science”—scientific truths, methods, technologies, and metaphors—is neither identical nor uncontested in either backcross breeding or genetic transformation.

Backcross breeding

The “Burnham hypothesis” of backcross breeding is the most widely accepted approach to chestnut restoration and the method historically pursued by TACF. The goal of backcross breeding is simple and elegant: to transfer the traits for blight resistance from the naturally resistant Chinese chestnut to the American chestnut through a series of
backcrosses and intercrosses, thereby producing BC$_3$F$_3$ chestnuts that [ideally] look and act like American chestnuts but possess the blight resistance of the Chinese species (Figure 9). BC$_3$F$_3$s are considered 15/16 “American” and 1/16 “Chinese,” and have been dubbed Restoration Chestnut 1.0 by TACF. Much like computer software, TACF plans to gradually develop and introduce new and improved versions of the species over time, but ultimately breeders hope that the tree will resume evolving on its own.

![Figure 9: TACF’s backcross breeding program](image-url)
Rooted in classical genetics and patterns of Mendelian inheritance, backcross breeding is concerned with phenotype, or the expression of observable traits based on genetic and environmental influences. Pioneered in the 1920s by plant breeders and geneticists, this type of breeding is most effective when a particular plant variety or species is highly successful in all ways but one (Harlan and Pope 1922; Briggs and Allard 1953). The goal of the technique is to improve a particular imperfection while retaining all other characteristics of the original species or variety. The original plant—the “recurrent parent”—is bred first with a “donor parent” that possesses the trait to be transferred. Through a series of crosses over multiple generations, offspring gradually become more and more phenotypically similar to the recurrent part, while retaining the desirable trait transferred from the donor parent.

Prior to the founding of TACF in 1983, backcross breeding was primarily used in the development of disease-resistant varieties of wheat, corn, and other cereal grains. With the advent of biotechnology and genetic engineering in the, however, scientific attention to breeding waned. Yet even as genetic engineering was launching in the late 1970s, renowned plant geneticist Charles Burnham of the University of Minnesota returned to backcross breeding in the hopes of producing a blight-resistant chestnut. Together with student Philip Rutter and a number of other collaborators, Burnham developed a breeding program for the American chestnut and officially formed TACF as a non-profit in 1983 (Willeke 2013). Burnham’s breeding program for the chestnut was not altogether new; from the 1920s to the 1960s the USDA had attempted to breed blight-resistant chestnuts using crosses between the Japanese, Chinese, and American species.
While these efforts were ultimately unsuccessful, they provided key information to TACF about sources of blight resistance and methods of cultivation, blight inoculation, and screening for resistance (Hebard 2011).

Since the 1980s, TACF has closely followed the breeding program laid out by Burnham, carefully breeding trees, inoculating them with the blight, screening them for blight resistance, and culling undesirable or poorly resistant specimens. The majority of TACF’s backcross breeding program is carried out at the organization’s research farms in Meadowview, Virginia, with additional breeding at state chapter orchards and orchards owned and maintained by TACF member landowners. In 2008, the first generation of Restoration Chestnuts (B₃F₃) had been planted at the Meadowview research farm, and since then, they have been widely planted on private and public land throughout eastern North America. Although TACF’s goal is to produce and restore a blight-resistant tree, the resistance of the current generation remains to be seen. Early estimates suggested that only 17% of B₃F₃s exhibit as high levels of resistance (Hebard et al. 2013), but breeders believe that these rates are already significantly higher, and they hope that the number of resistant individuals will continue to increase as inferior trees are removed from breeding orchards.

Genetic transformation

In 1990, not long after the backcross breeding program was initiated, plant pathologist Bill Powell and forest geneticist Chuck Maynard began their own chestnut project at the SUNY-ESF. Instead of breeding, Powell and Maynard sought to produce a
blight-resistant tree through genetic transformation. Initially there was a large degree of distrust between transgenic chestnut advocates and the national leaders of TACF (Freinkel 2009). In the early 1990s, scientists and supporters formed a New York state chapter known as TACF-NY. While TACF-NY was officially part of the national foundation—and while its mission was ostensibly the same—the chapter decided to follow Powell and Maynard’s gene transfer path rather than the backcross breeding program designed by Burnham. This resulted in stilted and infrequent collaboration between TACF-NY and the national foundation until the mid-2000s:

You’d never think there’s this competition in the chestnut world, but it’s there. The molecular guys, the genetic transformation guys—it was much more touch-and-go with them until recently. They wanted nothing to do with our breeding, and some of our people wanted nothing to do with transgenics. (Author interview 2012)

A TACF staff member similarly recounted, “For a long time [TACF-NY] didn’t trust me because I was from the breeding world. And, you know, never the twixt shall meet” (Author interview 2012).

While genetic engineering is often portrayed as a straightforward and precise endeavor, it took Maynard and Powell’s team sixteen years to develop the ability to move a gene into a plant before successfully producing a transgenic American chestnut. Nearly a quarter-century since they began this project, they have now established successful techniques for transferring a gene into a single plant cell, growing plants from somatic embryos, and ultimately regenerating numerous chestnut trees from a single genetic transformation event. The first transgenic American chestnuts were planted in the field on June 7, 2006, in Syracuse, New York, and as of 2013, 1,324 transgenic chestnuts have
been planted in the ground, with an additional 1,311 growing in a greenhouse at SUNY-ESF. These 2,500+ trees represent trials of about 40 genes that have been successfully transferred and are being tested for their effects on blight resistance (Maynard and Powell 2013). In 2012, TACF-NY members and the team from SUNY-ESF also planted transgenic chestnuts at the New York Botanical Garden, a stone’s throw from the site of the first blight infections in 1904.

Among the most promising of the trials at SUNY-ESF involve two genes: first, a gene isolated from wheat that codes for the enzyme oxalate oxidase, and second, a gene isolated from the Chinese chestnut that codes for laccase protein. The gene for oxalate oxidase has been used in a number of other transgenic plants, as it is able to break down oxalic acid, which is secreted by the chestnut blight fungus and other pathogens. Hence the addition of the “OxO” gene, as it is commonly called, helps American chestnuts withstand blight by neutralizing oxalic acid, leading to smaller blight-induced lesions and higher survival rates (Zhang et al. 2013). Numerous transgenic chestnuts containing the OxO gene have been planted in test plots near the SUNY-ESF campus and other New York state locations and are currently being evaluated for de-regulation. Ongoing research has also begun to explore genes from the Chinese chestnut, which have only recently been isolated and mapped through the multi-university Fagaceae Genome Project (www.fagaceae.org), a genome sequencing and mapping project.
De-extinction and science in the Anthropocene

Despite different practices, histories, technologies, and discourses, backcross breeding and genetic transformation are both pathways to the same goal: blight-resistance and successful restoration of the functionally extinct American chestnut species. By examining these two approaches, I consider the multiple logics by which scientists and advocates contend with the new realities of the Anthropocene. I focus on issues of health, scientific expertise and authority, and genetic knowledge-practices to demonstrate how chestnut restorationists grapple with and put to use emerging ideas about nature as perpetually open, disequilibrial, and influenced all the way down by human societies.

Health, resistance, and immunity for an unknown future

Both the backcross breeding and transgenic approaches to chestnut de-extinction are bound up with biopolitical concerns around promoting health, resistance, and immunity in the wake of an unknown and potentially threatening future. Such concerns surface in different ways and at different times in the restoration process, but both approaches share a commitment to future health that, I argue, typifies science in the Anthropocene. Health has emerged as a concept that materially and discursively links ecological concerns to human populations, suggesting that the Anthropocene is an era of increased “ecological disruptions and vulnerabilities caused increasingly by human actions” (Dalby 2007, p. 155). Such disruptions are thought likely to be more severe than any other security threats yet posed to modern states (Brauch et al. 2009), and this requires new non-reductive and non-linear approaches to health (Soskolne et al. 2007).
This is as true for ecological health as it is for human health, and indeed the two have come to be seen as mutually constitutive rather than separate realms.

At the most basic level, de-extinction aims not only to revive species but also to “enhance biodiversity and ecological health worldwide” (The Long Now Foundation 2013). For the chestnut, both genetic engineering and backcross breeding are often justified as projects that are not merely about the chestnut as a species but are also about promoting healthy forests capable of withstanding emerging threats that extend beyond the blight. In this light the chestnut is seen as a “tool—a powerful tool—to increase the health of our ecosystems” (Author interview 2011). Similarly, restoring the chestnut “would benefit the idea of One Health, where people, plants, animals are really living in this healthy condition, well-fed, well-cared for. It’s beneficial to everybody” (Author interview 2012). And when questioned about the importance of restoring a single species, a TACF member in turn asked: “If we can get a healthy forest established, isn’t the chestnut a good opportunity to make that happen? At the end of the day, isn’t [sic] healthy forests what we’re after?” (Author interview 2012) In a world of uncertain futures and impure natures, health has become a focal point for science and conservation in the Anthropocene.

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6 The One Health movement is indicative of new approaches to human and ecological health in the Anthropocene. The concept recognizes that the health of all species is important and inextricably linked. Advocates aim to bring together environmental science, biomedicine, and veterinary medicine to better understand and improve the lives of people, animals, plants, and indeed all species. In part a reaction to emerging health risks (particularly infectious diseases), One Health recognizes that “a changing environment… creates significant challenges” (One Health Commission 2014).
Health is particularly salient in the case of the chestnut as the culprit for the tree’s decline was a fungal pathogen epidemic that spread throughout the population and rendered the species functionally extinct. The goal of both backcross breeding and genetic transformation is not to cure the blight, but to impart resistance into the population such that some trees are able to withstand blight infection—in line with biopolitical emphases on developing immunity rather than doing away with the threat. But increasing resistance is both a life-protecting and death-producing process (Esposito 2008, 2011), and in backcross breeding, tree mortality is a vital part of the process of increasing resistance to the blight. “We’re going to have some losses, and in biology that’s the norm. When we see mortality, when we see blight entering the system, I get excited” (Author interview 2012). Breeders inoculate seedlings with the blight fungus to test resistance levels, thereby selecting individuals with intermediate or high resistance and eliminating those that cannot withstand the blight. Seedlings are first inoculated with strains of the blight fungus when they are one to two years old. Some trees are inoculated with Ep155, a highly pathogenic strain, while others are inoculated with SG2-3, a weaker strain of the fungus (Hebard 2011). After these inoculations, trees with the smallest cankers are selected for, while trees with larger cankers are removed from the breeding orchard, so as to eliminate the potential that these trees would add undesirable pollen to the collective “pollen cloud” (Author interview 2012) (Figure 10).
While both breeders and transgenic researchers aim to create healthy, blight-resistant chestnuts, this project can also be problematic and can even, as Esposito warns, end up negating life itself. For the chestnut, this is biological reality: by increasing resistance to the blight through breeding, some restorationists worry that the population will lack the genetic diversity to evolve in the wild and will experience inbreeding depression or genetic drift. Others worry that the reduced genetic diversity will render blight-resistant populations less resistant to other invasive pests, such as the chestnut gall.
wasp, *Phytophthora* root rot, and the ambrosia beetle. In this way, breeding for blight resistance, “when pushed beyond a certain limit, forces life into a sort of prison” (Esposito 2006, p. 51) in which immunity is no longer beneficial. This fear is salient for scientists involved with the transgenic program as well. By adding one or few genes that impart blight resistance, resistance may not be durable over the long term, as “the fungus could mutate and be selected for overcoming the type of gene you put in, and that’s seen in other plants. We don’t want that” (Author interview, 2013).

Fears about the unknowability and unpredictability of the future thus come to be addressed through the concepts of health and resistance, and by promoting “health” as a catch-all term, scientists prepare chestnut populations and ecosystems for the risks and threats that the future may entail. Yet this focus on health at times negates life, overprotecting individuals and ultimately increasing risks and even producing death. This is a contentious issue for de-extinction of animal species particularly, as the process entails many failed pregnancies, malformed embryos, birth deformities, and genetic mutations—very real health problems that occur in the name of species health writ large. While similar issues (e.g. culling of malformed specimens and failed culturing of somatic embryos) occur in the genetic transformation of chestnuts, they do not incite the same alarm for plant bodies as for animal bodies, not only because plants are generally not considered sentient beings but also because of the long history of plant improvement.

Health concerns become manifest in materially different ways in backcross breeding and genetic transformation, despite a shared concern for making life anew in ways that promote species, ecosystem, and planetary health. The genetic transformation
project relies on biopolitical notions of novel health crises to rationalize the use of biotechnology in ‘nature.’ TACF-NY and the SUNY-ESF research team have partnered with the Forest Health Initiative (FHI), a multi-year initiative funded by Duke Energy, the USDA Forest Service, and the U.S. Endowment for Forestry and Community. FHI considers the transgenic chestnut a test case for the use of biotechnology to promote forest health in the wake of increasing threats (pests, diseases, and pollutants). This initiative puts forth a variety of evidence to show that American forests are imperiled yet essential, including historical data on rapid rates of infection with chestnut blight as well as more recent risk assessments that indicate that without intervention, 25% of all trees will die from pests or diseases within fifteen years (Forest Health Initiative 2012). Framed as a matter of biopolitical urgency, this problematization of threats to forest health authorizes scientists to wage war against the actors and actions that threaten the future of life. This logic legitimizes and even necessitates biotechnological interventions into forests in the name of health.

Nowhere is this more apparent than in a quote from FHI leader and President and CEO of the U.S. Endowment for Forestry and Communities: “We simply don’t have the luxury of time that affords using only twentieth century tools to confront twenty-first century challenges” (Forest Health Initiative 2012). Instead of “twentieth century tools” like backcross breeding, Owen and FHI promote the use of twenty-first century tools like genomic mapping, genetic engineering, and cloning for rapid replication. Biotechnology here is seen as a security mechanism, to use the biopolitical term, by which forests can be made healthier and more resilient without cutting off the circulation of life (e.g. global
trade, the movement of timber, etc.) Given rising threats to forest health, coupled with the ongoing biodiversity crisis and global climate change, de-extinction through genetic transformation becomes viewed not just as politically neutral and scientifically objective, but also as a responsible choice, a precondition for the future of life. This view of escalating health threats is not unique to FHI or chestnut restoration and is commonly expressed in the literature on forest genetics:

The health of undomesticated tree populations is increasingly coming under threat from biotic (insect and disease) and abiotic (global climate change and pollution) factors. The application of genomic discoveries in forest trees to enhance forest health will probably become an important global priority, paralleling the application of genomic tools for health improvement in humans. (Neale 2007, p. 539)

Genomic tools have indeed become fundamental to science, conservation, and health in the Anthropocene—both for forests and people—and the chestnut itself has come to serve as a flagship species for biotechnological interventions into ecosystems. These biopolitical entanglements are inseparable from the politics of human life; ecological applications do not parallel human applications (as Neale (2007) suggests above) but shape and are shaped by them as well, as taxonomic boundaries are continually created and defied in efforts to improve, protect, and govern life.

*Scientific authority and objectivity in a time of urgency and uncertainty*

De-extinction also involves tensions around how to claim and maintain scientific authority and objectivity in a time of urgency and uncertainty. The increasing recognition that we are living in a new epoch has encouraged science in pursuit of socioecological transformation (e.g. Ehlers and Krafft 2006; Lave et al. 2014). But even as current
ecological crises necessitate action, scientific culture of late has been marked by a deep fear of political assumptions and normative judgments within science (Robbins and Moore 2013). In case of chestnut restoration, the explicit objective of scientists is to first transform a species and then use this species to transform the forests of eastern North America. And while restorationists often emphasize this grander goal, they also at times frame their work as merely a scientific puzzle detached from the urgency of the world around them. Here I consider how backcross breeders and transgenic researchers grapple with both the applied nature of their work and the many uncertainties associated with restoration, demonstrating how scientific authority and objectivity are destabilized in a world that is profoundly uncertain yet in need of urgent transformation.

The social, economic, and ecological benefits of chestnut restoration are central to the work of TACF and backcross breeders. Their goal is not only to advance science but also to fundamentally change the species and its native landscapes. Hence scientific decisions are made with these potential benefits in mind. For example, much debate within TACF centers on the details of the breeding process, and particularly if and how one should select trees for “American character.” American character encompasses a variety of phenotypic traits (often having to do with leaves) that are viewed as indicators of the tree’s genetic composition. As breeders want to produce a tree that looks and functions like the American chestnut, they rely on subjective estimates of phenotypic traits to weed out undesirable, un-American specimens. By assaying traits like leaf size, shape, color, dentation, waxiness, and presence of hairs, a breeder evaluates trees and ultimately makes selections (Figure 11).
Trees are generally selected and bred within four to seven years; therefore they do not necessarily express all of the desirable or undesirable traits at this time. It is difficult, for example, to judge the timber form or wood quality of a tree in its earliest years—and particularly one that has been inoculated with the blight fungus and is struggling to survive. Breeders therefore look to leaf, bud, stipule and twig traits as predictors of the timber quality and ecological competitiveness—i.e. the ‘American character’—of a tree.

A Pennsylvania TACF breeder explained:
We figure the more American we can get it, the more it’s going to exhibit those characteristics that it had back in the day. Can’t prove it, but we assume that if we select for as many American traits as we can, everything else is going to come along with it. And so that’s where you start getting into that more American/less American kind of debate. (Author interview 2012)

By selecting trees on the basis of expressed traits, breeders hope to produce blight-resistant chestnuts that are ecologically competitive, economically valuable, and culturally resonant. In so doing, breeders aim to maximize the transformative potential of their project:

Timber is the reason I’m concerned about American character. We can’t select for timber type necessarily. We can’t select for timber production or volume. You can’t do that until the trees are at least 15 or 20 years old. And we don’t have any [molecular] markers for it or anything, so as an analogy—a stand-in—for timber volume, we look for American character. (Author interview 2012)

Here, selection criteria and breeding procedures are determined with the long-term economic value of the tree in mind: “Economically, it’s a timber tree. We need to ensure that the resistant trees have high yield, high quality timber” (Author interview 2012).

Breeders aim to produce a tree that not only withstands blight infection but also is a timber source. A TACF forest ecologist remarked:

Is it 100% American chestnut? Technically no. Is it American enough? I think so. And more importantly, is it American enough to be ecologically and economically beneficial to our landscapes? I say yes, even though there’s still those Chinese genes that take away the claim of being the American chestnut. (Author interview 2012)

These remarks again underscore that the science of backcross breeding proceeds in conversation with specific economic, social, and ecological goals. Decisions about American character are seen as particularly crucial to the transformative potential of the restoration project. Here, the scientific practices of breeding serve normative goals of
landscape change, partly in response to concerns about the health of landscapes and the provision of ecosystem goods and services in an age of increased threats.

And yet, despite this image of breeding as a social and ecological project, TACF members and scientists at times portray their work as purely objective, apolitical, and detached, concerned only with performing sound science and pushing the bounds of knowledge forward: “We’re about science. We’re about good science” (Author interview 2012). This self-representation is shared across both the backcross breeding community and the transgenic community, but it is often articulated in different contexts. On one hand, breeders emphasize the scientific and objective nature of their work as a way to gain legibility, credibility, and authority in the broader scientific community. By connecting backcross breeding to ongoing debates in genetics, scientists downplay the “outdated” nature of Mendelian genetics and instead highlight breeding as pushing the frontier of genetics forward. Here, the uncertainty and complexity of the world aid breeders in maintaining scientific authority:

There’s [sic] still a whole lot of unknown things—we don’t know how these genes interact, and no gene works alone. It’s not just one, two, or three genes—it’s probably a whole bunch. We just don’t know. So, we stay focused on the science, and making sure the science is done right. (Author interview, 2012)

This emphasis on scientific credibility and objectivity among the backcross breeding community has increased as the approach competes for traction against the transgenic approach. Unlike backcross breeding, which is performed in the field, often by volunteers rather than trained scientists, and relying as much on anecdotal evidence as published data, the production of transgenic chestnuts at first glance fits well with ideas about what the modern life sciences are and should be—performed in a lab by scientists
with formal training, advanced degrees, and lab coats, using complex and cutting-edge technologies, published in reputable journals, and funded by scientific funding agencies and industry rather than individual donors. For researchers and advocates of transgenic chestnuts, detachment, objectivity, and a narrow scientific focus are most commonly expressed when considering the broader normative and political economic implications of genetic transformation:

We’re not in the business to support or to say GMOs are important or not important. We’re here to focus on the science. We try as an organization to stay out of that realm. We don’t have the breadth and the depth and the expertise to say is it good or is it bad. We focus on the science… Some companies may want to use the biotechnology efforts on the chestnut to say biotechnology’s right, and that may be. That’s what they do. That’s not what we do. It’s not our business. We just do the science. (Author interview 2012, emphasis added)

Here, the purpose of de-extinction is narrowed from social and ecological transformation to “just doing the science” in isolation from political assumptions, opinions, or value judgments. Transformation through genetic engineering is a socially and politically dangerous undertaking, and it behooves scientists to view knowledge production as separate from broader socioecological transformation.

Thus, both the backcross breeding and transgenic communities rely on portrayals of science as value-free and politically neutral, although they generally do so in different contexts. What these examples signal are threefold. First, they illustrate that claims to scientific objectivity and authority remain key to enacting particular visions on the landscape. Even as restoration science aims to intervene in and improve the world, decisions about how to do so remain predicated on the idea that science is objective, even if no longer omniscient. Hence, the second point I make here is that chestnut restoration
reflects deep insecurities about how to maintain this scientific authority and objectivity while also pursuing transformative projects like de-extinction. Third, motions to the uncertainty of genetics are used strategically to allow the breeding and transgenic communities to collaborate toward a common scientific mission while also competing for legibility, funding, and public acceptance.

*Genetic knowledge-practices*

Chestnut de-extinction is also animated by struggles around genetic knowledge-practices, at times embracing recent scientific developments that challenge genetic determinism, while at other times reinforcing the reductionist idea of a one-way interaction between genes and organisms. These tensions are emblematic of the complex and contested process of de-extinction in the Anthropocene. Here, I consider the Anthropocene as a site of struggle between the ‘age of biological control’ and new ideas about biological life as unfixed, relational, and defined by breached boundaries (Paxson and Helmreich 2014). Importantly, while claims to naturalness pre-Anthropocene often relied on ideas about nature as stable and tending toward equilibrium, we now see claims to naturalness resurfacing through new concepts of biology as dynamic, disorderly, and fundamentally open.
Backcross breeding: Mendelism meets molecular genetics

On the surface, the competition between backcross breeding and genetic engineering is one of conflicting scientific paradigms—an ‘old science’ (Mendelian genetics) operating at the organismal scale versus a ‘new science’ (molecular genetics) working at the scale of the molecule. In chestnut breeding, genes have until recently remain largely black-boxed: significant but not fully knowable, targeted only by proxy. While breeders recognize linkages between the organismal scale and underlying genetic differences, genes themselves are generally not observed, identified, or directly quantified in the breeding process. In contrast, the genetic transformation approach understands resistance as determined by a particular set of discrete entities known as genes; the genes write the code that ultimately determines the behavior, appearance, and identity of the organism. In an early paper describing how backcross breeding might be applied to the chestnut, TACF founder Burnham illustrated this view of conflicting scientific paradigms:

In an era when molecular genetics and related biotechnologies are being heralded as a solution to many seemingly intractable problems, Mendelian genetics is still a powerful tool in solving a problem that has not yet yielded to other approaches. What it appears to offer here is the recovery of the American chestnut with all its desirable qualities of hardiness, competitiveness, and form. (Burnham 1988, p. 486)

For Burnham, a corn geneticist whose career spanned the shift from classical genetics to molecular genetics, achieved blight-resistance through backcross breeding served as a defense of earlier and ostensibly more primitive genetic knowledge-practices.

Increasingly, however, chestnut breeders have turned to molecular genetics and biotechnology to improve the precision of backcross breeding. One TACF member
remarked: “With breeding, you don’t really know what genes you’re transferring. You don’t know what the composition of the species will be. You don’t know how resistant the next generation will be. There’s a whole lot you don’t know” (Author interview, 2012). The frustration here is that you can only know what you see in backcross breeding; you do not know the precise genetic composition of organisms, the specific genes that are transferred, or the locations of those genes on a chromosome. Breeding also obscures the supposedly straightforward relationship between environmental influences and genetic determinants, as it can be unclear whether particular traits are expressions of genotypes or related to environmental conditions.

To remedy these uncertainties and improve the precision of backcross breeding, TACF scientists increasingly call for the use of molecular markers in selecting individuals for breeding. In 2006, the NSF-funded Fagaceae Genome Project was initiated to develop genomic tools for American chestnut restoration (Wheeler and Sederoff 2009; Fang et al. 2012). A collaboration of scientists from four public universities, TACF, and the U.S. Forest Service, the Fagaceae Genome Project has also worked closely with FHI, as both projects emphasize the utility, affordability, and necessity of genomic tools for forest science, health, and restoration. Through their collaborations with FHI and the Fagaceae Genome Project, TACF scientists and members have become increasingly interested in the use of genomic tools, like molecular markers, in breeding. At a breeding orchard in central Pennsylvania, the TACF Regional Science Coordinator pointed to a group of B₃ trees—trees that had been backcrossed twice with American chestnuts to dilute the characteristics of the Chinese chestnut. She explained:
Here’s a third backcross generation. They do look pretty darn American. You know, as far as I can tell from form and type and leaf character, I’m very confident that from an ecological standpoint, what we’ve created will be able to hack it in the woods. The blight resistance still remains to be seen, but I’m convinced that the additional backcrossing is necessary for American character. If we had markers—if we had genetic markers that told us it was American, it would be a lot easier. (Author interview 2012)

What molecular markers would add to backcross breeding is selection based on genotype rather than based on phenotype. A marker is linked to the gene(s) of interest; if a particular marker tests positive, it means that the organism possesses the desirable alleles linked to the gene of interest. Trees can then be selected based on whether they carry the gene(s) of interest, rather than whether they express a given trait—a presumably more reliable way of breeding for blight resistance or American character.

But despite this optimism around the benefits of markers, it remains unclear just how useful, reliable, and affordable markers would be for the selection of desirable chestnut individuals. Advocates suggest that marker-assisted selection (MAS) would allow for the “fast-tracking” of resistant lines with earlier and better culling of undesirable specimens (Collard and Mackill 2008; Wheeler and Sederoff 2009). However, to be useful in a variety of breeding contexts, molecular markers may need to be re-established for every single breeding line, because the locations of alleles within the chromosome are often non-uniform across unrelated individuals (Groover 2007). Further, establishing markers for complex traits, like blight resistance or American character, is difficult as such traits are not linked to a single gene. First quantitative trait loci (QTLs) must be mapped to determine what parts of the DNA are linked to genes that drive expression of a complex trait (e.g. blight resistance). At present, at least three resistance
loci have been identified for Chinese chestnut, indicating that blight resistance is not controlled by a single gene or even by a single region of the genome (Kubisiak et al. 2012).

An equally significant issue is that QTLs are not always consistent across environments, but vary in both magnitude and direction (Collard and Mackill 2008). This is in part because of the complex relationship between genes and the environment, as different patterns of gene expression occur in different environmental conditions. While scientists studying genomic applications for chestnut restoration recognize these complexities, they are rarely translated to TACF members, who generally believe that molecular markers will simplify the breeding process: “If I had molecular markers for American chestnut and blight resistance, I wouldn’t have to do this [fieldwork]. I could run the leaves, I could check the genetic material across the markers, and I would never have to be out in the field” (Author interview 2012). In this way the move toward molecular techniques in backcross breeding reflects the reductionist idea that genes determine life; if we can only know which genes do what and where, then we can shape biological life accurately and precisely through selection and breeding.

Not all breeders, however, are enthusiastic about the potential use of molecular markers for breeding:

I know how to breed trees... Some people might talk like it’s... rocket science. They’re right that it sure isn’t simple... But if you’ve ever farmed, and if you know your land and soil and know your trees and keep track of everything real close, you can do a good job of it... I don’t understand exactly what a genetic marker is, and I don’t need to. (Author interview 2011)
Another breeder stated that “plants are unpredictable” and that any attempt to pinpoint the genetic causes of particular traits would ultimately fall short. Here the use of genomic techniques undermines breeding as a “field” science, reducing the role of the environment (land, soil, trees) and rendering environmental knowledge and field experience seemingly unnecessary in a world that is reducible to QTLs.

Genetic transformation and resurfacing claims to naturalness

While the convergence of backcross breeding with molecular genetics has seemingly only amplified the idea of a one-way interaction between genes and organisms, the genetic transformation approach to chestnut de-extinction exhibits more variable genetic knowledge-practices. Scientists working on transgenic chestnuts have tended to perpetuate reductionist ideas about genetics while simultaneously drawing on novel scientific insights that imply a plastic, permeable, and open-ended world, where genes flow unencumbered across bodily boundaries. By switching back and forth between these different worldviews, multiple yet contradictory claims to the “naturalness” of genetic transformation emerge.

In promoting the transgenic chestnut project, scientists and advocates claim that gene insertion need not be considered an unnatural process, as gene flow occurs between species in nature. Researchers emphasize that they don’t use gene guns or other elaborate technologies—they use a “natural genetic engineer,” Agrobacterium tumefaciens, a soil bacterium that infects plants and inserts a small segment of its own DNA into the host’s DNA. A devastating pest for many crops, Agrobacterium tumefaciens has become
enrolled in the agricultural biotech industry and is now widely used to transfer genes into Bt corn, cotton, and numerous other GM crops (Sunikumal and Rathore 2001). By highlighting the work of this “natural genetic engineer,” the transfer of genes into the chestnut is portrayed as merely another example of gene flow as it occurs across organismal boundaries in the wild. In a featured presentation at the 2013 TACF Annual Meeting, SUNY-ESF researcher Bill Powell asked, “Is moving genes between species natural? Genomics is showing us that maybe it is natural. There is transfer of genes from one species to another.” Powell went on to emphasize that genes can move—gene flow is not only happening in the environment but is occurring in people as well. If we consider gene transfer in humans, he quipped, one of three of us are GMOs.

This circulation of genes through processes other than traditional reproduction is referred to as horizontal or lateral gene transfer; recent studies have demonstrated that gene transfer indeed occurs in both prokaryotes and eukaryotes and is a powerful evolutionary force (Keeling and Palmer 2008; Moran and Jarvik 2010; Zhaxybayeva and Doolittle 2011). It is in this discourse of free-flowing genes that we see claims to naturalness resurfacing, as Powell draws on recent scientific advancements to demonstrate that transgenic chestnuts are not foreign, threatening organisms but are just as natural as any other living being in our dynamic, boundary-less world.

This construction of gene transfer as a normal and everyday occurrence works to naturalize transgenic American chestnuts, indicating that genetic engineering involves only the same processes—and thus the same risks—as classical backcross breeding and “wild” gene transfer. But even as novel scientific insights on the mobility of genes are
emphasized, the novel procedures and technologies involved in genetic transformation are minimized, rendering gene transfer merely the product of your everyday soil bacterium and a few harmless disease-fighting genes: there are no laminar-flow hoods with HEPA filters to keep the air aseptic, no sterilized petri dishes filled with an embryo initiation medium, no liquid solutions of rooting hormone, no green fluorescent protein (GFP) marker genes isolated from jellyfish, and certainly no CaMV35S promoter patented by Monsanto—all of which are key parts of the gene transfer and regeneration process. Some of this erasure is to be expected, as science is rarely depicted as the messy enterprise it is, yet this erasure also does important work in disentangling transgenic chestnuts from popular environmentalist discourses that equate genetic/genomic technologies with science fiction, Frankenfoods and Big Ag.

Increasingly scientists are attempting to combine multiple genes to ensure long-term blight resistance in a process known as gene stacking or pyramiding. For the chestnut, this might mean “stacking” the OxO gene from wheat with several genes from Chinese chestnut to produce transgenic trees that have multiple mechanisms for blight resistance. Importantly, a single gene for resistance is never transferred alone, although its accompanying materials are rarely discussed in public fora. The transgene is put into a “gene construct” that, for the chestnut, includes a promoter (used to control and amplify expression of the transgene) and one to two marker genes. Gene stacking itself is a response to concerns about the unknowability and unpredictability of a dynamic world. In such a world, one gene is insufficient for durable resistance in the long term, because
fungi, bacteria, and other pests are always already evolving in response to environmental changes—and doing so rapidly.

Yet while certain discourses and practices reflect emerging scientific ideas about an open, under-determined world, genetic transformation of the chestnut also reinforces reductionist ideas of a one-way interaction between genes and organisms. At the 2013 TEDxDeExtinction event, Powell used the metaphor of words within a book to describe how genes comprise an organism and to demonstrate just how insignificant the changes wrought by genetic engineering are for the organism:

Let’s think of the chestnut and the chestnut genome as a book. And let’s say that book is filled with words, and the words represent the genes in the chestnut. We know about how many genes are in the chestnut, and they would fill about a 180 page book. So, if you’re 1/16 Chinese, what that means is that eleven pages are from Chinese, are in Chinese. Now, that might not be important, because we have a lot of duplicate genes between the two, but it might be important… Chinese chestnut has actually been bred for thousands of years as an orchard tree; the American chestnut is a wild timber tree. There’s a lot of traits we don’t want from the Chinese chestnut. (Powell 2013)

This portrayal of genes as words within a book indicates that genes and genetic codes determine traits, with little recognition of the plasticity of life and the importance of interactions between environment, organism, and molecules (McAfee 2003; Guthman and Mansfield 2013). Further, this analogy gives the impression that each gene has a knowable meaning—a predictable expression—and can be moved, removed, added, or manipulated at will, with the same precision with which one might edit a text document. Genes from another organism are considered words in a different language—the genes of the Chinese chestnut become words written in Chinese. Backcrossed chestnuts are thus problematic because they contain “eleven pages” of genes that “are in Chinese,” while
transgenic chestnuts are superior because the supposed precision of genetic engineering allows for the introduction of fewer genes—a mere sentence or turn of phrase as opposed to the eleven pages of life-altering information introduced by breeding. It is in this portrayal of genes as distinct, knowable bits of information that a second, though contradictory, claim to naturalness emerges. Researchers and supporters claim that transgenic chestnuts are more predictable, genetically closer to the original species, and therefore purportedly more natural: “We are making such a small change in the genome that it doesn’t change the species. It will definitely be the same species” (Author interview 2013).

Similar informational metaphors are ubiquitous in the popular genetic literature (e.g. Colby 2011), eliding the complex realities of gene flow, gene-environment interactions, and the mysteries of unpredictable gene expression. In light of the ubiquity of reductionism in accounts of genetic engineering, McAfee (2003) asks: “Who among non-scientists would guess—having heard the praise of genomics “precision”—that most of the cells or embryos into which technicians attempt to insert new genetic material are killed, or are deformed… or carry the “gene” yet fail to express the desired trait?” (p. 206) This certainly holds true for transgenic chestnuts, as researchers admit that the gene insertion process is “inexact” (Post and Parry 2011, p. 961) and “essentially a random process” with numerous variables that “may disrupt gene expression, leading to changes in phenotype” (p. 956). For example, when exposed to the Agrobacterium, the vast majority of cells do not take up the new genetic construct—hence why it is necessary for the construct to include one or more selectable marker genes. The purpose of these
markers is to distinguish between the few cells which have been successfully transformed and the many which have not.

Indeed, at nearly every phase of the process there are higher rates of failure than success. When somatic cells are extracted from chestnut nuts and grown in tissue culture, roughly one of 1,000 embryos is successfully cultured (Powell 2013, personal communication). Even among successfully transformed cells, every “transformation event” yields different phenotypic results. Scientists generally attribute these phenotypic differences to position of the transgene, malfunctions of the promoter, and environmental differences that alter gene expression. When the Agrobacterium transfers new genes into the cell, the location on the chromosome where the gene is inserted is not controlled. Because the expression of a trait is influenced by its position, it is not surprising that trees produced in different transformation events exhibit vastly different levels of blight resistance.

Another source of uncertainty is the promoter (used to “turn on” expression of a gene), as different promoters yield different rates of expression, though a successful promoter is not necessarily equally successful in all transformation events. Further, even after the gene transfer process is complete and the trees are grown and planted in the wild, there may be unexpected non-target effects of genetic transformation. The first studies of non-target effects have found that transgenic trees containing the OxO gene (along with a promoter and marker genes) increased herbivory and growth rates of gypsy moth predators (Post and Parry 2011). Not only is the gypsy moth itself a highly destructive non-native forest pest in the eastern U.S., but proliferation of its larvae may in
turn increase populations of white-footed mice, which are instrumental in the spread of Lyme disease (Dagleish and Swihart 2012).

In short, genetic transformation is not a simple, predictable, or precise process but is itself uncertain, inexact, and contingent. This poses both a problem and an advantage for chestnut de-extinction. At times the contingency and complexity of the process is simplified, bringing it in line with the genes-as-informational-code metaphor (McAfee 2003; Rossi 2013). In this metaphor, the transgenic chestnut is genetically closer to the traditional American species—and therefore more “natural”—than the backcrossed chestnut. At other points reductionist discourses are jettisoned in favor of a view of genes and biology as open, mobile, and dynamic. Here, too, the transgenic chestnut is naturalized, a symbol of life as full of possibility yet docile enough to be bent toward human aims (Paxson and Helmreich 2014).

The idea of reductionism in molecular genetics is certainly not new; McAfee (2003) shows how the basic assertion that biological life is determined at the molecular scale has been proven scientifically false, and Rossi (2013) discusses how synthetic biologists attempt to “actualize the reductive informational code metaphor” (p. 1127) by designing organisms from the ground up. Further, McAfee (2003) argues that the claim that genes code life helps contribute to the formation of new commodities, property rights, and markets. The molecular reductionist paradigm “has long supported the project of technoscience in support of capital accumulation in agriculture, in support of social control, and, from time to time, of explicit agendas of eugenics” (McAfee 2003, p. 216). Yet the genetic transformation of chestnuts is not explicitly in the service of capital but
rather environmental conservation. Scientists assert that they will not patent or profit from a transgenic chestnut, that they will not use materials that cannot be widely and freely distributed, and that their aim is to use biotechnology for public benefit.

Even so, the project of de-extinction through genetic transformation is discursively and materially inseparable from the associated economic reductionism that supports capitalist expansion into life at the molecular scale (McAfee 2003). The molecular reductionist paradigm that is fundamental to de-extinction makes possible new commodities and markets, and the transgenic chestnut research program is materially and institutionally supported by biotech firms such as ArborGen, a leading developer of commercial transgenic trees, and Monsanto. While this has not a central focus of the chapter, it speaks to the complexities of restoration in an era in which nature is increasingly bound up with neoliberal capitalist economies.

**Conclusion**

Science in the Anthropocene is a mixture of the logics of recovery and discovery, anticipating a future that is novel and experimental yet strangely familiar. We see this in the dueling scientific approaches to American chestnut restoration, as both approaches grapple with, operationalize, and challenge ideas of an unpredictable and yet unrealized “future nature” (Paxson and Helmreich 2014, p. 3). Identifying health, scientific objectivity, and genetic knowledge-practices as three key areas of tension, I show that the de-extinction project is neither cohesive nor unproblematic, reflecting the complexities of conservation in a recombinant, uncertain world. Formal representations of restoration as
natural, systematic, and precise belie significant scientific and power-laden struggles. While backcross breeding and genetic engineering are often portrayed as either entirely cooperative or mere rival approaches, I have shown here that the project of chestnut restoration functions as a boundary object, linking communities with overlapping yet divergent scientific bases, practices, and material outcomes.

My purpose in analyzing the multiple discourses and practices at work in chestnut restoration is not to invalidate or vilify any one approach, but rather to underscore that de-extinction is far more than a simple reversal of the forces of extinction. Instead, it is a conservation project in and of the Anthropocene—a heterogeneous, inventive, and biopolitical project in which species are produced rather than merely re-discovered. Such novel specimens are often created with the expectation that they will seamlessly fill the niche—functional or symbolic—of an historic species, promoting vague notions of ecological health while warding against the increased threats associated with the Anthropocene. But given that de-extinction efforts differ in their material practices, technologies, genetic epistemologies, and ideas about health and science, the natures they produce cannot be presumed to be equivalent in any way, shape, or form. Such heterogeneity must be taken seriously if de-extinction projects are to have the impacts that proponents anticipate. For the chestnut, it remains to be seen whether backcross breeding and genetic transformation will produce markedly different effects on the landscape, but initial studies of ecological interactions and non-target effects indicate that this may indeed the case (Post and Parry 2011).
The scientific insights driving the declaration of the Anthropocene—for example, that ecosystems are fundamentally novel and that the climate system has been forced into a new state—suggest that we are living in a no-analog world. Coupled with novel genetic/genomic technologies, such a declaration opens the door to efforts like de-extinction, which use science to model new and potentially desirable nature-society relations (Paxson and Helmreich 2014). And yet, even as de-extinction emerges from the experimental beaker of the Anthropocene, it also reveals itself as a project of establishing equivalent natures—manufacturing analogs in a no-analog world. The case of the American chestnut, and the multiple natures produced in the name of restoration, demonstrates that this idea of material equivalency ought to be discarded. Processes of production matter, and de-extinction is not a reversion to a previous time, but is instead a form of co-production, an interspecies interaction that forges new materialities on both sides of the species divide (Haraway 2008).

De-extinction also re-shapes scientific knowledge, rationalities, discourses, and techniques. Science does not arrive at the breeding orchard or biotech laboratory pre-fabricated, awaiting its next object, but is itself re-constituted through the embodied relations and material interactions among scientists and nonhuman matter. In the genetic transformation of chestnuts, for example, the experiences and findings of scientists at times challenge reductionist accounts as genes as code for life (e.g. through evidence of non-target effects or variation in gene expression), rendering a world that is not fully predictable, even with a fully sequenced genome. In sum, de-extinction is a species-making project that calls for conservation interventions into nature in the names of health
and life and challenges the purifying and reductionist logics of species, bodies, and genes. But much like the DNA of the species it produces, de-extinction is also a relic of the past: made possible by the Anthropocene but haunted by resurfacing claims to naturalness and purity in a world of impure and fundamentally social natures.
Chapter 5: Race, landscape and memory: chestnuts in Appalachia

In his introduction to *Mighty Giants: An American Chestnut Anthology* (2007), Bill McKibben writes that the story of the American chestnut “echoes like a fable”—a fable that “we need to start telling more and more, for the hope it gives and the lesson it provides” (p. ix). Indeed the chestnut’s demise and redemption are the stuff of legends: a species of tremendous cultural value is brought to its knees by a foreign invader, only to be revived decades later through the “hard work… of many dedicated scientists, conservationists, and lay people, young and old, poor and wealthy, and everything in between” (Case 2007b, p. 1). A veritable American dream in the making, the restoration of the American chestnut serves as a hopeful environmental narrative in an age where such stories are becoming increasingly scarce.

But this national narrative is not the chestnut’s only plotline, and the species also spins tales of Appalachia as a “perpetual frontier-inside” (Scott 2010, p. 222), a region that is simultaneously the American heartland, a fallen wasteland, and everything else in between. Because the blight served as a tangible representation of broader social, economic, and environmental changes, the tree’s demise is often told as part of the narrative of the downfall of rural Appalachian subsistence farming and culture. In some cases, the chestnut and its blight are even suggested as both cause and potential solution for social and environmental problems (e.g. poverty, inequality, unemployment, forest
degradation, etc.) that continue to plague rural Appalachia. In other cases, the chestnut serves as a romanticized and nostalgic vision of an Appalachia that is white, folksy, downhome, and close to nature.

In this chapter I reflect on some of the tropes that undergird narratives about the American chestnut. I particularly explore how chestnut restoration is structured by, complements, and challenges existing racial formations, particularly those of Appalachian and American whiteness. How do racialized, place-based imaginaries inflect discourses and practices of restoration? How are narratives about the past materialized on the landscape in ways that reflect or reinforce notions of whiteness and American exceptionalism? Even as ecological restoration turns toward the future—away from historical benchmarks and nostalgic renderings of virgin forests—chestnut restoration remains premised upon stories about the past—both about Appalachian degradation and isolation and about Appalachians as the pioneer roots of the nation. Such references to the past have been central to imaginaries of whiteness in Appalachia for over a century (Scott 2009). Here I suggest that chestnut restoration functions as a commemorative act, a nostalgic re-imagining that constructs Appalachia as a landscape of memory for the white American nation, a medium through which discourses about national identity and racial heritage circulate.

Landscapes of memory order the past, giving it “an everyday familiarity and a spatial permanence” (Alderman and Inwood 2013, p. 188). Chestnut restoration is part and parcel of the mythos that surrounds and gives order to Appalachian past and present, simultaneously coding the region as both a nostalgic white American ideal and a
problematic, degenerate, and isolated white population that requires intervention and optimization from the outside. But despite the common coding of Appalachia as white—whether that whiteness is idealized or maligned—the processes of chestnut restoration reveal that Appalachia as a region is neither purely white nor racially innocent (Inscoe 1995). And in spite of tropes of Appalachian isolation and stasis, chestnut restoration illustrates a region that is constituted by change, interconnection, and contradiction. In the acts of memorializing, ordering, and controlling the past, the landscapes of Appalachia are produced anew, disordered and over-signified through contradictory materialities and meanings.

In the following section I discuss the historical trajectory of perspectives on Appalachia, emphasizing how scholarship has sought to explain the region’s marginalization from American society through various frameworks. I also explore recent efforts to bring ideas of relational space, memory, landscape, and whiteness into the Appalachian studies literature. Building on this work, I consider the region as a national landscape of memory that is explicitly coded white. I then turn my focus to discourses and practices around the chestnut blight and restoration, showing how the need for restoration is premised on particular narratives about the region’s social and ecological history and its connection to the broader nation. Finally, I conclude by suggesting that the privilege to claim that a certain nature is the proper nature is fundamentally related to racial formations of whiteness (Farough 2004).
Perspectives on Appalachia

The downfall and resurgence of the American chestnut has not merely played out against a static Appalachian backdrop, but has instead unfolded with and through the production of Appalachia as a social space. This is not to say that Appalachia is purely a social construction, a mere artifact of the stories told about it. Instead, it is a place scrambled by tropes of remote hollers, white trash, and old-time music, by the multiplicity of conflicting and contradictory practices that occur within and beyond its hills, and by layer upon layer of power-laden interactions across space, time, and species. This perspective is similar to that put forth by Rebecca Scott in her account of mountaintop removal in the Appalachian coalfields (Scott 2010); she writes that coal mining has an “excess of meaning” (p. 20) and that the nature-society relations in the region are overdetermined—structured by myriad cultural formations, including but not limited to race, class, gender, and sexuality. This view is exemplary of a broader trend in Appalachian studies literature toward examining the heterogeneity of the region, increasingly with an eye toward issues of race and gender (Inscoe 1995; Anglin 2004; Smith 2004; Hartigan 2004).

This recent perspective differs from longer term research trends in Appalachian studies, which have conceptualized the region using a number of specific models, most prominently the culture of poverty model, internal colonialism, and social class relations. These models have sought to explain the status of Appalachia by attending to particular cultural and economic determinants, and have themselves grown out of assumptions about Appalachia as a unified and fairly homogenous cultural region. The region was and
remains tremendously diverse, but early accounts of scholars, local color writers, and settlement house workers concealed these differences (e.g. Semple 1910; Campbell 1921), instead constructing mountain people as isolated mountaineers, the descendants of the earliest white pioneer settlers on whose backs the nation had been built (Shapiro 1986; Billings et al. 1995). Ellen Churchill Semple, for example, wrote of the eastern Kentucky mountaineer:

The isolation of his environment has left its stamp upon every phase of the outer life of the mountaineer, so it has laid its impress deep upon his inner nature. The remoteness of their scattered dwellings from each other… and the necessary self-reliance of their pioneer-like existence, has bred in them an intense spirit of independence which shows itself… in their calm ignoring of the revenue laws, and in their adherence to the principle of blood feud. (Semple 1901, p. 20)

The accounts of Semple and others portrayed a cohesive mountain culture that was gradually being “discovered”—a region that was isolated and independent, utterly unique from the rest of the nation but simultaneously purer. Despite rhetoric that suggested the unearthing of a pre-existing mountain culture, this was less a process of the discovery of Appalachia than of the construction of the region, as Henry Shapiro shows in *Appalachia on Our Mind* (1986). This is not to say that Appalachia is not in itself an actual place, but rather that what we call “Appalachia” is a complex intertextual reality (Shapiro 1986; Billings et al. 1995). Batteau (1990) extends Shapiro’s argument further, arguing that the “invention” of Appalachia occurred at the hands of outside interests and perhaps says more about urban society of the Northeast than about the region itself. In this chapter I view Appalachia as a project that encompasses yet extends beyond these discursive constructions. For example, environmental determinist texts (such as that of Semple), which portray the region as largely a function of natural environment have not only come
to shape what we know about the history of Appalachia but have also shaped material relations in the region in profound ways. While in geographic scholarship environmental determinism is passé and even notorious, such perspectives remain salient in chestnut restoration, a theme I will return to later in the chapter.

Early ethnographic accounts of Appalachia laid the groundwork for more detailed investigations in the 1960s. At this time perceptions of Appalachian culture shifted from charming and quaint to acutely problematic (Slap 2010), buttressed by the publication of Michael Harrington’s *The Other America* (1962) and Jack Weller’s *Yesterday’s People* (1965) and by Kennedy and Johnson’s attention to rural white poverty (Billings et al. 1995). At this time the culture of poverty thesis became widely used to explain Appalachia’s persistent poverty and apparent distinctiveness from mainstream America. From early- to mid-twentieth century accounts of Appalachia as a primitive folk culture, it was “but a short conceptual step to viewing Appalachia as a regionwide subculture of poverty” (Billings et al. 1995, p. 5). By attributing “under-development” to a cultural lag between the region and the rest of the nation, this view suggested that rural Appalachians were socialized into a backward culture marked by traits of individualism, self-determination, brazenness, and fatalism that prevented them from becoming the ideal white modern subjects (Lewis 1966).

Again the natural environment was central to this explanation, as the problematic cultural traits of mountain people had ostensibly emerged through their isolation and interactions with the rugged natural landscape. If only the culture of Appalachia could be *modernized* and brought in line with mainstream America, then the region might be put
on the path to progress—away from primitive, pre-capitalist, and pre-industrial economic relations and toward a ‘modern,’ economically rational, and developed society.

Importantly, as Billings et al. (1995) note, narrations of Appalachia through the lens of modernization theory grant agency not to the region itself but to broader exogenous forces that “come to” Appalachia. But in this perspective the problem is not these forces themselves, like the “coming of the roads” (Billings et al. 1995, p. 5), but the fact that local communities fail to adapt to such changes in the way that the idealized rational subjects would and should.

By the late 1960s, the culture of poverty model was subject to withering critique, and much scholarly and activist attention shifted toward understanding Appalachia through the lens of internal colonialism, drawing initially on dependency theory and later on a world systems approach (Walls 1976). In this model, Appalachia remained a problem to be solved, but the explanation for its persistent poverty lay not in its internal composition but in its exploitative relationship with the remainder of the nation (Caudill 1962). Attention therefore moved away from cultural explanations and toward political economic structures, framing the region as a victim of outside forces which had exploited both people and the environment in the name of development. While it may seem like the antithesis to the culture of poverty, both of these perspectives share key commonalities, namely a reification of Appalachia as fundamentally different from mainstream America yet internally homogenous as well as a region characterized by a lack of agency. Changes came to Appalachia, and although culture of poverty theorists generally saw such changes as inherently good (“progress”) and colonial theorists saw them as bad
(“exploitation), the dynamics of the region were commonly viewed as the result of outside forces.

From political economic models of Appalachia there emerged a body of social historical literature that attempted to “revise” Appalachian history by re-narrating it around the processes of industrialization and capitalist expansion (e.g. Eller 1982). Yet even as this literature “backtalked” to earlier stereotypes, it remained firmly rooted in the assumption that Appalachia is indeed a historically, culturally, and economically distinct region—arguing “from within a mythic system about the accuracy of mythology” (Shapiro 1986, p. 264). In terms of race, political economic models of Appalachia tend to focus occasionally on race relations and rarely on race more broadly, often reducing race relations to class relations. Further, in attempting to fight the negative stereotypes of Appalachians as hillbillies and white trash, scholarship has at times unintentionally supported the construction of a romantic white cultural icon that is subject to racial discrimination, thus equating Appalachian whites with other racial minorities (Hartigan 2004). This act “does more to obscure than illuminate the significance of race” (Hartigan 2004, p. 65) in American and Appalachian society, as it suggests that white Appalachians are in some way racialized more than other whites, reinforcing whiteness as the unmarked, invisible, racially innocent center of social life. To some extent this glorification of Appalachia as an exceptional white space continues in current scholarship, though attention has increasingly turned to the heterogeneity and internal social relations of the region, drawing on Marxist and poststructural theories to address
class relations (Simon 1984), gender (Oberhauser 1995a, 1995b; Latimer and Oberhauser 2004), race (Anglin 2002), and identity politics.

Geographers have been largely absent from the Appalachian studies tradition (for exceptions see Oberhauser 1995a; Nesbitt and Weiner 2001), though spatial perspectives have been taken up to varying degrees by others working in the region (Simon 1984; Scott 2010; Smith 2004; Kingsolver 2011). Recently Barbara Ellen Smith and Stephen Fisher, along with Rebecca Scott, have drawn attention to the iterative and dynamic relationship between society and space in the production of Appalachia (Scott 2010; Smith and Fisher 2012). This work has demonstrated that the spaces we call Appalachia are not pre-given but are produced. While previous accounts of the region often focused on either internal factors (e.g. cultural traits) or external factors (e.g. national economic growth and demand for resources), this work suggests that such approaches are simply not nuanced enough. Smith and Fisher (2012) draw on Massey (2005) and Lefebvre (1991) to show that Appalachia is not only socially produced but also productive, constituted by interactions across space rather than isolation in space. Such relations are myriad rather than reducible to a primary driver or key relationship (as in the internal colonialism model). For Appalachian scholarship, this perspective articulates a region that is concrete and embedded within multiple social relations; Appalachia becomes not an isolated site of contestation against the global but a point of intersection—a meeting place. Appalachia is the always unfinished outcome of innumerable past and present social relations—including cultural formations like race and gender—which help to shape future relations as well.

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In the next section, I draw on ideas about memory and whiteness to suggest that Appalachia serves as a landscape of memory for the nation. This perspective recognizes the reciprocal relationship between society and society, and rather than taking Appalachia as pre-given, it considers the region as a material and discursive construction, arguing that stories and memories about the region have indeed shaped it into a place apart from and a part of the nation.

**Appalachia as a white landscape of memory**

“Where we remember the past is important to how we remember.”

(Alderman and Inwood 2013, p. 189)

The role of memory in shaping racialized depictions of Appalachia is illustrative of the productive relationship between society and space. Most geographic scholarship on this subject has focused on the urban landscape, with few exceptions (Cloke and Pawson 2008), generally approaching memorial landscapes as texts to be interpreted, arenas for social conflict, or performances of identity (Foote 2003; Dwyer and Alderman 2008; Alderman and Inwood 2013). Here I broaden this approach to consider not individual memorial sites but rather the region of Appalachia as a landscape where national memories, heritage, and identities are reconfigured and reinforced. More specifically, I focus on how restoration circulates and materializes particular racialized narratives about the region of Appalachia and the American nation.

Arguably a reaction to space-time compression, people increasingly look to “refashioned memory, especially in its collective forms, to give themselves a coherent identity, a national narrative, a place in the world” (Said 2000, p. 179). Appalachia has
become a place in which and through which to remember the past. Its layers of symbolic associations, traditions, and histories play an important political role in mythologizing the history of the American nation and race, while simultaneously obfuscating particular elements of the past and present. Memorial landscapes are sites where memories are constructed and contested, and where particular social groups struggle to carve out a place in the nation’s past (Alderman and Inwood 2013). For Appalachia, “reference to the past has been a key to identifying Appalachian whiteness” (Scott 2009, p. 805). A foil to modern urban America, rural Appalachia has been constructed as a static region where early memories of the nation are materially anchored.

Scholarship on the region has gone to great lengths to unpack and dispute the trope of Appalachians as yesterday’s people (Shapiro 1986). And yet, characterizations of the region as log cabins, moonshine stills, and split-rail fences—all material artifacts of the past—remain salient in popular representations. Heritage has indeed become an industry in Appalachia (Scott 2010; Fletchall 2013). Visitors’ guides tout that in southern Appalachia, “family recipes concocted in stills hidden in the woods date back generations” (Melville 2012, p. 46), and that Appalachian Ohio’s “small towns, quaint villages and little cities are all monuments to the determined and brave pioneers moving westward and leaving behind a story filled with resilience, reinvention and promise” (Appalachian Country Travel Guide 2011, p. 1). In southwest Virginia, visitors are encouraged to “step back in time,” “experience pioneer life,” and “retrace the steps of adventurous explorers like Daniel Boone” (Heart of Appalachia Tourism Authority
2013). After all, “where else will you…experience nature and history that have been preserved for centuries?” (Heart of Appalachia Tourism Authority 2013).

Dotted with living history museums, heritage trails, gristmills, and blighted chestnuts, the material landscape of Appalachia narrates history in particular ways, often through tales of loss, sacrifice, progress, social relations to the environment, and stasis in a changing world—narratives that reflect the persistence of environmental determinist and modernist perspectives in understanding the region. But it is not just individual memorials or heritage sites that serve as memorials to the past, but rather Appalachia as a region has become a shifting symbolic system that reflects and reproduces particular shared memories of the nation while forgetting or obscuring others (Legg 2007; Dwyer and Alderman 2008). ABC’s 2009 documentary *A Hidden America: Children of the Mountains*, for example, portrays white impoverished youth of Central Appalachia as:

> the descendants of Davey Crockett, Daniel Boone, Loretta Lynn and Patsy Cline and the families of legendary soldiers and pioneers who helped open up the treacherous mountain passes and create an American continent. They are fighters steeped in family, ferocity and faith. (ABC News 2009)

As Rebecca Scott writes, this narrative reiterates the message that “white people shouldn’t be living like this” (2009, p. 808), while simultaneously associating Appalachian whites with pioneer settlers who sacrificed much for the growth of the nation. It is in the process of remembering and forgetting that visions of Appalachia as a fallen white frontier continually resurface, while facts that complicate that notion slowly atrophy and fade away. In the case of the chestnut, for example, restoration discourses commonly circulate ideas from historian Ralph Lutts’ (2004) work on the “chestnut commons”—a shared, bountiful resource for Appalachian communities—while leaving
behind one of Lutts’ most surprising findings: that at least some chestnut orchards were the subject of racial conflict (Lutts 2004).

In short, collective memory of white American culture has come to inhabit the hills and hollows of rural Appalachia, and even the region’s “natural” features, like the chestnut, are viewed as witnesses to and relicts of a shared past. Appalachia comes to be understood through the lens of a nostalgic desire for a down-to-earth life that stands in contrast to the modern ideal of whiteness (Scott 2009). Bringing in work on racial formation and whiteness suggests that idealized whiteness is accompanied by a contradictory desire for a life that is Other: “grounded, rooted, embodied, and therefore… not ideally white” (Redmond 2008). As such, Scott (2009) argues that Appalachian whiteness is “both stigmatized and idealized in terms of embodiment, closeness to nature, and tradition” (p. 806). This allows us to see chestnut restoration as an act of embodiment, grounding, and rooting into the land—a process emerging from both the desire for corporeality and the power of whiteness to enact one’s own vision of the world. This desire for closeness to nature is reflected, for example, in the current TACF president’s account of his first day planting chestnuts:

I finally got out of my office and had the chance to wear my favorite pair of work boots and my tattered, well-worn blue jeans. By the end of the day, blisters formed on my hands from repeated hand-to-hand combat with a very heavy dibble bar… The blisters felt good.”(Burhans 2009, p. 2)

By linking these themes of whiteness and embodiment with ideas about landscapes of memory and heritage, we are able to see Appalachia broadly and chestnut restoration more specifically as key sites in the preservation of collective memory, carrying fraught and racialized meanings about the nation’s past into the future (Foote 2003).
This, I argue, is an impetus for the restoration of the American chestnut in Appalachia. Far from a purely ecological project, restoration is also a social project—a project of remembering the past, and in remembering the past, shaping the future. Yet this process is neither simple nor unidirectional but scrambled and indeed self-contradictory. In the next section, I narrow my focus to consider the American chestnut more specifically, demonstrating that restoration is premised on particular narratives that link the chestnut with logics of differential worthiness, white national heritage, and romanticized cultural struggle.

**Chestnuts in Appalachia**

The story of the chestnut blight and ongoing restoration practices are illustrative of the implicit presence of race in nonracial structural and discursive formations (Frankenberg 1993; Omi and Winant 1994; Bonilla-Silva 2006). As a project that is commonly associated with Appalachia, chestnut restoration reflects how racial formations of whiteness are maintained and upheld through color- and power-evasive discourses that use nature to claim an essential sameness of all Americans, a cultural convergence in which citizenship and identity are equally available to all Americans, innocent of race (Frankenberg 1993). By contributing to the construction of Appalachia as a landscape of memory for the nation, chestnut restoration reinforces the idea that white heritage, landscapes, and people are the ones that matter (Scott 2009).

Chestnut restoration tells normative narratives about the landscape and the nation: about what it was and what it should be, about who it belongs to and how people should
interact with it. These narratives are often put forth as historical facts, yet as the scholarship on Appalachia has clearly shown, representations of the region—from personal memories to historical research—are culturally freighted and indeed over-signified, shaping and shaped by social formations like race, gender, and class. What gets circulated about the chestnut blight and subsequent restoration efforts is “filtered, screened, and interpreted to fit certain contemporary demands” and involves the “invention of tradition… to explain the past in terms of romantic or heroic struggles for identity” (Foote 2003, p. 29). These processes, as I show here, are inherently racial. In the following pages, I discuss four key truths put forth in discourses around chestnut restoration, suggesting that together these ideas do important cultural work in shaping national identity, heritage, and formations of whiteness.

The American chestnut is a democratic tree that has proven its worth and commitment to the nation and is deserving of restoration.

Trees in American culture have often been portrayed as inherently democratic (Rutkow 2012); former TACF president Marshal Case wrote of the American chestnut: “This tree played no favorites. It was available to all who chose to make use of its many remarkable qualities” (2007a, p. 3). “Social status doesn’t matter” (2007a, p. 2); what matters is that all Americans are “welcome to restore a lost American icon, a keystone species. There are no… barriers” (Case 2007b, p. 267). Moreover, restoration of the American chestnut is considered a project “for the future and health of the nation” (Case 2007a, p. 3), a “Tree of Hope,” according to former U.S. Secretary of the Interior Dirk
Kempthorne, and a celebration of the past representing “hope and security” throughout the chestnut’s range (Ronderos 2002, p. 6).

In this way restoration discourses frame the American chestnut as an inherently patriotic tree, materially and symbolically associated with American nation building, heritage, and identity. This idea has been reinforced through practices of restoration as well. Over the past decade, chestnuts have been planted at numerous nationally important sites, including the Abraham Lincoln Birthplace National Historical Park, Monticello, and Mount Vernon. On Arbor Day in 2005, George W. Bush planted an American chestnut on White House grounds, stating that “Our message is to our fellow citizens: Plant trees—it’s good for the economy and it’s good for the environment” (quoted in Haskell 2005). Former President Jimmy Carter has also had substantial involvement in chestnut restoration over the past two decades, serving as an honorary director of TACF, planting trees at the Carter Center, hosting fundraising events for TACF, and helping to procure federal funds through the U.S. Forest Service for research, breeding, and planting projects.

Beyond being associated broadly with the nation’s democratic roots, the chestnut movement also relies on the idea that the tree is somehow especially deserving of restoration. It is a “patriarchal tree” (Wood 2009, p. 8)—the “King of the Forest” (Case 2008, p. 51)—that “has earned its place” (Ditlow 2004, p. 22) on the American landscape. Now, it is the task of hardworking Americans to return the “true chestnut” (Miller 2002, p. 17) to its “rightful glory” (Carver 2004, p. 27). This normative narrative of a rightful and proper American nature distinguishes the chestnut from other less
worthy species and underscores that restoration is a national project, involving everyone from “tree farmers to presidents” (Case 2007a, p. 3). Even as it emphasizes a democratic, open, and welcoming American spirit, this language reinforces a hierarchical logic of difference. In this way restoration reiterates myths of meritocracy and fairness, portraying a society in which hard work and contribution for the greater good are valued above all else. But embedded within these stories are racial logics of differential worthiness that suggest that some trees are simply more American than others. Through stories about American history and tree plantings at key historical sites, the chestnut has come to be equated not only with the American nation, but with a particular vision of American heritage figured by the hardworking white pioneer settler on whose backs the nation was built.

*Appalachia represents the original American frontier—the raw materials from which the nation was molded.*

Stories about the chestnut blight often begin with an oversimplified and stereotypical depiction of pre-blight Appalachian folk as rich in resources but fundamentally isolated from the market economy, reliant only on the bounty of the forest for their livelihoods. Echoing early written accounts of Appalachia, these depictions tend to essentialize the Appalachian forest farmer as a sort of noble savage, marked by a rugged independence and a pioneer spirit. These traits ultimately, however, ceased to be advantages when the blight fungus swept through the region and forced rural populations to modernize, migrate, or be thrust into poverty. Interestingly, this blight narrative tends to run counter to portrayals of Appalachian forest farming as inherently unsustainable—a
tragedy of the commons in which intensive and unenlightened pre-modern forest use, coupled with population growth, threatened the forest farming way of life long before the blight (Otto 1983). Instead, narratives of the blight suggest that forest farming is not the problem itself but is the victim of outside forces arriving in the mountains: the blight, the railroads, the roads. Both of these narratives about Appalachian forest farming reflect the persistence of common stereotypes of the region. The tragedy of the commons perspective, for example, suggests that mountain people were not modern enough and thus were destined for failure, reflecting the enduring influence of culture of poverty theories. Similarly, the idea that the blight arrived in a peaceable Appalachian kingdom also supports notions of mountain people as pre-modern, but here the forest-dependent way of life is extolled as something to which to return, a fallen state of grace.

Just as the narrative around the blight tends to essentialize early settlers, it also renders the early twentieth century Appalachian landscape healthy and forested. Historian Eric Rutkow’s description of the chestnut in American Canopy: Trees, Forests, and the Making of a Nation exemplifies this common portrayal of pre-blight Appalachia:

The heart of chestnut territory was one of the most economically underdeveloped parts of the east throughout the nineteenth century. Many inhabitants continued to live in log cabins—constructed of chestnuts—long after the rest of the nation transitioned to more modern and elaborate home designs… Most were poor, isolated from the outside world, and remarkably dependent on their forest trees. The annual chestnut harvest provided not only a bountiful source of food for families and their animals, but also an income stream... As one Appalachian phrased it, ‘Chestnuts were like the manna God sent to feed the Israelites.’ (Rutkow 2012, p. 213).

This was a world in which white pioneer settlers headed into the mountain forests to “[live] well under the sheltering arms of the American chestnut” (Kingsolver 2001, p.
Wildlife were plentiful, log cabins were merely one felled chestnut away from fruition, and livestock required no feed but could range loose on the mountainside, eating through “acres and acres of chestnut groves” (Cameron 2002, p. 8). Chestnuts were so bountiful that letters from settlers indicate that mast in some areas was knee or waist deep, with reports of men falling into the nut piles and having to be pulled out (Cameron 2002, p. 7).

Discourses around the chestnut suggest that the forests of Appalachia provided pioneer settlers with what their former English overlords could not: freedom and independence, symbolized by “the bounty of the American chestnut” (Cameron 2002, p. 8). Settlers that were “tough enough or desperate enough to brave the hardships of carving out a homestead in the middle of the wilderness were rewarded by a companionable ally: a tree of seemingly limitless largesse” (Freinkel 2009, p. 19). And so these white pioneers began their self-sufficient forest farming lifestyle, clearing areas of forest as needed for agriculture, but also using the forests themselves for the provision of food and timber (Otto 1983; Yarnell 1998). The “chestnut commons” were apparently essential to supporting this way of life; though privately owned, mountain forests were treated as common property, and animals ranged and people collected chestnuts for personal consumption or trade (Lutts 2004). Though rugged and not especially fertile, the landscape provided for the people and served as the raw materials for what would become the national character: resourcefulness, creativity, and independence.

Yet despite the common portrayal of pre-blight forests as healthy, intact, and providing for the people, significant deforestation had already occurred by the early
twentieth century through conversion of forests for agriculture, mining, and logging. Federal government estimates suggest that 86% of forests in southern Appalachia had been cleared by 1908, leaving only the most inaccessible stands untouched (Yarnell 1998). The perception of the chestnut blight sweeping through vast tracts of primeval forests and rendering pioneers resource-less is a myth, but is a myth that does important work. In portraying the blight as the key event in the history of both Appalachian forests and settlers, this myth writes over any Native American uses of the land, constructs white Appalachians as a chosen but beleaguered people, and reinforces the idea that American character and identity are fundamentally linked to pioneer efforts to settle the frontier.

Memories of the chestnut blight depict a time of immense struggle for rural Appalachians and a level of ecological degradation unforeseen in Appalachian history. As such, the demise of the chestnut is often told as part of the narrative of the downfall of rural Appalachian subsistence agriculture in the early twentieth century. In Homeplace Geography: Essays for Appalachia (2006), sociologist and TACF member Donald E. Davis writes that “the loss of the chestnut tree made it virtually impossible for rural Appalachians to maintain their self-sufficient, forest-dependent way of life” (p. 216). This narrative gives significant explanatory power to the chestnut blight, translating it into a romantic struggle for identity and heritage and figuring the Appalachian settler as a tragic cultural icon. This image of rural settlers devastated by blight is echoed in
reminiscences published in TACF newsletters and publications. TACF member William B. Wood, a retired medical doctor from Chapel Hill, North Carolina, recalled of his childhood in Surry County in northwestern North Carolina:

The stories told by my parents, family and friends fostered curiosity, admiration, and sadness in me. How could such majestic trees, which provided abundant food for people and animals, provided timber for homes and furniture, and income for poor farmers, disappear? (2009, p. 7)

Wood reads the blight through a nostalgic ‘world we have lost’ romanticism common in both scholarly and popular accounts of Appalachia (Barnwell 2003). In the wake of the chestnut blight, his family struggled to make ends meet on their farm. To earn enough money to pay their bills, they decided to sell the timber of the last standing chestnut snag on their property to a local furniture plant. But ultimately the tree was sacrificed in vain, as the furniture plant that had planned to buy the chestnut lumber went bust. The family could not save their farm:

We began a new life but my heart and my love remained in that mountain valley, with the sweet freedom of the pastures and orchards, and the swift stream and hillsides. Only one big question remained: Have I manifested even a small part of the strength and generosity and sacrifice of that Last Great Chestnut Ghost? (Wood 2009, p. 9)

In this narrative we see a nostalgic longing for a raw, unrestrained, and embodied life associated with the rural mountain environment. Even as the author of the piece has achieved the ideal of modern white American citizenship—professor emeritus and former dean of University of North Carolina School of Medicine—he recalls and longs for the “sweet freedom of the pastures and orchards,” which come to be symbolized by chestnut restoration.
The blight has been called “the greatest tragedy that ever occurred in the Appalachian range” (Banks 2005, p. 20). In this designation a whole host of Appalachian problems and histories are ostensibly reducible to one ‘natural’ disaster. The inequitable distribution of land since the time of settlement, labor exploitation at the hands of the coal industry, contamination of air and water by extractive and chemical industries—it all pales in relation to the chestnut blight, at which point the people of Appalachia were put on a trajectory of degeneration, tragedy, and loss. The corollary to this, as I discuss in the following section, is that Appalachia requires intervention and restoration, and that the restoration of the chestnut will in some way reverse or ameliorate the misfortunes of the region.

Restoring the chestnut will help restore rural Appalachia.

Chestnut restoration is premised on the idea that it will not only be ecologically advantageous but will also provide real benefits for Appalachian landscapes and communities. These benefits are both material and symbolic and work to reinforce the longstanding image of the region as a place stuck in the past, requiring outside intervention to meet the rest of the nation in modernity. On one hand, TACF members see restoration as a symbolic victory for a region that has experienced tremendous ecological degradation: “It will be a confidence booster for people in Appalachia. I think it’s more symbolic than anything else” (Author interview 2012). Yet many restorationists also believe that the chestnut will provide material economic benefits to Appalachian communities, and TACF has emphasized these benefits in seeking funding. For example,
Charles Taylor, former U.S. Representative from western North Carolina and Chairman of the House Subcommittee on Interior and Related Agencies, lobbied for and ultimately gained $250,000 for chestnut restoration in the Southeast specifically because the chestnut will provide “significant long-term benefit to the economy and work force” of the region (Case 2008, p. 62).

Visions of long-term benefits of chestnut restoration generally invoke Appalachia as a normatively rural, natural landscape, closely yoked to the nation’s past:

With the return of the American chestnut to the mountain region, perhaps a whole world… could be restored to its original splendor. Healthy chestnut trees would certainly create real economic possibilities for all mountain residents, providing yet another reason to protect and defend our mountain homeplace. (Davis 2006, p. 216)

This discourse gives extraordinary explanatory power to the chestnut blight and uncritically portrays the restoration as a panacea for persistent socioeconomic and environmental issues in Appalachia. If the loss of the chestnut signified Appalachia at its nadir—poverty, out-migration, and degeneration, its restoration has come to symbolize a new model for Appalachia—a heritage landscape for the nation, a blank slate on which to grow forests, sequester carbon, empower citizens, and ensure the nation’s natural and cultural heritage.

Many of these hoped-for benefits are pinned on the reforestation of strip mined landscapes. Under the stipulations of the Surface Mining Control and Reclamation Act (SMCRA) of 1977, strip mines are reclaimed by replacing topsoil, smooth grading it to the point of compaction, and immediately reseeding it, often with non-native grasses or herbaceous species. Trees are generally unable to grow in these heavily compacted soils
of reclaimed mine lands. In an effort to encourage forest growth on mined sites, the Appalachian Regional Reforestation Initiative (ARRI) and non-profit spin-off Green Forests Work (GFW) promote a new Forestry Reclamation Approach (FRA) in which highly-compacted soils are ripped open, cleared of non-native species, and re-planted with fast-growing native hardwood trees (including TACF’s blight resistant chestnut). In 2008, TACF joined forces with ARRI (and later GFW) through a program called “Operation Springboard,” which aims to use reforested mine lands as a jumping-off point for backcrossed chestnuts to disperse into wild forests.

The broader goals of mine land reforestation efforts are to transform unproductive landscapes into healthy and productive forests. By planting native trees on sites that would otherwise be restored as non-native grasslands, ARRI and GFW hope to lay the foundation of a sustainable forestry economy in Appalachia—an economy that would provide ecosystem services like carbon sequestration, wildlife habitat, and erosion control as well as benefits to local communities through job creation, increased recreational opportunities, the establishment of high-value timber stands, and the empowerment of Appalachian citizens. At about $2.20 per tree, it costs roughly $1,500 to replant an acre of land—costs that GFW, ARRI, and TACF believe are well worth these benefits (Green Forests Work 2014). \(^7\)

What I call attention to here are the ways in which this vision is materialized on the landscape through the embodied practices of individual laborers. A significant portion

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\(^7\) The indirect cost of chestnuts is significantly higher than $2.20/tree given the long-term expenses associated with breeding, although these costs are borne by TACF rather than ARRI or GFW. As of 2009, B_3F_3 seedlings represented over $16 million, according to TACF.
of the tree-planting labor is performed by volunteer groups from local universities, the Sierra Club, the Boy Scouts of America, church groups, and TACF. Planting native trees is a physically challenging and “rewarding hands-on activity” (GFW 2014), a way to learn about the natural and cultural heritage of Appalachia, and a beneficial community-building exercise. The remainder of the restoration process is performed by paid migrant workers from Central America (primarily Guatemala and Mexico) working on H-2B Temporary Non-Agricultural work visas (Author interview 2013). Although GFW would prefer to create local jobs, they currently rely on contract tree planting companies, who hire guest workers and likely some undocumented migrants as a cheap and flexible labor source. In a moment of irony, Latino laborers are tasked with eliminating worthless exotic vegetation and planting in its place native American trees, including the iconic 15/16 American, 1/16 Chinese chestnut. Paid just over minimum wage, these workers are valued for their willingness to perform for low wages the hard physical labor that forest restoration entails, in contrast to American workers, who contractors tend to view as lazy, slow, and unaccustomed to manual labor (McDaniel and Casanova 2003).

Here we see how existing racial formations come to shape the process of chestnut restoration. For predominantly white volunteers, planting trees is considered a luxury, providing the embodied experiences—the dirty hands, the popped blisters, the sore muscles—that whiteness attempts to leave behind (Scott 2009; Redmond 2008). Latino guest workers are physically separated from these volunteer laborers in both space and time, never laboring alongside one another but working at different sites and times. Their presence is virtually erased from the restoration process; their pictures, for example, do
not grace the GFW website, which instead includes dozens of photographs of smiling volunteers wrestling with heavy dibble bars. Latino workers come to represent a “hidden population” (McDaniel and Casanova 2003) whose labor nonetheless reshapes Appalachian forests and revives an American icon. Interestingly, it is through this labor that, GFW hopes, a sustainable forestry industry will be grown and fostered, thus providing jobs to local populations and reducing unemployment, poverty, and inequality. Yet the forestry industry of the southern U.S. demonstrates that this is unlikely to occur, as there the timber economy has maintained, if not enhanced, social divisions, inequitable land distributions, and a segmented labor market (Bailey et al. 1996; McDaniel and Casanova 2003). While tree planting may empower volunteers, employ migrant labor, attract tourists, provide improved habitat, and sequester carbon, it does not fundamentally alter the distribution of resources in the region, particularly given that a significant portion of ARRI and GFW’s planting occurs on federal or state land, or land owned by large landholding or energy companies. Patrick Angel, of ARRI and the U.S. Office of Surface Mining, calls the chestnut the “magic bean” of Appalachia (Whitbread-Abrutat 2012, p. 24), yet it seems impossible that tree’s restoration will provide a magical antidote for problems of poverty, inequality, or social struggle.

**Conclusion**

Discourses of chestnut restoration explain Appalachia’s past in terms of a romantic struggle of white pioneer farmers against the ravages of the chestnut blight. By portraying rural Appalachian folk as a chosen but beleaguered people who have lost their
“manna from heaven” (Rutkow 2012, p. 213), this discourse plays into the victimized white cultural icon that has been reproduced in many representations of Appalachia (Smith 2004). Chestnut restoration relies on the “sentimentalized recovering of sanitized ‘heritage’” (Massey 1994, p. 168) to support its mission, and in so doing renders the region of Appalachia as a landscape of memory for the nation, where normative ideas about national heritage, race, and identity are figured. The project of chestnut restoration also attempts to order the past and even render it eternal, embedding within the landscape notions of Appalachia as both ideal and profoundly troubled, in dire need of intervention to force it out of its state of ecological and social “arrested succession” (Author interview 2012).

As this chapter demonstrates, the privilege to shape the landscape in one’s own image—the right to claim that a certain nature is the proper nature—is fundamentally related to the privileged sense of identity associated with whiteness (Farough 2004). Chestnut restoration reinforces the idea that white heritage, landscapes, and people are the ones that matter for the American nation (Scott 2009). One example that this chapter highlights is Latino labor, which is erased from the landscape of chestnut restoration, only made visible in discussions of what it is unfortunately not—jobs for white people. This is not to say that chestnut restoration is a racially motivated project, but rather to suggest that ecological restoration movements are implicitly shaped by racialized ideas about nature, nation, and heritage. Omi and Winant (1994) write that there is a “racial dimension present to some degree in every identity, institution, and social practice in the U.S.” (p. 15). Indeed racial meanings overflow the boundaries skin color, ethnicity, and
racism (Omi and Winant 1994), extending not only into all social relations but nature-society relations as well. Nature thus becomes a key site in the process of racial formation.
Chapter 6: Conclusions

“If you think of all of the ecological devastation in this country—we lost the buffalo, we lost the passenger pigeon—but this is one thing where we’ve struck a flag in the ground and said, ‘Not this tree.’” (Burhans 2009, p. 4)

The goal of this dissertation was to interrogate how the American chestnut is made to live as a simultaneously novel yet historic species. I have argued that the production and restoration of the chestnut are deeply biopolitical and racialized projects—in contrast to apolitical accounts of ecological restoration as merely the renewal of degraded landscapes. Bringing together Foucauldian biopower with ideas from nature-society geography and STS, I have shown that nonhuman nature and ecological science are key sites through which the politics of life and death are constituted, challenged, and remade. In so doing I have tried to understand the scientific rationalities, fraught histories, and social formations that shape chestnut restoration. What does it mean to stick a flag in the ground and say “not this tree”? And indeed, why not this tree?

I began to address these questions in the first chapter by theorizing restoration as a biopolitical and racialized project, in which the species is intervened in and altered in an effort to secure a lively future for it. Restoration is, to its very core, a project of making live and letting die. It is materially so in that it involves removal as a precursor to
renewal—elimination of non-native species from the landscape or Chinese genes from the genome—and it is discursively so in that it differentially values certain natures and visions of nature above others. What I have tried to do here is to flesh out the messy realities that constitute the biopolitics of nature, science, and race in the Anthropocene, calling attention to how the American chestnut has become so culturally and ecologically valued, and what scientific technologies and truth discourses are made to live alongside and indeed through the species.

I do not aim to suggest that chestnut restoration is somehow more biopolitical than other conservation or restoration projects. Better science—more objectivity and less uncertainty—is not the conclusion I find most compelling, despite arguments that “science, not mysticism, will save the American chestnut tree” (Bailey 2013). Rather, what I offer here is a perspective that understands science itself as a form of power. While the discourse of scientific progress insinuates that our knowledge of the biophysical world is objective, apolitical, and increasingly accurate over time, the sciences of conservation and restoration are themselves forms of power that generate particular truth claims in the name of fostering life. In chapter two, I explore these issues by considering the rise of conservation science as a shift from a sovereign form of rule that sought to subdue or conquer nature toward a biopolitical imperative to make nature live. Conservation’s organizing concepts—populations, biodiversity, genetic purity, evolution, extinction—provide the “rules of the game,” permeating the science with a biopolitical logic and sense of urgency that legitimates certain ideas, actors, and actions while rendering false or disempowering others.
In the case of the chestnut, backcross breeding to jumpstart evolution becomes a common sense solution to the species’ stasis at the hands of the blight. Yet at the same, discourses of genetic purity also suggest that the Chinese genes of backcrossed trees or the transgenes of biotech trees should be diluted as much as possible to protect the species as a unique form. This is a logic that also undergirds ideas about racial difference. While sharp biological distinctions (i.e. between races) are called into question when applied to human populations, distinctions between biological kinds are deemed appropriate, scientific, and indispensable when applied to nonhuman populations. These distinctions should not be understood separately, as it is often through scientific discourses about nonhuman nature that ideas about human difference are challenged, reinforced, or naturalized. Such comparisons between racial logic and species ontology are not meant to suggest that biopolitical strategies of distinguishing between threats and advantages are all one and the same, but rather that taken-for-granted concepts like species, populations, and diversity are entangled in biopolitical notions of difference, abnormality, and emergent life.

The history of the chestnut blight and the many efforts to control, eradicate, or build resistance to it provides a key opportunity to think through how such entanglements arise and with what effects. As I have argued, racial biologies and forest ecologies become articulated together through a shared biopolitical logic but the connection between nature, nation, and race also extends beyond this shared logic (Kosek 2006). In the case of the American chestnut, race and nation have played foundational roles in the history of blight control and efforts toward restoration. From early twentieth century
portrayals of the blight as an “undesirable immigrant” that “the American farmer must board and lodge forever” (Federal Horticulture Board 1922, p. 20) to more recent plantings of chestnuts at a 9/11 memorial, the species has long been associated with racialized visions of the American nation, national heritage, and white Appalachian heritage.

In chapter three, I examined early twentieth century knowledge-practices around the chestnut blight, finding that responses to the blight often took shape within broader nationalistic or xenophobic discourses. The Pennsylvania Blight Commission was established to wage a war of attrition against the blight—a metaphor that remains striking in contemporary TACF rhetoric (as slides from the TACF President Bryan Burhan’s speech at the 2013 Annual Meeting stated, “This is war. We must use every tool.”) Similarly, the foreign origins of the blight fungus were problematized in conversation with anti-immigrant sentiments, and chestnut breeding too shares a history and logic with the breeding of human populations for racial improvement (i.e. eugenics). In short, initial responses to the blight were linked to profound anxieties about the fate of the American nation, and warding off the fungus was also about protecting and promoting a particular vision of the ideal race and nation. This link between nature, race, and nation is not merely a historical relict but lingers to date, as restoration continues to be implicitly and explicitly shaped by ideas about American exceptionalism and national identity.

Yet the chestnut is not just an American tree but an Appalachian tree as well, and discourses of chestnut restoration have tended to romanticize Appalachia as the rural heartland, reinforcing the region’s status as a landscape of memory and heritage. Here we
see clearly the ways in which nature and race are articulated together in discourses about landscape, identity, and nation (Moore et al. 2003). Ecological restoration comes to reinforce or reshape particular social arrangements and truth narratives—here these include racial formations of whiteness and ideas about Appalachia as the pioneer roots of the American nation. Restoration not only produces a species anew but also inscribes new layers of meaning on the Appalachian landscape. Chestnuts are not planted on a blank slate—a bare earth—but are restored to existing landscapes and change them in ecologically and socially significant ways. Even on surface mines, where chestnuts are literally planted on bare earth, the act of restoration contributes to, writes over, or displaces other stories. In the project of making life live, some lives are necessarily privileged above others, rendering some killable or forgettable or erasable, in an effort to advance life as a whole. Yet the very ability to make live—for example, to establish the American chestnut as a national nature—is itself also a privilege, and here I have argued that the restoration of the chestnut is fundamentally related to historical racial formations of Appalachian and American whiteness.

Chestnut restoration also reveals much about the complexities of ecological science, restoration, conservation at a time where nature is widely understood to be unstable, emergent, and unpredictable. It is from this experimental beaker of the Anthropocene that de-extinction has emerged as a viable conservation practice, with the idea that if humans are the driving force on the planet, then surely we can harness that power toward promoting life rather than solely destroying it. Anticipating a future that is novel yet strangely familiar, scientists and restorationists are therefore working not just to
prevent the loss of pre-existing biological materialities but are actively and purposefully making life anew. The crises of the Anthropocene necessitate action, and chestnut restoration is one of many such projects that aim to compensate, if minutely, for the current ecological state of affairs. Yet restoration is far from straightforward, and the science itself involves biopolitical questions about how to make the species live, what forms of circulation might pose threats to nature, and who is authorized to make such decisions. Is the use of biotechnology necessary to secure forests from future health threats? Are Chinese genes more or less problematic than transgenes? Will increasing the blight resistance of the population render other threats, like Phytophthora, ambrosia beetle, and gypsy moth, more deadly? And more broadly, what sorts of unknowns constitute the emergence and integrity of life itself and what unknowns represent threats and must be guarded against? These are but a few of the questions that must be negotiated through chestnut restoration. Importantly, both the transgenic approach and backcross breeding deal with such issues, as each group attempts to assay life more acutely and to promote it more fully.

In sum, efforts to restore the American chestnut are not—and indeed were never—politically neutral projects. Wrapped in the language of biopolitical urgency and scientific objectivity, de-extinction is crucially shaped by the prevailing social and racial anxieties of our times. It is a project of make live and let die, a fundamentally biopolitical endeavor in which the conservation of nature is bound to notions of racial differentiation, white American and Appalachian heritage, and national security. The chestnut may be unique in its specific materialities, storied past, and cultural meanings, but it represents
but one of many example of how the politics of life and death are negotiated through ecological science and nature-society relations.

We see biopolitical logics, contradictions, and struggles in other conservation dilemmas, including the protection of the spotted owl (*Strix occidentalis*) and the regulation of gene flow in fisheries. In the Pacific Northwest, the spotted owl has been the subject of decades of disputes between environmentalists, loggers, and developers about old-growth forests. The species has become a national symbol for the Endangered Species Act (ESA) and has fundamentally changed how land is used in the region. But despite increased protection and habitat conservation, the species is still declining, and ecologists believe that the barred owl (*Strix varia*), which has expanded its range into the Pacific Northwest, is the reason why. The U.S. Fish and Wildlife Service (FWS) recently began a $3.5 million experiment to kill 3,600 barred owls—roughly $1,000 an owl—in an effort to make the spotted owl live (Shogren 2014). The FWS is legally compelled to protect the spotted owl under the ESA, and protection here means removing the barred owl as a biological threat. Death is not only sanctioned but compulsory.

In the Greater Yellowstone area, the management of gene flow across species provides another example of how the politics of life are also the politics of death. There, the native cutthroat trout (*Oncorhynchus clarki*) commonly interbreeds in the wild with the non-native but naturalized rainbow trout (*Oncorhynchus mykiss*), producing fertile hybrid offspring called “cuttbows” (*Oncorhynchus clarki x mykis*). While this gene flow could potentially serve as an evolutionary advantage in the long term, it is more commonly viewed as biological aberrance—a form of genetic pollution and a threat to
diversity. Hence fisheries managers have poisoned a number of waterways in and around Yellowstone National Park to remove rainbow trout as biological threats (Gallagher 2006; Koshmrl 2013). These waters are then restocked with native cutthroats. Yet somewhat ironically, other streams in the region are being poisoned to exterminate the cutthroat itself, as it is considered a threat to another native species, the Arctic grayling (*Thymallus arcticus*). We see in these fraught conservation decisions the process of bringing death into the fold, as conservation managers must sentence populations to death in the name improving and protecting nature as a whole. Here, the movement of genes across the landscape represents biological threat, producing diversity but at the same time threatening the distinct species that constitute such diversity.

I highlight these nitty-gritty examples of biopolitical production (Sparke 2006) to show how nature and ecological science become key sites in which the politics of life and death are constituted. The barred owl, hybrid cuttbow, chestnut transgenes, and Chinese traits come to be managed as “threat[s] that must be corrected or regulated. The presumption being that some form of equilibrium is possible” (Anderson 2001, p. 32). Yet as I have indicated in the discussion of the Anthropocene, the presumption of equilibrium—of taxonomic stability, genetic purity, and climax communities—is no longer a solid bedrock for conservation. Increasingly biology “offers accounts of bodies that defy secure taxonomic classification… Such bodies are contingent assemblages, bodies-in-formation, rather than pre-formed bodies” (Dillon and Reid 2001, p. 56). It is at this biopolitical juncture—between past and future, steady states and thresholds, species and “bodies-in-formation”—that the chestnut is being made to live as a novel yet historic
species. Restorationists may have stuck a flag in the ground and said, “Not this tree,” but the ground itself has changed underfoot.

What I have tried to do here is to begin to flesh out how nature is known, protected, and produced at this juncture. There is much I have missed, overlooked, or glossed over in telling this story, and I have come to realize that there is no way of writing that is not also a way of silencing and smoothing over complex realities, just as Donna Haraway notes that “try as we might to distance ourselves, there is no way of living that is not also a way of someone… else dying differentially” (2008, p. 80). Conservation and restoration projects are no different, and the choices that we make in deciding what natures to invest in, identify with, save, alter, or discard—and how to go about doing so—are politically charged, racially embedded, and ecologically crucial.
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Appendix A: Participant observation

<table>
<thead>
<tr>
<th>State</th>
<th>Counties</th>
<th>Key Participant Observation Events and Dates</th>
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<tbody>
<tr>
<td>NY</td>
<td>Onondaga County</td>
<td>• <strong>August 2011:</strong> Visited the American Chestnut Research and Restoration Lab at the State University of New York College of Environmental Science and Forestry, and observed transgenic chestnut plantings at the Lafayette Road Experiment Station (Syracuse)</td>
</tr>
</tbody>
</table>
| NC    | Buncombe, Haywood, and Yancey Counties | • **March 2011, July 2012:** Visited chestnut plantings and spent time in local communities (Asheville, Burnsville, Waynesville)  
• **July 2012:** Visited the TACF National Office (Asheville)  
• **July 2012:** Attended conservation planning meetings with TACF members and Wildlands Network staff (Asheville) |
| OH    | Athens, Belmont, Delaware, Hocking, Muskingum, Perry, and Ross Counties | • **2010-2013:** Attended TACF-Ohio Chapter meetings and tree plantings at Highlands Nature Sanctuary (Bainbridge), The Wilds (Cumberland), and Dysart Woods (Belmont)  
• **August 2011:** Toured chestnut plantings by the Forest Service in Wayne National Forest (Athens, Hocking, and Perry Counties)  
• **March 2012:** Visited chestnut research lab at Ohio University’s Department of Environmental And Plant Biology  
• **April 2012:** Visited greenhouses and laboratories at the USDA Forest Service Northern Research Station (Delaware) |
| PA    | Adams, Centre, Cumberland, Indiana, and Somerset Counties | • **February 2011:** Attended TACF chestnut restoration workshop (Sewickley)  
• **June 2011:** Participated in Appalachian Trail MEGA-Transect Chestnut Project (Pine Grove Furnace State Park) |
<table>
<thead>
<tr>
<th>State</th>
<th>Counties</th>
<th>Activities</th>
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<tbody>
<tr>
<td>PA</td>
<td>Adams, Centre, Cumberland, Indiana, and Somerset Counties</td>
<td>• <strong>March 2012:</strong> Attended Appalachian Studies Association conference where I met with a chestnut researcher and community members (Indiana University of Pennsylvania)&lt;br&gt;• <strong>April 2012:</strong> Planted trees at the Flight 93 National Memorial as part of the “Year of the Trees” at the former strip mine (Shanksville)&lt;br&gt;• <strong>May 2012:</strong> Visited TACF- Pennsylvania Chapter chestnut breeding orchard at Pennsylvania State University’s Russell E. Larson Agricultural Research Farm</td>
</tr>
<tr>
<td>VA</td>
<td>Washington and Fairfax Counties</td>
<td>• <strong>July 2012:</strong> Visited TACF Research Farms, Glenn C. Price Laboratory, and chestnut breeding orchards (Meadowview)&lt;br&gt;• <strong>October 2013:</strong> Attended TACF’s 30th Annual Meeting (Herndon)</td>
</tr>
<tr>
<td>WV</td>
<td>Summers and Greenbrier Counties</td>
<td>• <strong>June 2012:</strong> Visited MeadWestvaco Community Development and Land Management office (Rupert) and toured chestnut plantings on MeadWestvaco property&lt;br&gt;• <strong>June 2012:</strong> Attended Summers County 4-H Camp (Talcott)</td>
</tr>
</tbody>
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