PART II

Geographies of Variation

The Case of Invasion Biology

Fitcher was saddened to learn that his own compatriots were responsible for the garden's decline . . . Fitcher's revulsion at the sight of the wilderness that loomed before him now: the untrimmed crowns of the garden's trees had grown into each other, forming a canopy so dense that the grounds beneath, with their flower-beds and flag-stoned pathways, were shrouded in darkness; along the peripheries of the compound, the greenery was as impenetrable as a wall, and the unclipped aerial roots of the banyans that flanked the main gateway had thickened into a forbidding barrier—a portcullis that seemed to be designed to keep intruders at bay. This was no primeval jungle, for no ordinary wilderness would contain such a proliferation of species, from different continents. In Nature there existed no forest where African creepers were at war with Chinese trees, nor one where Indian shrubs and Brazilian vines were locked in mortal embrace. This was a work of Man, a botanical Babel.

—Amitav Ghosh, *River of Smoke*

CHAPTER FOUR

Alien Nation

A Recent Bio*graphy*

Since we have all been more or less constantly on the move since our ancestors decamped from the old neighborhood in Ethiopia, 195,000 years ago, you'd think that, as a species, we might have worked through our hostility and suspicion of newbies by now. But we haven't.

—Peter Behrens, *The New York Times*, March 16, 2012

Give me your tired, your poor, Your huddled masses yearning to breathe free, The wretched refuse of your teeming shore. Send these, the homeless, tempest-tossed, to me: I lift my lamp beside the golden door.

—Emma Lazarus, *The New Colossus*

A nation that cannot control its borders is not a nation.

—Ronald Reagan on signing the Immigration Reform and Control Act, 1986.

Where do plants, animals, and humans originate, and does it matter? Who migrates where, when, and why and to what consequences? Part II explores the naturecultural worlds of invasion biology. This project on biological invasions began simply enough as an interdisciplinary project in science and the feminist studies of science. This collaborative project was provoked by the growing public alarm about exotic and foreign species. As a biologist, I was keen to understand and explain the shifting landscape—why are numbers of native species dwindling and foreign species increasing? From feminist studies, I was interested in our generic fear about the "foreign" and invasion biology's

articulations of space and belonging, and of how science comes to mobilize a public toward social and environmental policy. More centrally, how did biology come to its categories of analysis, how did the production of knowledge in science proceed? The project continued as both the biologist and cultural studies scholar in me watched, observed, and analyzed the evolving collaboration.

In this chapter I trace the co-production of knowledge on the global migrations of biota—humans, plants, and animals—by exploring a brief *bio*graphy of life in the United States over the past decade. The following chapter explores my collaborative field experiments on invasive species, and the final chapter in this part is a meditation on my growing identification of being an alien studying aliens. How might such subjectivities, this spirit of kinship and alliance, be a source of productive knowledge production?

At the outset, I should be clear about my political and ecological sympathies. To me, humans are a part of nature and have co-evolved with the flora and fauna. A return to a pre-human world is not possible or even desirable. I do not believe that nature was once good, pure, and virginal and would have remained so without humans. Nature without humans was and is not a static idyllic utopia. Instead, to me, nature is a concept, an idea, and a place that is co-produced through the interactions and entanglements of various organisms, histories, and geographies. To me many of the issues we debate are largely moot: Is globalization good or bad? Should our borders be open or closed? Is hybridity or multiraciality a good or bad thing (Cardozo and Subramaniam 2013)? History is very illustrative—globalization has long been here, our borders have always been porous, and multiraciality and multiple sexualities are not new. Histories of our Planet remind us that complex ecological relationships produce and have always produced a dynamic, ever-changing, and complex ecological system. Nature is ever evolving—we see periods of little change, or stasis, and those with tremendous flux.

While I may not subscribe to a nostalgic pure nature of yesteryears, it is fitting to call our contemporary epoch the *Anthropocene*, an era driven primarily by the impact of human actions (Crutzen and Stoerme 2000). From colonial powers that reshaped local ecosystems to maximize resource extraction to neocolonial modes of contemporary resource attraction, from human-made war and poverty that have decimated many populations (human and other) to world social and economic systems that have enslaved and impoverished entire nations and their biota, human influence is profound. Refusing the unproductive choices of a nostalgic past or an anarchic future, I turn to a naturecultural vision of responsible and ethical living with our cohabitants, a vision that is always politically astute and reflexive of the complex histories of gender, race, class, sexuality, and nation that have shaped our ideas of nature and the natural.

Variation, Diversity, and Adaptation

Geography, it turns out, is central to the idea of variation in biology as we understand it today. Darwin credited his many geographical explorations, especially his voyage on the HMS *Beagle*, as critical to his developing theories, as was the tremendous variation he observed within and across geographies. Geography also has another important meaning that is central to our theories of evolution, that is, place. Variation is the raw material for natural selection and for geographies and their environmental contexts that lead to adaptations of organisms and the actions of natural selection. In Darwin's vision, nature is neither static nor stable. Organisms evolve as evolutionary contexts change. In addition to geological ruptures that literally move bodies of land, nature facilitates movements in many ways. Organisms migrate—a seed can travel tucked into a bird's feather or an animal's fur; an organism, egg, or seed can be carried on a floating log; strong winds carry pollen and seeds afar. Organisms housed within other organisms (symbionts, parasites, and other co-evolved entities) move afar with their hosts. Yet, ideas of nature *and* place go hand in hand—humans, plants, and animals come to "belong" to particular geographies, and we have come to talk about "nature in place" and "nature out of place."

Nature's Place

The idea of invasion is predicated on a discourse of "nature in place" and "nature out of place"—and by definition invasive species are introduced species that do not belong. This idea of "nature in place" has a complex and nonlinear history. The concept of "nativeness" was first introduced by the English botanist John Henslow in 1835, and subsequently Hewett Watson used this to delineate "a true British flora" (Davis et al. 2011a, Chew and Hamilton 2011). Watson's terminology drew on English common law about human citizenship rights (Chew and Hamilton 2011). Of course, "true" British flora constitutes the "not true" and the now familiar binary of the native/alien emerged. While the term continued to be used in the coming decades, no general policy about native/aliens emerged (Davis et al. 2011a). In our recent genealogy of invasion biology, Charles Elton's 1958 *The Ecology of Invasions* is cited as the classic book that ushered in the field of invasion biology. While laws policed biotic flows, it was only with SCOPE (Scientific Committee on Problems of the Environment) in 1983 that "invasion biology" as a field or discipline emerged (Davis et al. 2011b). Today, according to the U.S. Department of Agriculture (USDA), "invasive plants are introduced species that can thrive in areas beyond their natural range of dispersal. These plants are characteristically adaptable, aggressive, and have a high reproduc-

tive capacity. Their vigor combined with a lack of natural enemies often leads to outbreak populations" (U.S. Department of Agriculture 2012). Indeed, in recent decades, work on invasive plant species has exploded. The frenzied alarm has been sounded by groups of the right and left, environmentalists and non-environmentalists alike. At the level of research and policy, this is a fertile area. The USDA, state governments, National Science Foundation committees, as well as environmental groups such as the Nature Conservancy and the Sierra Club all have invasive species programs.

We have historically imagined our relationship with the biota of the world in numerous and diverse ways. In his influential book *Ecological Imperialism*, Alfred Cosby argues that the roots of Europeans' domination of the western world lie in their creating "New-Europes" wherever they went, especially in North and South America, Australia, and New Zealand (Crosby 1986). Rather than thinking of European domination as the result of technology, Crosby argues that we should understand it as simultaneously biological and ecological. Where Europeans went, their agriculture and animals went; they thrived while indigenous ecosystems collapsed. This vast migration of species ushered in a bioinvasion of mass proportions by the conquerors' animals, plants, weeds, and germs, yielding a "great reshuffling" (Crosby 1986, McNeely 2001, Warren 2007, Weiner 1996). Some plants were now ubiquitous; as Crosby remarks, "the sun never sets on the empire of the dandelion" (Crosby 1986: 7). The science of breeding and horticulture led to scientific breeding stations around the globe that turned raw materials from the colonies into plantation crops for the British, French, and other colonies and empires, including the Americas (Brockway 2002).

As early as 1776, the United States dealt with its first insect invasion by the Hessian fly. While the Americans and British responded with nationalist and xenophobic fervor, these invasions were seen as isolated events (Pauly 2002). Indeed, in the late nineteenth and early twentieth centuries, the USDA had an active program where biologists as "explorers" roamed the globe in search of new and interesting plants of economic and aesthetic interest. For example, Dr. Douglas Fairchild, director of USDA's Section of Seed and Plant Introduction from 1898 to 1928, is said to have introduced more than 80,000 species and varieties into the United States (Conlon 2010). Likewise, the American Acclimatization Society introduced a variety of plants and animals, including an attempt to introduce all of the bird species mentioned in Shakespeare's works to New York City's Central Park in the 1890s (Blair 2008). Such an open and laissez faire U.S. policy ended late in the nineteenth century, however, due in part to America's changing relationship with nature. In the decades after the Civil

War, industrialization, urbanization, and westward expansion transformed the nation's landscapes and redefined Americans' relationship with nature (Rone 2008). This new love of nature was evidenced in the dramatic growth in the number of Americans who considered themselves "nature lovers," and Americans saw their love of nature as *the* quality that distinguished the "natives" from the new immigrants. A love for nature translated into a zeal to protect nature, and immigrants came to be seen as not loving nature and as the problem. Nativists increasingly challenged federal government passivity about immigration. The "native" emerges as site of "purity" in our conceptions of humans and plant and animal ecologies. Indeed, as Philip Pauly (1996) notes, the paradigm of the nativist approach was the Chinese Exclusion Act, passed at the insistence of California workingmen in 1882, a year after the state's quarantine law. After World War I, Congress introduced limitations on entries of all European immigrant groups through the Immigration Act of 1924.

During the hearings for the Immigration Act, eugenics played a big role. Experts testified on the importance of bringing "good stock" into the United States, warning of the public cost of "bad stock" in caring for those who had physical and mental disabilities or diseases (Allen 1996). The new demographic policy on limiting human immigration was a central part of the vision of scientific bureaucrats to make the United States ecologically independent (Pauly 1996). Eugenic concerns span variation's genealogies and geographies—and fears of the high reproduction of the "poor" stock directly fueled concerns about the erosion of the environment (Stern 2005). While evolutionary biology and eugenics are intimately linked, so are environmentalism, ecology, and eugenics.

Like human immigrants, the arrival of foreign plants and animals is deeply intertwined with the needs of the U.S. economy—as ornamentals, recreation, utility, food, comfort, entertainment, soil erosion, and pest or weed control. The Asian carp was imported as a "worker fish" to clean up areas with aquatic weeds (Burdick 2005, Frazier 2010), and kudzu was promoted by the government to prevent soil erosion (Burdick 2005, Frazier 2010). More than half of the plants known to be invasive in North America were originally imported for their horticultural use (Marinelli and Randall 1996). Human "dispersal" is key for the movement of plants and animals (Bean 2007, Chew and Hamilton 2011, Klein 2002, Pysek et al. 2004). The majority arrived at our behest because *we* invited them; these invasions are best understood as *invited invasions* (Cardozo and Subramaniam 2013). These invasions were proliferated by the domestication, acclimatization, and breeding sciences—scientific disciplines that converted "foreign" species into economically valuable species (Brockway 2002). In the same spirit, botanical gardens introduced U.S. citizens, especially children,

to many species not native to the United States, ushering in a long history of fascination with exotic plants from across the globe (Daston and Park 2001).

The impact of humans on the rest of the environment has been a critical focus in recent environmentalist thought and activism. The profound migrations of people, plants, and animals have occurred within the complex circuits of colonialism, tourism, forced and voluntary migrations, trade, and globalization. A recent Gallup World Poll suggests that 1.1 billion people, or one-quarter of Earth's adults, want to move temporarily to another country to find more profitable work. Another 630 million people would like to move permanently (Matt 2012). While humans migrate, landscapes of home are always reinvoked in new geographies, as migrants have historically turned to the comfort of landscapes that remind them of home. Indeed, with the advent of cars, ships, and planes, and trade and travel, there is virtually no region of the Planet unconnected with another. World biogeography is constantly made and remade through the varied circuits of history and politics. Seemingly innocent ideas such as biological variation become entangled and translated into complex ideas of difference. Which landscapes are superior and which are inferior? What constitutes home and abroad? Who is deemed native and alien?

Naturecultural Migrations

Understanding the geographies of variation through a naturecultural lens is productive. Environmentalists raise the alarm over the growing number of invasive species and anti-immigration activists raise the alarm about immigrants. Unbeknownst to each, the anti-invasive and the anti-immigrant rhetorics help feed a rampant xenophobia about the problem with these "outsiders." Welcome to the naturecultural world! We cannot understand plant, animal, or human evolution without understanding their connections to each other. Yet biologists study plant immigration and social scientists human immigration, usually on different geographical ends of a campus. Environmental and immigrant activists likewise exercise their influence often through entirely different networks of influence and circuits of power. Yet, I would contend, that while the natural and political worlds appear separate and are reported in different sections of the newspaper and studied in different disciplines, xenophobic sentiments strengthen as they travel across campaigns against foreign plants, animals, and humans.

The power of the framework of naturecultures is in illuminating the complex circulation of knowledge. Indeed, the categories of native and exotic, foreign and alien, which seem to be such "human" categories, have their origins in

distinctions in early plant cultivations to explain the distribution of species—in distinguishing between the "wild" and the domesticated "garden" (Grese 2011). It is the failure to see naturecultures that leads to one of the great ironies where in an era of globalization, there is a renewed call for the importance of the "local" and the protection of the indigenous. The alarm about human immigration is accompanied by an alarm about alien plants and animals. With the increased permeability of nations and their borders,[1] and the increased consumption and celebration of our common natures and cultures, we begin to obsess about our different natures and cultures with a fervent nationalism, stressing the need to close our borders to "outsiders." The anxieties around the free movement of capital, commodities, entertainment, and the copious consumption of natural and cultural products have reached fever pitch. In the realm of culture and the economy, nationalisms, fundamentalisms, World Trade Organization (WTO) protests, censorship of "foreign" influences, and calls for the preservation of national cultures abound.[2] The globalization of markets, and the real and perceived lack of local control, feed nationalist discourse. High unemployment rates, coupled with the search of companies for cheap labor abroad and the easing of immigration into the country, have increasingly been perceived as threats to local employment. These shifts continue to be viewed by some elements of both the right and the left as a problem of immigration.

The histories and interconnected political valences (in biological and social histories) of humans and plants and animals are entirely obscured and lost. Yet through a naturecultural lens, they come crisply into focus. Suddenly, we begin to see that our anxiety about a fast-changing Planet, the immense mobility and flux of our lives, and the fear of anarchy and chaos appear in a myriad of sites. Rhetoric of "nature out of place" is everywhere—among economists, labor activists, unions, politicians, border control agents, environmentalists, biologists, and epidemiologists. We feel under siege, an illusion of multiple data points of multiple phenomena, all pointing to the same problem—nature "out of place." Suddenly these anxieties seem right, obvious, commonsensical, and, above all, "natural." We respond with xenophobic ideologies across multiple sites, trying to restore nature to its rightful place. What a naturecultural analysis allows us to see is the circulation of knowledge—that these are not different data points after all, but the same data points appearing in multiple loci. Indeed, these are all symptoms of the same anxieties, the same problem—our cultural anxieties of a purportedly fast-changing world, anxieties that we and "our kind" will be left behind.

Science, like politics, is not monolithic. While certain stories and viewpoints dominate, there are *always* other viewpoints. Science is only one site in our na-

turecultural world where social anxieties manifest themselves. As politicians, activists, and a society at large grapple with ideas of the "nation" and who belongs, these same battles spill over into the scientific and natural worlds. The case of invasion biology is an ideal case in point. If the ideological battles are being waged across multiple sites, it also suggests that a naturecultural analysis allows a fertile opportunity for resistance and collaboration.

Alien Nation! A Recent *Bio*graphy: A Tale in Four Acts

Thinking natureculturally reminds us that plants, animals, and humans share a common *bio*graphy. In examining the history of foreign plants, Philip Pauly (1996: 70) argues that

> commonplace symbolic connections between geographically identified organisms and humans were omnipresent and powerful. Americans perceived the English sparrow as an avian Cockney pushing aside larger but better-mannered American birds. The gypsy moth's devastation of respectable neighborhoods confirmed casual prejudices about Gypsies. The introduction of pulpy tropical fruits, carrying the aromas of the Far East, really did increase sensuality among Americans raised on tart apples and bland pears. These specific associations could operate at high cultural levels, and their implications could be molded consciously.

I explore the ghostly naturecultural world of the "foreign" by examining invasion biology in four "Acts," four moments in the popular media over the past decade, each demonstrating the multiple cultural valences on immigration. The stories come from a wide array of players, from scientists and nonscientists, environmentalists and nonenvironmentalists alike. While I focus on popular news sources here, the spirit of the debate is well evident in the scientific literature as well. *Act I: The Aliens Have Landed* explores the explosion of research on invasion biology in the 1990s, the decade when invasion biology emerged as a discipline of its own (Davis et al. 2011a). During that time, the efforts of biologists and environmental activists dealing with alien biota were reported every day in newspapers and magazines across the country. This section also sets up the basic arguments and rhetoric that frame invasion biology. Over the following decade, the daily reporting on invasive species continued. The following three acts represent departures from these daily reporting—moments that gave me pause or cause to sit up and wonder, "This is different! What is going on?" *Act II: And Then the Towers Fell* examines one of several cases of

sensationalized mass hysteria around particular aliens, in this case the Chinese snakehead in Crofton Pond in 2002. The case enacts the arc of the politics of a post–September 11, 2001, world. *Act III: An Obligation of Reluctance*, set in 2006, features an op-ed in *The New York Times* unreservedly and exuberantly promoting an embrace of the wild diversity of all plants, including alien biota. The piece accuses those wanting to kill weeds and other biota of rampant xenophobia. Finally, *Act IV: The Invasive Species War* examines a well-publicized debate in 2011 in *Nature* and subsequently reported in the popular press of a debate among biologists on the question of invasive species.

A Note on Studying Naturecultures

Why focus on popular media and popular representations? This work is about tracking the production of knowledge. Take two parts in the process of the production of knowledge. First, biologists produce knowledge about invasive species and their destructive impact and publish these in scientific journals. Second, environmental societies across the country mobilize private citizens to sacrifice their weekend leisure in joining campaigns to uproot invasive plants from their local habitats (Neyhfakh 2011). How do we connect the two? To understand this, we need to understand the knowledge biologists produce; who biologists are; how biologists garner funding for their work; how work gets published; and how biologists promote their work to the nation, lobby popular support, and shape environmental and public policy. First, it is not as though biologists do their work and nonbiologists "apply" the work. The two are inextricably interconnected. Popular media is grounded in the work of invasion biology, often involving the same biologists. But only selected research gets the attention of the popular press. Scientific jargon and complexity is often translated and made accessible—and some things are often lost in the translation. So while we need to be nuanced about how knowledge and theories travel, they are indeed connected and do indeed travel. Second, contrary to popular mythology, most scientists are not bearded rationalists plotting the latest bomb! Rather, even a brief perusal of biology or any of the sciences demonstrates a history of intellectually curious, politically engaged, passionate, and concerned scientist-citizens. Scientists are located in society, are embedded in cultures, and bring to their work a diverse range of cultural understandings, varied politics, and ambivalence present in society.[3] Indeed, scientists—as is evident in most invasion biologists presented here—are deeply involved in influencing environmental policy, in getting the public and politicians to take what they see as the problem of environmental management seriously. This is a field where the

scientists have taken very vocal and public stances, and not a case where their ideas are being simplified or misrepresented. Finally, science would not function without funding. Institutions of science are perennially working to garner more funds and showcase the importance and impact of their work. They do this through lobbying the government and private sector for funds, but, most important, in making visible the public value of their work. The public face of science is critical to the institution of science. Fear narratives have been a potent force in mobilizing politicians and the public (B. Hartmann et al. 2005). Through all these factors, nature and culture co-constitute scientific knowledge.

But there is a deeper philosophical problem here. One of the challenges in talking about naturecultures is that it requires a different set of tools than we have. Our theoretical frameworks, our vocabulary, categories, rhetoric, and discourses, are all geared to an academy with individual disciplinary histories and traditions. Do humans belong to the natural or cultural worlds? As an animal species with a common evolutionary history that links all of life, humans are clearly part of the natural world. And indeed, biologists and biological anthropologists study humans and their impact as part of "nature." But as creators of a complex society that has intruded on most aspects of the Planet, we humans are clearly part of the cultural world as well. And indeed, the disciplines of the social science and humanities are devoted to such explorations. Thus, studying humans poses epistemological and ontological problems and, of course, many disciplinary confusions. Further confusing the issue, plants and animals are considered by some to be part of the cultural world as well.

We also have to confront the perennial frame of the long-enduring debate: matter versus representation. When we talk about how humans *are* and what humans *do*—being and knowing—we have to employ language, be they words (visual/oral), pictures, graphs, or numbers. Each has its own particular and peculiar histories. When we talk about "alien" species, is the problem just about "representation" or a problem with terminology? Let us, for example, say that we create a new term *XXXX* to talk about foreign plants. Do we solve the problem? No! The fundamental point of thinking natureculturally is understanding that so long as the category of "foreign species" (whatever term we may call it) exists in our minds, it is still linked biologically, rhetorically, historically, and philosophically to a binary world of natives/aliens. Some have suggested that we use different and less pejorative words, such as *piggy backers, opportunists, spawn, mirrors, providers, hybrids, tricksters, matrices, transients, founts,* or *teachers* (Larson 2007b). The point is not only the xenophobia that permeates the terms of invasion biology, as some have argued, but also the way natives and aliens are presented as a biologically and ecologically useful binary. This is not

just about language or words but the ways in which human history has created particular categories or "ontologies." The point of thinking natureculturally is to understand that whether we deploy visual, tactile, auditory, or linguistic vocabularies, these are all languages with shared histories, categories, and structures. In fact, the neurophysiologist Richard Gregory estimates that visual perception is more than 90 percent memory and less than 10 percent nerve signals (1998). We can never escape these cultural, historical, and disciplinary memories or the ghostly hauntings of naturecultures. It misrepresents the problem and misidentifies the solution. Understanding them as naturecultures allows us to step back to see what is underpinning these natural and cultural battles—a profound anxiety and deep ambivalence about our ideas of the nation, home, and belonging.

ACT I: THE ALIENS HAVE LANDED

When I began thinking about this project in the late 1990s, an article in a recent special issue on "Biological Invaders" in the prestigious journal *Science* began as follows:

> One spring morning in 1995, ecologist Jayne Belnap walked into a dry grassland in Canyonlands National Park, Utah, an area that she has been studying for more than 15 years. "I literally stopped and went, 'Oh my God!'" she recalls. The natural grassland—with needle grass, Indian rice grass, saltbush, and the occasional pinyon-juniper tree—that Belnap had seen the year before no longer existed; it had become overgrown with 2-foot-high Eurasian cheatgrass. "I was stunned," says Belnap. "It was like the aliens had landed." (Enserink 1999: 1834)

While I was reading the literature to understand the ecologies of native and exotic species, the biological and cultural work showed a growing panic about alien and exotic plants and animals. Newspaper articles, magazines, journals, and websites all demanded urgent action to stem the rise of exotic biota.

"They Came, They Bred, They Conquered"

Newspapers and magazines introduced the topic of biological invasions with the sound of alarm. Consider some of the headlines:

> New Rules Seek to Prevent Invasive Stowaways (Barringer 2012)
> Alien Invasion: They're Green, They're Mean, and They May Be Taking Over a Park or Preserve Near You (Cheater 1992)
> The Invasion of the Woodland Soil Snatchers (Barbara Stewart 2001)

Native Species Invaded (United Press International 1998)
Bio-invasions Spark Concerns (*CQ Researcher* 2000)
It's a Cancer (Weaver qtd. in Verrengia 1999)
Creepy Strangler Climbs Oregon's Least-wanted List (Brinckman 2001)
Biological Invaders Threaten U.S. Ecology (K. A. McDonald 1999)
U.S. Can't Handle Today's Tide of Immigrants (Yeh 1995)
Alien Threat (Bright 1998)
Biological Invaders Sweep In (Enserink 1999)
Stemming the Tide of Invading Species (Kaiser 1999)
Congress Threatens Wild Immigrants (Weiner 1996)
Invasive Species: Pathogens of Globalization (Bright 1999)

What is striking is that the majority of these headlines do not specify that the article is about plants and animals but rather present a more generalized classic fear of the outsider, the alien that is here to take over the country. An opening line of an article reads: "The survey is not even halfway done, yet it has already revealed a disturbing trend: immigrants are forcing old-timers out of their homes" (B. Stewart 2001: 1B). Invaders are reported to be "racing out of control," causing "an explosion in slow motion" (Hebert 1998). Aliens, they claim, are redrawing the global landscape in ways no one imagined. Exotic plants, they argue, are irreversibly altering waterways and farmlands. The "irreversibility" is highlighted as a way to stress the sharp departure from the past—a vision of how we are moving from a peaceful, co-evolved nature in perfect harmony and balance to an uncertain future with alien and exotic plants and animals. They argue that we cannot recapture the glorious past, our nostalgia for a pure and uncontaminated nature in harmony and balance, if we do not act *now* to stem the tide of outsiders.

A careful examination of the biological and cultural literature reveals that the parallels in the rhetoric surrounding foreign plants and those of foreign peoples are striking. As Nancy Tomes has argued, our anxieties about social incorporation (associated with expanding markets, increasingly permeable borders and boundaries, growing affordability of travel, and mass immigration) have historically spilled into our conceptions of nature. For example, she documents how our panic about germs has historically coincided with periods of heavy immigration to the United States, of groups perceived as "alien" and difficult to assimilate. She documents these germ panics in the early twentieth century in response to the new immigration from Eastern and Southern Europe and in the late twentieth century to the new immigration from Asia, Africa, and Latin America. "Fear of racial impurities and suspicions of immigrant hygiene practices are common elements of both periods," she writes. "These

fears heightened the germ panic by the greater ease and frequency with which immigrants travel back and forth between their old, presumably disease ridden countries and their new, germ obsessed American homeland" (Tomes 2000: 195). Like these earlier germ panics surrounding immigration and immigrants, questions of hygiene and disease haunt exotic plants and animals. Similar to the unhygienic immigrants, alien plants are accused of "crowd[ing] out native plants and animals, spread[ing] disease, damag[ing] crops, and threaten[ing] drinking water supplies" (Verrengia 2000). The xenophobic rhetoric that surrounds immigrants is extended to plants and animals.

The first parallel is that aliens are "other." One *Wall Street Journal* article quotes a biologist's first encounter with an Asian eel. "The minute I saw it, I knew it wasn't from here," he said (Robichaux 2000: 12A). Second is the idea that aliens/exotic plants are everywhere, taking over everything: "They're in national parks and monuments. In wildlife refuges and coastal marine sanctuaries. In wilderness areas that were intended to remain living dioramas of our American paradise lost" (Verrengia 2000). "Today, invasive aliens afflict almost every habitat in the country, from farms and pastures to forests and wetlands—and as every homeowner knows, gardens, flower beds and lawns" (Cheater 1992: 24).

The third parallel is the suggestion that they are silently growing in strength and numbers. So even if you haven't noticed it, be warned about the alien invasion. If you haven't heard about biological invasions, it is because "invasion of alien plants into natural areas has been stealthy and silent, and thus largely ignored." E. O. Wilson states: "Alien species are the stealth destroyers of the American environment" (qtd. in K. A. McDonald 1999: A15). Articles remind us that alien plants are "evil beauties"—while they may appear to look harmless and even beautiful, they are evil because they destroy native plants and habitats (Cheater 1992). These campaigns are eerily similar to the antiprostitution public health propaganda put out to soldiers. The fourth parallel is that aliens are difficult to destroy and will persist because they can withstand extreme situations. In an article on the invasion of the Asian eel in Florida, the author notes the following:

> The eel's most alarming trait, though, is its uncanny ability to survive extreme conditions. In one study by a Harvard zoologist, an Asian swamp eel lived seven months in a damp towel without food or water. The olive-brown creature prefers tropical waters, yet it can flourish in subzero temperatures. It prefers fresh water but can tolerate high salinity. It breathes under water like a fish, but can slither across dry land, sometimes in packs of 50 or more,

> sucking air through a two-holed snout . . . Even more of a riddle is how to kill the eel: It thus far appears almost immune to poisons and dynamite. (Robichaux 2000: 12A)

The fifth parallel is that aliens are "aggressive predators and pests and are prolific in nature, reproducing rapidly" (Verrangia 2000). They are the "new vermin" of modernity (Baskin 2002, Smout 2003). This rhetoric of uncontrollable fertility and reproduction is another hallmark of human immigrants. Repeatedly alien plants are characterized as aggressive, uncontrollable, prolific, invasive, and expanding. One article summarized it as "They Came, They Bred, They Conquered" (Bright 1999). Alien species are characterized as destroyers of everything around them. A park warden is quoted as saying, "To me, the nutria [swamp rats] are no different than somebody taking a bulldozer to the marsh" (Verrengia 2000).

Sixth, once these plants gain a foothold, they never look back (Cheater 1992). Singularly motivated to take over native land, aliens have become disconnected from their homelands and will never return and are, therefore, "here to stay." Finally, like human immigrants, the greatest focus is on their economic costs because it is believed that they consume resources and return nothing. "Exotic species are a parasite on the US economy, sapping an estimated $138 billion annually, nearly twice the annual state budget of NY, or a third more than Bill Gates' personal fortune" (Verrengia 1999).

Not only are aliens invading rural and natural habitats, they are also endangering the cities. "Cities invaded," articles cry. From historical sites to urban hardwoods, alien insects are reported to be causing millions of dollars worth of damage (Verrengia 1999).

> Just as human immigrants may find more opportunities in an already overcrowded city than in a small town, invasive plants take advantage of the constant turnover and jockeying for position that characterizes species-rich ecological communities. The classical dictum that "diversity begets stability," Stohlgren says, is simply not true in some ecosystems. Communities with high diversity tend to be in constant flux, creating openings for invasives. From a conservation perspective, the results of these multi-site, multi-scale studies are disturbing. The invasions may threaten some of the last strongholds of certain biologically rich habitats, such as tall-grass prairie, aspen woodlands, and moist riparian zones. (U.S. Geological Survey 1999)

Finally, we see foreign plants, animals, and humans as exploited and exploitable. In drawing attention to the political and ethnic category Asian Ameri-

can, Karen Cardozo and I argue that we ought to understand the term *Asian/America* as a multispecies *assembling*. Humans, plants, and animals share incredibly intertwined histories. For example, foreign humans come into this land because of the "need" for labor, expertise, skills, or beauty at one point in history only to be severely regulated once they are here, and then rejected, shunned, and sent back once they have outlived their usefulness. We see this in Chinese railroad workers, migrant workers in the farms, mail order brides, technology workers in the 1990s, and of course doctors and nurses (who are still in short supply). Similarly, the now invasive Asian carp was brought into the country as a "worker fish" to help clean algae-filled canals, and kudzu was once promoted by the U.S. government, who paid farmers to plant it for erosion and soil control. Yet these histories get entirely forgotten in the xenophobic quest to eradicate individual ethnic groups or individual species to bolster the idea of a pure nature and nation eliminating its foreigners (Cardozo and Subramaniam 2013).

The Oversexed Female

One of the classic metaphors surrounding immigrants is the oversexualized female. Foreign women are always associated with superfertility—reproduction gone amok. Such a view suggests that the consumption of economic resources by invaders today will only multiply in future generations through rampant overbreeding and overpopulation. Consider this:

> Canada thistle is a classic invasive. One flowering stem can produce as many as 40,000 seeds, which can lie in the ground for as long as 20 years and still germinate. And once the plant starts to grow, it doesn't stop. Through an extensive system of horizontal roots, a thistle plant can expand as much as 20 feet in one season. Plowing up the weed is no help; indeed, it exacerbates the problem; even root fragments less than an inch long can produce new stems . . . The challenge posed by thistle is heightened because, like other troublesome aliens, it has few enemies. (Cheater 1992: 27)

Along with the super-fertility of exotic/alien plants is the fear of miscegenation. There is much concern about the ability of exotic plants to cross-fertilize and cross-contaminate native plants to produce hybrids. Campaigns against the foreign are often constructed around preserving the "genetic integrity" of native species and the prevention of their interbreeding with native populations (Smout 2003). Native females are, of course, in this story, passive, helpless victims of the sexual proclivity of foreign/exotic males.

Responding to Alien Species

Journalists and scientists borrow the same images of illegal immigrants arriving in the country by means of difficult, sometimes stealthy journeys, when they describe the entry of exotic plants and animals. Alien plant and animal movements are described with the same metaphors of illegal, unwelcome, and unlawful entry (Hebert 1998). The response to such unlawful and stealthy entrants parallels our immigration policy with changing rules and images of armed guards patrolling borders (Barringer 2012). Former Montana Governor Marc Racicot is passionate: "I just hate them. They are genetically deviant miscreants that have no rightful place on this Planet. We all have to be a part of this war on weeds" (Associated Press 1999 qtd. in Hettinger 2011: 194). Interior Secretary Bruce Babbitt of the Clinton administration called the "alien species invasion" an "explosion in slow motion" that was turning even "staunch conservationists into stone killers" (Verrengia 1999). Like immigration and the drug problems, the language called for a need to "fight" and wage wars against exotic/alien plants and animals (Larson 2005). In 1999, President Clinton signed an executive order creating the national Invasive Species Management Plan directing federal agencies to "mobilize the federal government to defend against these aggressive predators and pests" (Hebert 1998). Thus the "Feds" were called on to "fight the invaders" and defend the nation against the "growing threat from non-native species" (Hebert 1998). In rather strong language, then Interior Secretary Bruce Babbitt summarized the situation: "Invasive alien species . . . homogenize the diversity of creation . . . Weeds—slowly, silently, almost invisibly, but steadily—spread all around us until, literally, encircled, we can no longer turn our backs. The invasion is now our problem, our battle, our enemy . . . we must act now and act as one [in order to] beat this silent enemy" (Babbitt 1998).

A review sponsored by the Ecological Society of America published in the *Issues of Ecology* concluded that the current strategy of denying entry only to species already proven noxious or detrimental should change (Mack 2000). Instead of an "innocent until proven guilty" stance, we should instead adopt a "guilty until proven innocent" one. This strategy is further racialized when a biologist rephrases this by suggesting we replace a "blacklist" (where a species must be proved to be harmful before banned) with a "whitelist" (where species has to proved to be safe before entry) (Simberloff qtd. in Todd 2001: 253). Paralleling the language of third world debt that marks colonial legacies in the human world, we have the "invasion debt" that recognizes the legacies of biotic movements and accounts for the long list of foreign species that are

already in the country (D. M. Richardson 2011). In all of this, exotic and alien plants are marked as "guilty," foreigners, and black and, therefore, kept out purely by some notions of the virtue of their identity.

Natives

What is tragic in all this is of course the impact on the poor natives. "Native Species Invaded," "Paradise Lost," "Keeping Paradise Safe for the Natives" are the repeated cries. Native species are presented as hapless victims that are outcompeted and outmaneuvered by exotic plants. Very often, exotic plants are credited with (and by implication, native species are denied) basic physiological functions such as reproduction and the capacity to adapt. For example, "When an exotic species establishes a beachhead, it can proliferate over time and spread to new areas. It can also adapt—it tends to get better and better at exploiting an area's resources, and at suppressing native species" (Bright 1999).

Invaders, Interior Secretary Bruce Babbitt claimed, "are racing out of control as the nonnative species in many cases overpower native species and alter regional ecosystems" (qtd. in Hebert 1998). Not only do they crowd out native plants and animals, but they also endanger food production through the spread of disease and damage to crops and they affect humans through threatening drinking water supplies. Consider this:

> English ivy joins 99 plants on a state list of botanical miscreants that includes Himalayan blackberry, Scotch thistle and poison hemlock. With dark green leaves and an aristocratic heritage, however, it looks like anything but a menace.
>
> Don't be fooled.
>
> The creeper loves Oregon, where it has no natural enemies.
>
> It needs little sunlight. It loves mild, wet climates.
>
> Robust and inspired, English ivy jumps garden borders, spreading across forest floors, smothering and killing ferns, shrubs and other plants that support elaborate ecosystems and provide feeding opportunities for wildlife. Insatiable, English ivy then climbs and wraps trees, choking off light and air. (Brinckman 2001: 1A)

Articles invariably end with a nostalgic lament to the destruction of native forests and the loss of nature when it was pure, untainted, and untouched by the onslaught of foreign invasions. At the end of one article, a resident deplores the dire situation. "I grew up on the backwater," he declares, "and I'm watching it disappear, it's really sad." And the article concludes, "Spoken like a true native" (Verrangia 2000).

ACT II: AND THEN THE TOWERS FELL

Calling 911

On September 11, 2001, the World Trade Center was attacked and the "war on terror" began. This was the first large-scale act of terrorism on the U.S. mainland. The United States (and indeed the world) has endured the specter of 9/11 ever since. In response, the nationalist spirit soared, as did calls for revenge and war. The United States started two wars in Afghanistan and Iraq. On U.S. soil, immigrants, especially those phenotypically "brown" or who looked "Muslim," no longer felt safe as violent acts against immigrants rose. Immigration and law enforcement allied their policies to the larger national and foreign policies. Anti-immigrant rhetoric singed the air as the nation focused on "those who hate America." To be brown was to be an invader, a possible terrorist. And predictably, these sentiments further intensified the earlier images of alien plants and animals (Larson 2007b). Aliens that were once stealthy and silent killers now grew teeth and became more aggressive, menacing, ravenous individuals with extraordinary predatory powers. A case in point is the sensational snakehead (*Channa argus*) that was found in the Crofton Pond in Maryland in June 2002 (Derr and McNamara 2003). Headlines and news stories warned of the land-walking, air-breathing, torpedo-shaped, migrating Chinese predator, with big teeth and a voracious, insatiable appetite, which reproduced rapidly:

> Killer Chinese Fish Surfaces in Maryland (*Action News* 6 2002)
> Stop That Fish! Snakeheads Walk All over Crofton (Ringle 2002)
> Freaky Fish Story Flourishes (Huslin 2002b)
> Crawling Snakehead Fish Scaring Washington (Doggett 2002)
> Freak Fish Found in Two More States (*CBS Evening News* 2002a)
> Invasive "Walking" Fish Found Across U.S. South (Dart 2002)
> Spawn of Snakehead? Freak Fish Have Spawned! Oh My! (Huslin and Ruane 2002)
> Maryland Fears Carnivore Fish Invasion (*Edmonton Journal* 2002)
> A Crusade to Stop the Voracious Fish (O'Brien 2004)
> Chinese Snakehead Not Maryland's Only Foreign Problem (*Daily Record* 2002)

A CNN feature began with asking, "What has a head like a snake, a mouth full of teeth, a long dorsal fin, and the ability to live out of water and waddle around for days at a time?" (*CNN News Online* 2002). The "Asian walkingfish," they charged, was "capable of consuming a pondful of fish and then limping along on its strong pectoral fins and belly to other waters, breathe air and sur-

vive for days on land if it stays wet." Some stories claimed they were so highly predatory that they "ate their own young." As an Interior Department spokesperson put it, "These things reproduce quickly. They eat literally anything that's living, including cannibalizing themselves. They'll eat ducklings. They will eat amphibians. So if you leave them in a body of water or give them anything, there'll be nothing left. They're a bad actor" (Huslin 2002c).

Again and again, the headlines invoked the rhetoric of "good" and "evil" and natives as victims, frameworks that resonated with the rhetoric on the war on terror. As the biologist L. B. Slobodkin quipped, "Good species are native species, and oddly enough, the less one might reasonably call them successful, the better they are" (Slobodkin 2001). A CBS story introduced an adult snakehead as a "grown-up killer evil fish" and a juvenile as a "baby killer evil fish." The discovery brought a flood of tourism as people flocked to the region to view the "evil" in the pond. In response, the local capitalist spirit thrived with snakehead paraphernalia. The website snakeheadstuff.com emerged with T-shirts and mugs emblazed with catchy slogans such as "Frankenfish: Marching to a Pond Near You." The robust war on terror spilled over into a "war" with the fish:

Maryland Wages War on Invasive Walking Fish (Mayell 2002)
Wanted Dead: Voracious Walking Fish (*CBS Evening News* 2002b)
Biologists on Mission to Kill (Huslin 2002a)
State declares victory over Snakehead fish (Kobell and Thomson 2002)
Soon Ghastly Fish Will Walk into Sunset (Cowherd 2002)

"Wanted" posters (figure 1) highlighted its "foreign" origins (Derr and McNamara 2003: 127). Campaigns and contests emerged to publicize and exterminate the fish. The Department of Natural Resources launched its own, "Kill a Snakehead to Win" (Department of Natural Resources n.d.). To enter, one had to catch and kill a snakehead (hint: cut the isthmus to kill the fish), photograph the fish with a ruler to show its size, and email the picture for the competition. They were reminiscent of the war on terror and programs like Operation TIPS, which recruited citizens as neighborhood spies. The *CBS Evening News* dramatically aired a story declaring, "No one is sure how many of them are out there, but every one of them is wanted, not dead or alive—just dead" (2002b). Officials proclaimed, "We'll conquer the snakehead. It doesn't matter how big it is, how tough it thinks it is. We'll destroy the snakehead" (Huslin and Ruane 2002). "We are on a 'mission to kill,'" they said (Huslin 2002a). "We want this fish dead. No question about it" (Mayell 2002). One article (Ringle 2002) joked that the paranoid may see the hands of Al Qaeda!

FIGURE 1.

What of the fish's biology? Some news outlets gave voice to these dissensions. Exotic aquatic species is a very old problem (Derr and McNamara 2003). Since the mid-nineteenth century, more than 139 nonindigenous species have been introduced into the Great Lakes and a new species a year into the Chesapeake Bay and the Hudson River system (Mills, Scheurell, et al. 1996). Yet the news stories tended to the sensational. Some biologists argued that such extrapolation tended to the paranoid, "more Hollywood than science" (Kluger

2002). Others argued that the snakehead was nothing more than a "common swamp fish" from Southeast Asia, living in irrigation ditches and rice paddies, thriving until the dry season, before squirming to the next pocket of water. At best its "walk is really more of a wriggle. Such clumsy location does not lend itself to wanderlust, and snakeheads in a good pond are likely to stay forever. Snakeheads are extremely lazy and sedentary," said the Hawaiian biologist Ron Weidenbach (qtd. in Kluger 2002).

Investigating snakeheads as culinary delicacies, vendors said that the best the fish usually do in open markets is several hours under wet burlap and under sunny skies "they are said to fricassee fast" (Kluger 2002). Over the past few years, they have appeared in half a dozen other states but in modest numbers and with limited impact. The snakehead did thrive in Hawaii, where it was aggressively fished (better than bass!—felt many locals). While scientists plotted to exterminate the fish in Maryland, large-scale artificial breeding projects are underway in China and neighboring countries to meet the growing demand for snakehead meat in Asia (Emery 2002).

Where exactly are the Chinese snakeheads from? They arrived in China from India or Southwest Asia during the Pleistocene (Chew and Laubichler 2003). There are fossils of channids in Switzerland and France dating back to the Oligocene (Chew and Hamilton 2011). The history of snakeheads reveals a complex migration history in contrast to the simple origin story from Crofton Pond. As Chew and Hamilton ask, "Do snakeheads *belong* in China? How can a fish demonstrate belonging other than by being, surviving and persisting *here*, *now*, any of which probably exceed its awareness of the issues at hand?" (Chew and Hamilton 2011: 42).

Despite this, the fear of the snakehead rose to fever pitch. Within a couple weeks, the pond was poisoned and all species were killed. The incident was used as an opportunity to publicize the dangers of invasive and exotic species.

> Something from the X-Files: The Frankenfish is here. The invasion has begun. Nothing can stop it (Harrison 2002)
> Juvenile "Frankenfish" Raise the Odds of Alien Invasion (Barnes 2002)
> Invasion of the Snakeheads: Frankenfish is not the scariest import (Fields 2005)

The cycle was revisited the following week after snakeheads were found yet again, this time in Wisconsin. Officials, however, were less worried because of the harsh winters.

ACT III: THE OBLIGATION OF RELUCTANCE

In 2006, an interesting op-ed entitled "Border War" appeared in the editorial spread of *The New York Times* (Ball 2006). It began:

> The horticultural world is having its own debate over immigration, with some environmentalists warning about the dangers of so-called exotic plants from other countries and continents "invading" American gardens. These botanical xenophobes say that a pristine natural state exists in our yards and that to disturb it is both sinful and calamitous. In their view, exotic plants will swallow your garden, your neighbors' gardens and your neighbors' neighbors' gardens until the ecosystem collapses under their rampant suffocating growth.

I was delighted! The author went on:

> If anything suffocates us, though, it will be the environmentalists' narrow mindedness. Like all utopian visions, their dream beckons us into a perfect and rational natural world where nothing ever changes—a world that never existed and never will.

My heart sang! Then the author concluded:

> Let's welcome, as spring arrives tomorrow, as many huddled masses of flowers, herbs and vegetables as can fit in our unique melting pot of a nation, unrivaled in its tradition of lush diversity and freedom to grow rampantly.

This was music to my ears. In the center pages of *The New York Times,* someone acknowledged the dense traffic of meanings between our worlds of natures and cultures, of the ways in which we transfer our cultural anxieties into law and order of the plants and animals that house our gardens and streets. Having worked on this issue for many years, I welcomed the author's sentiments and politics. Delighted, I filed it away. Until one of my colleagues pointed out who the author was—George Ball, president of the Atlee, Burpee and Co, a seed company. I came to a halt and had to ponder what had happened. This op-ed appeared during a resurgence of the immigration debate within the United States. We were witness to the rabid xenophobic rants of Congressman James Sensenbrenner and his House Bill 4437, the Border Protection, Antiterrorism and Illegal Immigration Control Act of 2005, which charged any undocumented immigrant and anyone who "assisted" her or him with "aggravated felony." We have seen the rise of the Minutemen vigilantes and the growing number of deaths at the border due to the militarization of Operation Gatekeeper (Coronado 2006). But we also saw more than one million people march to protest

the anti-immigration legislation in LA and across the country. Labor activists of yesteryear reappeared in the papers. People stayed away from work in support. And we saw a debate within the Republican Party as President Bush, Senator McCain, and others attempted to carve a path that moderated the criminalizing of immigration in the Sensenbrenner position. And yet others on the right advocated an open door to immigration. March was an important month when these debates unfolded, and perhaps it was no surprise that the head of a seed company who is in the business of trying to sell seeds of all varieties (and not only native ones) should favor an open policy of unbridled choice for our gardens.

In another interview, Ball goes on to further elaborate. Weeds, he argues,

> are not considered desirable. Weeds are invasive, uncontrollable plants . . . Taboo plants. A lot of weeds are so called because they take off in all directions, they have qualities of sinfulness. You know this is a garden. There are certain things you just simply can't have in your yard if you want to have these other objects, and that's the border between desirable and undesirable. God and the Devil . . . Here are these little tiny white flowers with shabby little green leaves that this plant has worked with all its strength, its ancient lineage of energy, of genetic reality, to produce, for whatever reason. Who am I to pull that out? And there I was, looking at it in my hand. In what way was this better or worse than the lily of the valley? I felt so stricken by my own complicity.

Here in hyperbole with allusions to hard work, beauty, and ancient pedigree was the righteous and ethical angst of the recently native. And yet these were fueled by the politics of an ebullience of commerce, of unbridled choice in our economies and gardens. I favored one but not the other. It has been a difficult lesson to learn in our times. A strange confluence of bedfellows as notions of purity and authenticity haunt our imaginations of science and the natural. We see this rhetoric not only in our discourses on invasive species, but also on genetically modified organisms and the new reproductive technologies. Rhetoric is never innocent. Histories of gender, race, and class politics are central to why certain ideas resonate and take hold. It would seem that the political right and left have both inherited and indeed embraced the colonial imaginary.

As George Ball argues in an interview, "I find extraordinary the whole question of hybrids and the sentimental fondness for older plants because I find that sentiment in all of our attitudes about philosophy, religion, et cetera—that old-time religion, that fundamentalist religion. When people stop being religious fundamentalists they switch over to being food purists; it simply transposes

itself from one domain to another." I cannot but celebrate such sentiments when contrasted with the often xenophobic and nativist politics and sentiments of many conservationist groups that I otherwise support. And yet while the inclusivity of George Ball resonates, I am troubled with the voracious appetite of global capitalism that will sell anything—even at the cost of habitat destruction, the debt and dependence of family farms, and the embrace of high-input agriculture. Complex times call for complex measures. I feel the obligation of reluctance—the obligation to no ideology where all means justify the end and a deep reluctance to agree with any position without a thorough investigation of the political, ecological, historical, and economic roots as well as consequences of those positions.

ACT IV: THE INVASIVE SPECIES WAR

In April 2011, Hugh Raffles published an op-ed in *The New York Times* entitled "Mother Nature's Melting Pot." Two months later, in a June 2011 issue of *Nature*, M. A. Davis and eighteen other biologists wrote a commentary cautioning, "Don't judge species on their origins" (Davis et al. 2011a). There were high-profile responses to and comments on both pieces. Several articles in *Science* also responded to the Davis et al. piece. In July 2011, Leon Neyfakh reported on this public turn in the *Boston Globe* as "The invasive species war." All three well-publicized pieces were making similar points, many of which I have already outlined earlier in this chapter. In spirit, all argue that "'non-native' species have been unfairly vilified for driving 'beloved native' species to extinction, and polluting 'natural' environments,'" thereby creating "a pervasive bias" against alien species (M. A. Davis et al. 2011a: 153). After all, not all native species are well adapted to local communities, nor all foreign species maladapted to them. The biological world presents too much heterogeneity and complexity for such simplistic generalizations (Hettinger 2011). After all, the increase of invasive species has happened alongside climate change and other land use changes. Indeed, given the dynamic nature of evolution, some natives may well be destined to be temporary residents in the grand scheme of evolutionary time—with or without humans (Raffles 2011). We should abandon such thinking, these pieces argued, since the native/alien binary while still a "core guiding principle" in biology was declining in its usefulness, even becoming counterproductive.

Shifts in species composition have been ubiquitous in evolutionary history and should not surprise us. Despite many "apocalyptic" scenarios of invasions, major extinction threats are not backed by data (Richardson 2011). Most campaigns to eradicate invasive species simply have not worked, these articles argue.

In contrast, they remind us that new arrivals can often help an ecosystem rather than only hurt it; alien species have often increased biodiversity and helped habitats, allowing native insects and birds to flourish (Davis et al. 2011a, Neyfakh 2011). Many of our prized flora and fauna, such as honeybees, are foreign in origin, yet economically invaluable (Raffles 2011). The quintessential day lilies and Queen Anne's lace that beautify the New England roadsides are in fact aliens (Pollan 1994). For example, the ring necked pheasant, state bird of South Dakota, the purple lilac, state flower of New Hampshire, and the red clover of Vermont are all foreign in origin (M. A. Davis et al. 2011a, Neyfakh 2011). In contrast, some native species such as the pine beetle (*Dendroctonus ponderosae*) and many species of native barnacles have proven to be invasive and have caused great damage (Hettinger 2011). Others go further in arguing that invasives in fact restore Earth's ecosystems—growing where nothing else will, they remove toxins and restore health to habitats (Timothy Lee Scott and Buhmer 2010).

All these pieces conclude that the selection of any historical period as "native" is entirely arbitrary. Classifying organisms by their "adherence to cultural standards of belonging, citizenship, fair play and morality does not advance our understanding of ecology" (M. A. Davis et al. 2011a: 154). Instead, we ought to embrace a more dynamic and pragmatic approach, focusing on the function of species in their ecosystem rather than making their geography of origin a litmus test. Raffles connects the anti-immigrant crusades of the Minutemen and the Tea Party as well as the native species movement led by environmentalists, conservationists, and gardeners to a widespread fear captured in Margaret Thatcher's well-known phrase of being "swamped by aliens." Instead, plants and animals, like humans, need a "thoughtful and inclusive response" (Raffles 2011).

Neyfakh begins his piece with the Charles River Watershed Association's weekend campaigns to eradicate the European water chestnut. The "No More Water Chestnuts" campaign, he argues, can attract up to seventy volunteers on a Saturday morning. Volunteers pull out the undesired plants by their roots and collect them in plastic laundry baskets. Similarly, towns have begun to regulate the number of alien plants in home gardens. What breeds such passion? Here the responses to the above pieces are revealing. In response to Davis and his 18 colleagues, Daniel Simberloff along with 141 colleagues argue that the original piece was the "slander of ideologically driven contrarians" rather than scientific wisdom (Simberloff et al. 2011). These biologists argue that Davis et al. are creating two "straw men." First, they refute that most conservation biologists and ecologists oppose non-native species per se. Second, that they ignore the benefits of introduced species. Other letters by Lerdau and Wikham,

Alyokhin and Lockwood et al. all concur and vehemently disagree with Davis et al. They argue that there is no campaign against all introductions or the eradication of all introduced species. Finally, they accuse Davis et al. of downplaying the severity of the impact of non-native species, especially those that do not manifest their invasiveness until decades after their introduction (Lockwood, Hoopes, and Marchetti 2011). Further, while indeed new entrants may appear to increase local biodiversity, the loss of local species decreases global diversity (Alyokhin 2011). Invasive species policies have seen considerable success in eradicating invasives (Lockwood 2011). Lerdau and Wikham caution that waiting and watching is often unsuccessful; it is cheapest, easier, and most effective to eradicate foreign species soon after detection (Lerdau and Wikham 2011, Haack et al. 2010). They insist that harmful species must be kept in check using biological, chemical, or mechanical means (Simberloff et al. 2011). Simberloff et al. (2011) conclude that the ills of alien and exotic species is a "non-debate" in the scientific community, lest politicians use the essay to cut environmental funding for the eradication of invasive species.

In reading the original commentaries and the voluminous responses and comments, on the surface, it seems that both sides aren't so far apart. Both sides agree that only a fraction of the non-native species are harmful; when they are, all agree that they can be destructive and need to be reined in. But how do you tell which "alien" will become the "invasive"? Nip it in the bud, some biologists say. Catch it before it becomes a problem! Similarly, how do you tell which "alien" will become the "terrorist"? Again, our immigration policy has been about nipping it in the bud—"racially'" profiling particular nations, whether they are citizens or not.

Perhaps it should not surprise us that all three pieces appeared in the summer of 2011. The pro-immigrant sentiments were in the air. The Tea Party was at the helm in Congress, holding the nation hostage in the debt crisis talks. Anti-immigrant, xenophobic vitriol pervaded the country as several states passed anti-immigrant laws that targeted anyone looking "foreign." In response, the pro-immigration activists launched a national and visible debate about the dangers and benefits of immigration. California came to be the third state to pass a version of the Dream Act, which allows the undocumented to receive government tuition aid. Thirteen states allow undocumented students to qualify for in-state tuition rates (*New York Times* Editorial 2012). In a political climate where immigration is hotly debated, pro-immigration and pro-invasive rhetoric should not surprise us. The invasive species "war" reflects our continuing ambivalence about immigration.

In this debate, my sympathies lie with Davis et al. There are striking similarities in the qualities ascribed to foreign plants, animals, and people, and these debates track each other. The xenophobic rhetoric is unmistakable. The point of my analysis is not to suggest that we are not losing native species, or that we should allow the free flow of plants and animals in the name of modernity or globalization. Instead, it is to suggest that we are living in a cultural moment where the anxieties of globalization are feeding nationalisms through xenophobia. The battle against exotic and alien plants is a symptom of a campaign that misplaces and displaces anxieties about economic, social, political, and cultural changes onto outsiders and foreigners.

The obsession with native/alien reflects something deeper—a pervasive nativism in environmentalism and conservation biology that makes environmentalists biased against alien species (Pollan 1994, Paretti 1998, Warren 2007). For example, the final chapter of one of the many recent books on the topic is entitled "Going Local: Personal Actions for a Native Planet." Such rhetoric conjures up a vision where everything is in its "rightful" place in the world and where everyone is a "native" (Van Driesche and Van Driesche 2000). In this debate, the "natives" are ironically the white settlers, not the original natives.

I want to be clear that I am not without sympathy or concern about the destruction of habitats, which is indeed alarming. In their zeal to draw attention to the loss of habitats, however, some journalists and scientists feed on the xenophobia rampant in a changing world. They focus less on the degradation of habitats and more on alien/exotic plants and animals as the main and even sole problem. In contrast to humans, where the politics of class and race is essential, the language of biological invasions renders *all* outsiders (Devine 1999). Conservation of habitats and our flora and fauna need not come at the expense of immigrants.

Instead, let us consider exotic/alien species in their diversities. Mark Sagoff points out that the broad generalizations of exotic/alien plants obscure the heterogeneity of the life histories, ecologies, and contributions of native and exotic plants (Sagoff 2000, 2005). For example, he points out that nearly all U.S. crops are exotic plants while most of the insects that cause crop damage are native species. Ironically, alongside a campaign against foreign species, there is simultaneously another campaign that promotes the widespread use of technologically bred, genetically modified organisms for agricultural purposes.[4] In these cases, the ecological dangers of growing genetically modified crops in large fields are presented as minimal. Concerns of cross-fertilization

with native and wild plants are dismissed as antiscience/antitechnology. Ultimately, it would seem that it is a matter of control, discipline, and capital. As long as exotic/alien plants know their rightful place as workers, laborers, and providers, and controlled commodities, their positions manipulated and controlled by the natives, their presence is tolerated. Once they are accused of unruly practices that prevent them from staying in their subservient place, they threaten the natural order of things.[5]

What is most disturbing about displacing anxieties attending contemporary politics onto alien/exotic plants is that other potential loci of problems are obscured. For example, some scholars point to the fact that exotic/alien plants are most often found on disturbed sites. Panic about aliens minimizes significant destruction of natural habitats through overdevelopment. A displacement of the problem onto the intrinsic "qualities" of exotic/alien plants and not onto their degraded habitats produces misguided management policies. Rather than preserving land and checking development, we instead put resources into policing boundaries and borders and blaming foreign and alien plants for an ever-increasing problem. Unchecked development, weak environmental controls, and the free flow of plants and animals across nations all serve certain economic interests in contemporary globalization. Ultimately, the campaign against the foreign does not solve species extinctions or habitat degradation.

The Ghosts of Naturecultures

Rhetoric, words, and symbols play a central role in the campaigns against invasive species because anti-immigrant rhetoric latches onto long-enduring, powerful, and familiar tropes of fear (B. Hartmann et al. 2005). The fear of the outsider, impurity, and pollution tracks centuries of campaigns that have rendered some bodies as violent, frightening, undesirable, and worthy of being controlled, even exterminated. The fears about cross-fertilization of foreign and native plants are eerily reminiscent of fears and laws against human miscegenation. The ideologies that produced this history simmer beneath the anti-immigrant rhetoric that helps contemporary campaigns rouse strong sentiments and mobilization.

What is the history that simmers beneath? It is the lives of the ghostly dispossessed—the bodies displaced, starved, colonized, violated, sterilized, experimented upon, maimed, killed, exterminated. In the realm of nature, there is increasing attention to the destruction of forests, conservation, preservation of native forests and lands, the commodification of organisms, and concern over the invasion and destruction of native habitats through alien plant and animal invasions. Yet how does one launch a campaign to save the forests? The most

successful have been to draw on tropes of fear and terror. Like the successes of the "population bomb" that engendered visions of the brown hordes at our borders, invasive species rhetoric draws on the same tropes of a beleaguered white nation under siege by the violent and invasive hordes of the brown, black, and yellow. A naturecultural lens allows us to see the underlying nativism—an ideology where nature and people are "in place."

Invasion ecologists and environmentalists are often embattled in making a case for the environment. The fact that climate change is even debated is a case in point. Environmentalists, often members of the progressive left and supporters of peaceful, inclusive visions of the world, recoil at being labeled "conservative, backwards—even intolerant" (Neyhfakh 2011). But in order to bring attention to the crisis of the environment, must we resort to age-old xenophobic and racist attacks? A naturecultural lens allows us to see the immense destructive power of such campaigns and what is lost when xenophobic, racist, and sexist sentiments undergird a worthy goal. Whom are we saving and what is lost in such saving?

Indeed, while Davis et al. and their critics may agree that only some species are destructive, and while officials agree that only a few individuals resort to terrorism, the deeper political and philosophical question is, what of the "other" others? In the very act of labeling humanity and biota into two categories—native and alien—marking the presumed good from the possible evil, our quest for an inclusive, ethical world is lost. There are other characteristics—biological and social—that are useful; foreignness need not be the sole criteria (N. Davis 2009). After all, the most invasive species is the human, especially the elite, white, western human!

To what lengths will we go to "restore" our world to some nostalgic vision of the past? Whose nostalgia? While invasive species do damage, so do roads and "green" bioenergy plants that are erected in service of our communities. Restoration ecology as a field has embraced biological, mechanical, and chemical interventions with gusto. Small orange flags mark the sites of our increasingly herbicide-ridden landscapes. Will we chemically bombard ourselves to our nostalgia? What does it mean to "restore" our world, while we pollute our soil and ground water? What are we saving, and for whom?

Feminist and postcolonial critics of science have shown us repeatedly how political, economic, and cultural factors inform and shape scientific questions, answers, practices, and rhetoric. Both the cultural and scientific worlds house diverse and heterogeneous views with a long tradition of dissent. Many ecologists and conservation biologists have developed alternate models, challenging the dominant framework of conservation biology (D. Keller and Golley 2000).

Studying "naturecultures" means being cognizant of how science and the humanities are embedded in naturecultural contexts. Just as science does not mirror nature, we must not reduce science to mirroring politics either—right or left.

Living in Naturecultures

Susan Matt reminds us that in the nineteenth century, millions of immigrants who were homesick from the emotional toll of migration were diagnosed by a medical condition with its clinical name: nostalgia (Matt 2012). Many generations later, in the twenty-first century, we are suffering the same nostalgia! What does it mean to be homesick for a world that is two centuries old, a world we have never seen but in our nostalgic visions?

This is a story in flux. It is not clear if U.S. politics and society will rework its rhetoric against aliens (flora, fauna, or humans) or if anti-invasive rhetoric imbued with a simplistic anti-immigrant rhetoric will prevail. If history is any indication, this is not a linear story and we are not at the story's end. Society will revisit, reshape, and rethink its ideas of national belonging and of natives and aliens for centuries to come. As long as we do not resolve the fundamental question—about variation, diversity, and difference—these debates will continue to rage in science and society, in defining our natural and cultural worlds. And to be sure, each time these debates are renewed, we will debate them as new problems that we have never encountered before!

CHAPTER FIVE

My Experiments with Truth

Studying the Biology of Invasions

> The truth will set you free, but first it will piss you off.
>
> —Gloria Steinem when accepting an award, 2005

> I have the nerve to walk my own way, however hard, in my search for reality, rather than climb upon the rattling wagon of wishful illusions.
>
> —Zora Neale Hurston, "Letter to Countee Cullen"

Over the past three decades feminist scholars have amply demonstrated that critical social categories such as gender, race, class, sexuality, and nation are inextricably interconnected with science and its studies of nature. Science has played a central role in shaping these categories, and these categories have in turn shaped science. For the most part, this endeavor has focused on historical works. If social and political factors have always been important to science in the past, surely they must also be to the science of the present? If the history of science teaches us that science has always been socially embedded, surely science continues to be socially embedded? How does one practice science with that knowledge? That is, how do we study the biology of naturecultures?

As we saw in the previous chapter, invasion biology as a field can be understood to be deeply embedded in its political and cultural times. We have also seen that this is not a monolithic field. The scientific world continues to debate the terms and interpretations of native and foreign species and what it means for our environment (Hattingh 2011, Larson 2007a). What would it mean to engage the feminist studies of science *in* the practice of science? This is the project that has engaged me—to use the historical, sociological, rhetori-

cal, and philosophical insights of the cultural and feminist studies of science *in* the practices of experimental biology. A project that brought the sciences and the social studies of science, the humanities and the biological sciences, into conversation with each other in order to together produce knowledge about the natural world. I believed I found the perfect project in exploring the biology of plant invasions. This chapter presents one example of how we can experiment with an interdisciplinary repertoire of research questions, methods, and epistemologies to produce knowledge about the biological world—an experiment about experimenting!

The experiments in this section focus on biological invasions. We have seen in the previous chapter that in recent years, there has been considerable panic and hype about invasive plant species. The alarm is framed around the "identity" or foreign origins of plant species rather than about the ecological or environmental contexts of invasion, that is, a greater focus on the invasive plant rather than on the destruction of local ecologies. The response in turn has been about identifying and eradicating the troubling species. For example, local environmental societies lead their communities in weekend missions to pull out noxious species. Popular ideas of plant species thus tend to personify organisms into sensationalized notions of good native and evil foreign species. While less sensational and categorical, the same ideas permeate scientific work and the views of some scientists.

The experiments on the biology of invasions progressed alongside my growing understanding of the increasing number of critiques and alternate visions of invasion biology that have emerged over the past few decades (J. H. Brown and Sax 2004, 2005, Calautti and MacIsaac 2004, Chew and Hamilton 2011, Coates 2003, 2006, M. A. Davis 2009, M. A. Davis et al. 2011a, Gobster 2005, Hattingh 2011, Larson 2007c, Sagoff 2000, 2005, Slobodkin 2001, Subramaniam 2001, Theodoropoulos 2003, Townsend 2005, Warren 2007). While some biologists have continued in the tradition of viewing humans as outside of nature, others have worked hard to incorporate humans into the natural world and to bridge the worlds of science and society (Bradshaw and Bekoff 2001, Dietz and Stern 1998, Odum 1997, De Laplante 2004). Despite the strident tones of many biologists, even Charles Elton, often regarded as the father of invasion biology, was rather moderate in his views.

> I believe that conservation should mean the keeping or putting in the landscape of the greatest possible ecological variety—in the world, in every continent or island, and so far as is practicable in every district. And provided the native species have their place, I see no reason why the reconstitution of

> communities to make them rich and interesting and stable should not include a careful selection of exotic forms, especially as many of these are in any case going to arrive in due course and occupy some niche. (Elton 1958: 155)

Finding a way to think natureculturally was particularly important for the experiments we were undertaking. In Southern California where the project was based, human-made disturbance has a very long and destructive history. Ranching and cattle grazing over hundreds of years have considerably altered the landscape. In a state with long histories of biotic migration, questions of what are deemed native and exotic are particularly and deeply fraught. How do we move beyond ideas of a picture-perfect "nature," which we artificially maintain? How do we understand the human species as part of nature, in all its shifts and evolutions? I came to understand these as important questions that can guide biologists in the development of experimental research. Is it possible to characterize exotic/native plants? Do they all share common life history parameters and ecological traits? How heterogeneous and diverse are the species within those categories? How static and co-evolved are native communities? What is the relationship of plants and their soil communities and what impact do exotic plants have on them? Do they destroy and degrade these communities? As ecologists, we can test these theories, intervene, and participate in the national conversation not only on exotic plants, but also on immigration and race relations.

As we have seen, the binary formulation of nature/culture has been thoroughly critiqued (Demerritt 1998, Valentine 2004). Our definitions of what is natural/unnatural, pristine/degraded, or authentic/fake remain arbitrary, ambiguous, contested, and fuzzy and make poor grounds for biological and environmental policy. Yet there remains tremendous power in the binary tropes that shape environmental thinking; despite the critiques, the binary black/white vision endures and "sparks our passions but darkens our vision" (Cronon 1996b: 39). The real problem is that such a vision ultimately leads us "back to the wrong nature" (Cronon 1996a: 69).

More important, these formulations have shaped not only our language but also the theories and discipline of ecology. When the field of invasion biology emerged in the 1980s through SCOPE (Scientific Committee on Problems of the Environment), most of the biologists were ecologists, particularly community ecologists (M. A. Davis 2011b). As a result, invasion biology emerged as a disciplinary offspring of community ecology and is still dominated by the niche-based theories of MacArthur and Hutchinson. In its early years, deterministic models were emphasized, focusing on local processes. For example,

the connection of diversity and invasibility remains a strong idea—species-rich environments are more resistant to invasion than species-poor ones. Like Elton and Darwin's naturalization hypothesis, the theories tend to focus on species traits and local and deterministic factors. Even while empirical studies contradict the easy connection between species richness and resistance to invasion, niche-based theories continue to be overused at the expense of regional and historical factors. Invasion biology has seen much more theory generation than rejection, and as a result theories explaining invasions have tended to accumulate. Many feel that these factors have impeded the growth of the field (M. A. Davis 2011b). Indeed, "those who believe their policy towards aliens is determined by some objective standards are living in ivory towers" (Mabey 2005: 46).

Some scholars question the disjuncture being the empirical evidence of ecology when compared to its theoretical claims. For example, examining terms such as *community* or *ecosystem* shows them to be rather murky and changing over time (Sagoff 2006). Despite the vast literature in ecology, there is a "stunning lack of evidence that natural communities or ecosystems possess any mode of organization that can serve as the object of 'environmental protection'" (Sagoff 2006: 157). In fact, there is little consensus on what constitutes an ecosystem or how natural selection structures ecosystems. Rather than a science with consensus, the empirical evidence suggests that ecosystems and communities lack organization, structure, or function and are rather temporary, contingent, and even ephemeral accidents of history (Sagoff 2006). Indeed, the idiosyncrasies of ecologies of communities and ecosystems could be a law in itself. Normative and intrinsic values of concepts like ecosystems and biodiversity, especially in a world with profound human intervention, remain problematic (Hattingh 2011). This line of reasoning—of unraveling the social, cultural, and ideological assumptions of biological concepts—is powerful, and many biologists have raised them. These issues are prevalent in invasion biology. Stephen Jay Gould summarizes this well in arguing that native plants are

> only those organisms that first happened to gain and keep a footing . . . In this context, the only conceivable rationale for the moral or practical superiority of "natives" (read first-comers) must lie in a romanticized notion that old inhabitants learn to live in ecological harmony with surroundings, while later interlopers tend to be exploiters. But this notion, however popular among "new agers," must be dismissed as romantic drivel. (Gould 1997: 17)

With respect to invasive species, many biologists question whether the hype and vilification of foreign species is warranted, given the empirical evidence except perhaps in the case of small islands. Yet it is repeatedly touted that invasive

species are the second greatest threat for the extinction of species (P. Roberts et al. 2013, D. H. Richardson 2011, M. A. Davis 2009). Invasive species have received far greater press than many other environmental problems. Indeed, dealing with human-induced environmental effects and the impact of climate change is more urgent than ever and likely to intersect with lots of fields in biology and outside (D. M. Richardson 2011).

This intellectual context with a history of reflexive critiques on language, theories, and philosophies of ecology seemed an ideal context in which to begin to think natureculturally. The project on biological invasions was a collaborative project with two biologists, James Bever and Peggy Schultz.[1] Jim and Peggy's research interests involve arbuscular mycorrhizal (AM) fungi and their role in plant ecology. Arbuscular mycorrhizae are characterized by the arbuscules, or vesicles, they form with the roots of vascular plants. Belonging to the phylum *Glomeromycota*, these fungi develop a symbiotic association with the roots of vascular plants. The fungi help plants capture nutrients such as phosphorus, sulfur, nitrogen, and other micronutrients from the soil and in turn the plants house the fungi in their roots. In addition, AM fungi also physically affect the soil through the production of glomalin, a sticky substance that binds soil particles and improves soil aggregation (Wright and Upadhyaya 1998, Chaudhary and Griswold 2001). It is believed that more than 80 percent of vascular plants species form mycorrhizal associations (Harley and Smith 1983). While sometimes mildly pathogenic, mycorrhizal fungi are usually in highly evolved mutually beneficial or mutualistic associations with plants. AM fungi are believed to have played a critical role in the evolution of vascular plants and their colonization of land (Brundrett 2002). Jim and Peggy's lab is broadly interested in the biology and ecology of these fungi, and they proved to be great colleagues and collaborators. Politically engaged, they were supportive of my research goals. What excited me about their work and approach to invasive species was moving beyond the usual "geographic origin" story approach to invasion ecology; instead, they took seriously the ecological contexts of plants. In paying attention to the environmental contexts of growth, especially the soil communities of plants, their work held exciting potential for collaboration. Mycorrhizal fungi and their relationship with native and exotic plant species seemed like a great context for a science/science studies project. Their work on fungi that were in "mutualistic" relationships also challenged the role of competition as the critical driver of ecology and evolution of plants. Living in Southern California where human-made landscape changes are considerable, they were interested in invasion biology themselves, and thus this project on the role of mycorrhizal fungi on invasion biology emerged as a collaborative one. I was

particularly mindful of the intensity of time that fieldwork and subsequent data gathering would take during busy semesters when my job involved teaching in a humanities department. It was a daunting task to fit in with the challenges of interdisciplinary work. A collaborative project with supportive colleagues who had an established laboratory seemed an ideal context in which to explore these questions, and indeed it was.

Studying Invasion Biology

How can you do interdisciplinary work across disciplines that have no channels of official communication? Geographically separate on campuses with no joint conferences, no journals, no interdisciplinary committees, and no hallway conversations? As we saw in the previous chapter, some biologists have long been critical and reflective of the field of invasion biology (Hobbs and Richardson 2011, Preston 2009, D. M. Richardson and Pysek 2008, Simberloff 2003, Soulé and Lease 1995, Vermeij 2005), and yet the field has continued on rather unaffected. The strategy was to do interdisciplinary work with multidisciplinary audiences in mind. This way the work could be published in several disciplinary journals with some of the interdisciplinary insights being translated into the language of disciplines. The interdisciplinary methodology could be published in interdisciplinary sites. Given the institutional structures, it was the only way I could conceive of funding and carrying out such work. As will become evident later in the chapter, one of the tautological challenges of invasion biology is that testing ecological theories necessitated working with the categories of native and naturalized.

RESEARCH QUESTIONS

The experiments we carried out were designed to examine the relationship between native and naturalized species and their soil communities, in particular, AM fungi. Did native species perform better than naturalized species when grown with native soil communities? Were naturalized species less dependent on soil communities than native species? Did AM fungi grow better with native species? The experiments thus tested whether the ecological context of plants with respect to their soil communities mattered to the success of native and naturalized species. Similarly, did the composition of soil communities shift depending on the plants that grew in them? Can we really talk about the broad categories of native and naturalized as though they were homogeneous? Do all native and naturalized species act in identical ways whereby these categories of native and alien/naturalized make biological sense?

EXPERIMENTAL DESIGN AND METHODS

In this experiment we worked with a range of native and naturalized plant species to see if the categories of native and naturalized mattered. First, we did a floral survey of plant families in Southern California to evaluate whether native and naturalized species varied in their dependence on AM fungi. We also developed cultures of soils drawn from native and naturalized species to see if the density of AM fungi in the soil varied depending on which plant species grew with them.

The field experiments were conducted in Southern California, and all the seeds and inoculum for the soil were collected from UCI Ecological Preserve and the Starr Ranch Wildlife Sanctuary in Orange County. We tried to maximize the range of families represented in our experiment to include species that were known to associate with AM fungi as well as those that were not.

Seeds were collected and then propagated in the greenhouse. They were randomly assigned to the various treatments to ensure uniformity. Just as seeds were propagated, soil organisms were propagated by collected soil from the same locations as the seeds and then grown in the greenhouse to create soil inocula that were used to develop native and exotic soil communities. In order to create the inoculum for native and exotic soil communities, we collected soil from areas that were dominated by natives and those dominated by exotic/naturalized species; these became the "native" soil and "exotic" soil treatments in the experiments. The soil treatments were then mixed with an autoclaved (sterilized) mixture of local soil and sand and grown with nine different native grassland species. All the soils derived from native and exotic sites were pooled to create the experimental treatments of native and exotic soil. For sterile treatments, the same sources were mixed but autoclaved so the soil was sterile. Tests confirmed that the soils were indeed sterile.

We worked with 14 species, 6 native and 8 naturalized. The experiment was conducted over 2 stages.[2] In the first stage, each of the 14 native and naturalized species was grown in 3 soil treatments: native, naturalized, and sterile. Did native plants do better in native soil than exotic or sterile soil? Did naturalized species do better in native soil, or did they prefer exotic soils? Each of the 14 species grown in 3 treatments was replicated 5 times (14 x 3 x 5 = 210). The 210 pots were randomly placed in the field, and the growth of the plants was measured each month. At the end of the experiment, the seeds and plant and root biomass of the species was measured.

While for stage one, we had broad categories of inoculum—native, exotic, and sterile, at the end of stage one, we had specific soil for each of the 14 spe-

cies. For stage two of the experiment we used plant species-specific soils as inoculum and grew each plant species in the soil of every other plant species including its own—each combination was replicated 3 times. Plants were also grown in their own cultivated soil, and these were replicated 10 times. So we were able to test not only how native species and exotic species collectively performed in native, exotic, and sterile soils, but also how native species grew in the individual soils of other native and naturalized plant species. Did native species do best in their own soils? Did they do equally well in all native soils? What about exotic species? The 636 plants were randomly divided into 3 spatial blocks and the growth of the plants was measured each month. At the end of the experiment, the seeds and plant and root biomass of the species were measured to evaluate the growth success of the plants.

RESULTS

Several significant pieces of evidence emerged that are worth highlighting here.

FLORAL SURVEY

Southern California is a site of tremendous anthropogenic, or human-induced, change. Cattle ranching over hundreds of years has profoundly affected the landscape of Southern California. The floral survey showed that while all sites had native and naturalized species, a greater proportion of naturalized species in these sites belong to nonmycorrhizal families (i.e., plant families that did not associate with mutualistic mycorrhizal fungi). This was true in all the locations we examined except one, San Mateo Canyon Wilderness area. Strikingly, San Mateo Canyon Wilderness area has remained largely undisturbed and also has the lowest percentage of nonmycorrhizal plant species. This reinforces the idea that disturbance is important to the success of nonmycorrhizal species and that reduced mycorrhizal dependence of naturalized species may be a source for the success of naturalized species (Murray Frank, and Gehring 2010). The pattern shows that species with weak associations with mycorrhizal fungi also are highest in areas with anthropogenic change, emphasizing the critical role of disturbance in changing species compositions. As a result, mycorrhizal naturalized species are underrepresented in our study, a factor that will come to shape its results.

EXPERIMENTAL RESULTS

Overall, the results reinforced many of the patterns predicted in the literature. Native plant species had higher mycorrhizal infection rates than naturalized species, and their growth rates were higher in native soil than in exotic soil. Naturalized species were less dependent and responsive to mycorrhizal fungi

than native species (even among species that did associate with mychorrhizal fungi). Naturalized species, on the other hand, did not show a significant response to the soil treatments, that is, they did not do substantially better in one soil treatment (native, exotic, or sterile) compared to others.

To make sure that we were not making false assumptions about the soil, we tested the inoculum densities in native- and exotic-dominated sites and indeed there was a significantly higher density of mychorrhizal fungi in native-dominated soil than in exotic-dominated soil.

Indeed, if you pool the data and look at the categories of native and naturalized, natives overall do better in native soil and naturalized species show a greater adaptability and ability to grow in a range of soil types. But using the broad categories of native and naturalized also obscures the heterogeneity inherent in the diversity of species and range of life histories of natives and naturalized species. While the categories of native and naturalized show the broad patterns, in each of the experiments there was significant variation among native and naturalized species. While some natives did better in native soil than exotic soil, there was variation in that some did much better than others. Some naturalized species did better in native soil than exotic soil and some did better in sterile soil than either native or exotic soil. Thus the heterogeneity is striking and worth noting. One of the other significant aspects of the results was ascertaining feedback cycles. In a positive feedback cycle, plants do well in their soil communities, which in turn do better with those plants. Thus we can see a positive feedback cycle where plant communities and soil communities are caught in a cycle that facilitates the growth and the success of each other. But plants can also show negative feedback, and here plant communities may hinder the growth of soil communities, or vice versa. In the experiments, naturalized species show greater negative feedback, than native plants, that is, they did better in the soil of other naturalized species than in their own soil. While the pattern was overall more marked in naturalized species, some native species also show negative feedback. Disturbance of soil particularly aids plant species in negative feedback loops.

THE COMPLEXITIES OF THE RESULTS: A DISCUSSION

What is in part being lost in the broad categories of natives and naturalized is the variation and heterogeneity within each of the categories. There is considerable variation among native and naturalized plant species. In particular, response to mycorrhizal fungi varies considerably across naturalized species, and this may be one of the multiple reasons for their success. Ecologists suggest that certain life history characteristics enable plants to thrive in disturbed habitats. Traits

such as high fecundity, rapid growth, self-compatible breeding systems, and efficient dispersal mechanisms are all traits that have been shown to be crucial to success. Not all naturalized species become invasive, and some native plants can also be invasive. Association with mycorrhizal fungi has been suggested as yet another variable that shapes plant and soil communities (Pringle et al. 2009). Furthermore, naturalized species do not do well in all contexts—they appear to thrive in habitats with low species diversity, high heterogeneity, and, most important, disturbance. Naturalized species also appear to have fewer pathogens in their new environments.

The results suggest that we *cannot* understand plant invasions without considering the ecological contexts of plants. The success of some species may occur through the central role soil communities, especially mycorrhizal fungi, play (Stampe and Daehler 2003). The complex feedback loops that emerge between individual plant species and their preference for individual AM fungal species can fundamentally alter the species compositions of both plant and soil communities and ultimately the future composition of both plant and soil communities (Batten et al. 2008, Marler et al. 1999, Zhang et al. 2010). Some naturalized species do particularly well in disturbed habitats. Let us not forget that disturbance also alters species composition among native species and that native species can also be invasive. But the species that thrive in disturbed habitats tend to be non-AM fungi dependent and thrive in disturbed habitats. Nonmycorrhizal plants erode soil communities, which in turn makes it difficult for native species to reestablish.

The experiments also show that weaker dependence of naturalized species on mycorrhizal fungi affected soil communities of fungi. Overall, naturalized species sustained lower AM fungi densities. There was variability among naturalized species' response to AM fungi, however. Some naturalized species grew better with AM fungi but were poor hosts to the AM fungi, while others did poorly in the presence of AM fungi but proved to be excellent hosts. Therefore, the patterns of establishment and reestablishment of native species depended a great deal on the exact species composition of the natives and naturalized.

Disturbance is not a new phenomenon in Southern California with its long history of cattle ranching. Some biologists have argued that this has created an alternate ecological state. The degradation-of-mutualism hypothesis suggests that naturalized species appear to be poorer hosts for mycorrhizal fungi as well as less dependent on the fungi. Lower dependence and poor host qualities together create new habitats that are mycorrhizae poor. The theory predicts that this will create new stable states. The vegetation, with its prevalence of nonmycorrhizal fungal families, is now in a new equilibrium. Most important,

these results also suggest that merely pulling out invasive plants and replacing them with natives is not enough. One needs to pay attention to the individual species and their relationships with the soil communities to fully understand the environmental context. Soil communities play an important role here and cannot be ignored.

Engaging Feminist Science Studies: Notes from the Field

How should we understand the experiments and their results within the context of the social and feminist studies of science? In planning the experiments, I began to see the layered history of biology and politics embedded in the very structures of the experiment. And as the experiment progressed, my mind was churning with the complexities of studying natural systems. Of course, plants and animals are not people, and it is dangerous to read too much into the patterns of data. But as we have seen earlier, science is not innocent and removed from society. Deeply steeped in language and history, it is shaped by its historical contexts. These are worth examining. During the course of the experiments, several issues emerged.

TERMINOLOGY

The first issue we encountered immediately was terminology (Chew and Hamilton 2011). The loaded vocabulary of *native* and *alien* was troubling for all the reasons we saw in the previous chapter. Yet the literature and the theories of biological invasions were entirely predicated on these categories. We settled on *native* and *naturalized/introduced* as less sensational terminology and one that was historically in tune with the migration process. It was much easier to talk about naturalized plant species (since the term is often used in the literature) than naturalized soil (since soil is not one organism or entity), however. As a result, we often used the term *exotic* soil to refer to soil that naturalized species grew in.

LANGUAGE

The language of invasion biology creates a tautology—from beginning to end in experiments, the narrative is always about natives and aliens. It is impossible to escape this binary framing. Whether native and naturalized or something obtuse as Species Set A and Species Set B, the underlying formulation of experiments like ours is one of categories based on the purported geographic origin of the species. Any results that emerged would conceptually still be

about that sole category of analysis. The very framing shaped the experiments and their interpretations. Any complexities that emerged were quickly and easy framed in the binary formulation of nature in place/nature out of place. This binary thinking forever locks in thinking about "the patterns of native/aliens"; it never moves beyond this formulation. It never allowed us, for example, to see if characteristics such as dispersal mechanisms, or reproductive strategies, or habitat heterogeneity, or other life history traits may be equally or more important. While this project did look at AM fungi, I was struck by how it was always folded into an analysis of AM fungi of native versus naturalized. The framing of native/alien structured all thinking and limited other possibilities.

There is also little doubt that this framing has shaped academic, popular, and activist frames. As we prepared the manuscript for publication, and if we were serious about its publication, we had to speak to the field—and this ultimately framed the story we needed to tell. And indeed the importance of framing is well documented in the literature on the sociology of academic fields. This work on invasion biology was funded because it built on a long history of research that has been constructed around the binary of native/alien. The work is read and synthesized by a community locked into the trap of this duality. Invasion biology has been a discipline of its own now since about the late 1980s (M. A. Davis 2009, M. A. Davis et al. 2011a). National organizations such as NSF, Nature Conservancy, as well as professional societies and journals recognize this as an urgent and important field. There are books, journal issues, and journals like *Biological Invasions* entirely devoted to this field. Money to fund these projects has been pouring in. For this work to be intelligible, and legible within the frames of the discipline, the binary framing is constitutive of the field.

More central to issues of native/exotic plants are questions of what gets to be called a "native" species. Given that the majority of Americans are immigrants themselves, the reinvention of "natives" as the white settlers and not "Native Americans" is striking. The systematic marginalization and disenfranchisement of "Native Americans" makes the irony all the more poignant. The love of the sequoia tree in the conservation movement is a eugenics symbol—its long life a testament to the glory of the white American settler as native. It is striking how plant and animal species never outgrow their labeling while the humans telling the stories (i.e., white Americans) have been rendered native in less than a few generations. But the categories of native/exotic are not as easy or clear-cut biologically speaking.[3] There can be dispute on how certain species can or should be characterized. While some use the term *invasive* more loosely to suggest the proliferation of a particular species, the official definition necessitates their alien origins.

> Invasive Plant: A plant that is both non-native and able to establish on many sites, grow quickly, and spread to the point of disrupting plant communities or ecosystems. Note: From the Presidential Executive Order 13112 (February 1999): "An invasive species is defined as a species that is 1) non-native (or alien) to the ecosystem under consideration and 2) whose introduction causes or is likely to cause economic or environmental harm or harm to human health." (U.S. Department of Agriculture 2012)

In contrast to alien invasives, the term *opportunistic native plants* is used in some official circles to mark native plants that are "able to take advantage of disturbance to the soil or existing vegetation to spread quickly and out-compete the other plants on the disturbed site" (U.S. Department of Agriculture 2012). While natives are opportunistic, a character flaw, aliens are invasives, a serious threat! There have been many attempts to redefine the term, but it has become increasingly apparent that a rigorous definition of native and alien inevitably leads to contextual definitions, changing scales, and blurred boundaries (Warren 2007, M. A. Davis 2009, M. A. Davis et al. 2011a, Helmreich 2009). Throughout our project the ways in which the language framed and sometimes circumscribed the issue in dualistic frames of native/foreign was unavoidable.

ECOLOGICAL CONTEXTS

Invasibility, it emerges, isn't a characteristic of species; it has to be understood as a response to particular ecological habitats. At superficial glance the results reinforced all the ills of foreign species. Naturalized species degraded mutualistic fungi and created a context where native plants were at a disadvantage. They thus paved the way for a shift toward plant communities with nonmycorrhizal-dependent foreign species. But a deeper look at the data gave one pause. Is the foreign origin of plants the best ecological trait to focus on, rather than particular life history characteristics? In the floral survey, the one site that was undisturbed showed no significant differences in native and naturalized plant families that were nonmycorrhizal. Other studies have also found the critical importance of disturbance (Hobbs and Richardson 2011, Marvier, Kareiva, and Neubert 2004). Indeed, species that are "invasive" outside their native ranges are unlikely to be so within their home ranges (Hierro et al. 2006). Invasibility is thus a contextual response of certain species in certain environments. Disturbance and the history of grazing in Southern California seem key to the shift in the ecology of plant communities. Given the heterogeneity that native and naturalized plant species displayed, what if we focused on those characteristics rather than the native/foreign origins of plants? For example, biologist Mark

Davis has a useful suggestion in this regard (M. A. Davis and Thompson 2000, M. A. Davis 2009). Rather than classify species as native and exotic, categories that are often too heterogeneous and fraught with numerous complications, he suggests a more complex scheme attending to the varied life histories of plants and animals. He suggests three criteria: dispersal distance, uniqueness to the region, and impact on the new environment. Plants may be able to disperse their seeds short or long distances; plants may be common or novel in their uniqueness to the region, and their impact on the environment may be small or great. With this ($2 \times 2 \times 2 = 8$ categories) model, he argues that only two of them, those that are unique to the region and have short and long dispersal with great impact on the environment have the potential to become "invaders," as the term implies. We can move from a model where all exotic and naturalized species are seen as a problem to a model where we examine the ecology and life history traits of plants to evaluate their impact on the environment. Such a model that focuses on the biology of plants rather than their origins is a useful way to understand plant communities and their ecologies. In our experiments here, the ability of plants to be good hosts to mycorrhizae seems important to the ecological future of the site. Others such as Woods and Moriarty suggest we move from thinking of native and exotic purely as geographic categories to thinking of them as "cluster concepts," using multiple criteria, not just geography, to determine their status (Woods and Moriarty 2001). Indeed, we could see "invasion" as a symptom of larger ecological problems rather than as the ultimate problem that needs to fixed (Hobbs and Richardson 2011, Macdougall and Turkington 2005, D. M. Richardson et al. 2007).

Nature, biology, and ecology are never static, stable, and unchanging. Some have suggested that we move from a geographic label such as "native/foreign" to thinking in terms of a "damage" criterion—eradicate only those species that cause damage. Again, on deeper reflection, this is not so easy because sometimes exotic species do have both positive and negative effects. For example, the eucalyptus tree was introduced into the state of California from Australia about 125 years ago. In 1979 California decreed removing all exotic plant species capable of naturalizing and this included eucalyptus trees. While eucalyptus trees have plenty of negatives, it turned out that native monarch butterflies had grown dependent on the trees during their annual migration (Woods and Moriarty 2001). Indeed, it turns out that eucalyptus trees are now used by a range of butterfly and bird species, and at least one species of salamander has adapted to it (Woods and Moriarty 2001). In a world with profound human-induced movements of flora and fauna, a decision to suddenly decree what is native/foreign seems rather arbitrary. Local ecologies always evolve. Some natural-

ized species act as "native" and indeed some biologists see this as a criterion of naturalization (Carthey and Banks 2012). Returning to some notion of a yesteryear seems unproductive. Rather, we must wrestle with these complicated and at times confusing histories and be clear what ecological outcomes we are working toward—not a restoration to some nostalgia vision of the past.

Moving away from blanket labels and focusing on the dynamism of the biology of plants also allows us to recognize the complex nature-cultural pathways that have created the world as we know it. These categories are a lot more porous than most realize. Many species, for example, have become "culturally native" because of their long entanglements with countries and cultures (Warren 2007). Take, for example, a recent compilation of the one hundred heritage trees of Scotland. Of these, forty-two of them are technically alien species but have been rendered native through time. Often scientific judgments clash with cultural belongings (Rodger, Stokes, and Ogilvie 2003). Similarly, nearly all U.S. crops are foreign in origin, sometimes brought into the country through government-sponsored trips across the world. The current composition of plant communities of Southern California through cattle ranching is many hundreds of years old. Focusing on the biology of species, our recent ecological histories (including human ones) recognize the complex ways in which human beings have mediated the ecological shits. Shifting the focus from the invasive species as the problem to the complex geopolitical histories that have created our naturecultural world is a productive shift. Thus the solutions also become less about merely eradicating foreign plants and more about attending to the proximate cause of ecological shifts—overdevelopment, grazing, degradation of land, ecological fragmentation, soil erosion, and so on. If our desired model of nature, for whatever reason (biological, political, economic, or aesthetic), necessitates the management of particular species, we can do so without generalizing the pattern to all foreign species. A naturecultural approach also forces us to think more holistically about management. M. A. Davis's suggestion is one potential model among many that we can envision. While I am not necessarily advocating this model, attending to the biology of species allows us to refuse several binaries. The exotic/native binary seems more simplistic than the biology of species suggests. But we also avoid the nature/culture binary. Rather than analyzing this case purely as one of "cultural" production and therefore all hype, we can attend to the realities of changing ecosystems that are all too familiar and in some cases a cause for concern. If we choose to "manage" nature, we should realize, as the ecologist L. B. Slobodkin says, "that we preserve species and control species that are 'bad' from a human standpoint but with the understanding that the ethical problems are ours and not those of the organisms" (Slobodkin 2001: 8).

Toward Naturecultural Ecologies: Naturecultures as Dynamic

In reflecting on the experiments, it is clear to me that biology can never be separated from society or nature from culture. The very language of native and alien, explanatory frameworks of invasive species, and the field of invasion biology with its self-propelling biological and political apparatuses are not easy to derail. Should Southern California go back to its pre-ranch days? Can it? Is this even possible? Or desirable? As such, naturecultures are not static but historically contingent themselves. The contexts of plants five hundred years ago, fifty years ago, and today are vastly different, leading to selections of different life history strategies. What if Southern California is in a new ecological equilibrium, as some ecologists believe? On what basis do we make decisions on what is "natural"? Paying attention to naturecultures allows us to recognize the intricate interconnections between natures and cultures in our analyses as well as our responses. These insights should force us to reconceptualize the biological and cultural language and frameworks by which we talk about the migrations and the redistributions of plant and animal species in our world today.

BEYOND BLAMING THE VICTIM

The language of invasive species misidentifies the problem that faces us and misplaces and displaces the locus of the problem. It scapegoats the foreign for a problem they did not create and whose removal will not solve the problem. The problem is not the foreign species per se but rather the human-made ecological disturbances that have caused ecological change to the plant and soil communities. Perhaps as some have argued, without naturalized and exotic plants we would be surrounded by impoverished, barren, and lifeless landscapes. We need to approach the problem with thought and reflexivity. The parallels between our approach to invasive plants and human terrorism are deep and worth pondering. With the rise of ideas and institutions of security and border security, we have also seen the emergence of the field of *bio*security, neatly tying into ideas of a nation in peril from its foreign humans and other biota (Hulme 2011, D. M. Richardson 2011). For those who believe that we should not steep ourselves in the return to false nostalgia of a white native country, why do we do so when it comes to our flora and fauna? If we are wary of pathologizing foreign humans, why not be careful about pathologizing foreign plants and animals? Instead, why can we not recognize the inherent diversity and dynamism of natures and cultures and work toward a vision that is ethical and respectful of all life?

Rhetoric of "natives" supports antidemocratic politics and ultimately yields less than maximally reliable sciences. "Naturecultures" force us to simultaneously attend to and transform both societies and the sciences that are dedicated to such projects, yielding more maximally objective and democratic results. Paying attention to the heterogeneity of native and foreign plants is also ecologically productive. The categories of native and foreign are not useful. Instead, let us focus on ecological traits that cause change we find undesirable and on the causes of these changes that we should be actually worried about—destruction of habitats, erosion of diversity, soil erosion, overdevelopment, monocultures, high input agriculture, pollution of air and water. And above all let us be clear that our choices are "human made" whether for economics, aesthetics, or enhancement of particular ecological characteristics like biodiversity, harmony, and species richness that humans have deemed important. Let us not fall back on age-old tropes of a pure nature or the natural.

We have to realize that nature is not that imagined nostalgia for a mythical yesteryear but rather an evolving entity, in which we are intimately involved. Whether we like it or not we are defining nature through our actions. This is not to fall back on an anarchic world where anything goes in the name of a free market or globalization. Rather, it is about taking responsibility for the world we live in and for us as a community to define the values that will guide us in our relationship with the natural world. We do not need to resort to the naive and powerful tropes of a fear of the foreign and alien or the calls for a nostalgic mythical white America. Instead, we should deal with the central vexing questions of variation, diversity, and difference that have plagued us for centuries in a larger context. Do we pathologize invasive species or recognize the valuable role they play in greening otherwise barren and desolate landscapes? Do we vilify foreign species or recognize the fundamental roles humans have played in redrawing landscapes from grazing and agriculture to more recent effects of climate change (Klinkenbord 2013)? This is the naturecultural world that can await us. If not, the ever-dynamic naturecultural world fueled with false nostalgia, irresponsible ecological management, overexploited landscapes, overdeveloped lands, and rampant consumerism will surely do it for us. The dire crisis of climate change, with its fast-changing plant and soil communities among many others, is surely all the evidence we need.

CHAPTER SIX

Aliens of the World Unite!

A Meditation on Belonging in a Multispecies World

Illegal aliens have always been a problem in the United States. Ask any Indian.

—Robert Orben

Every seed has a story . . . encrypted in a narrative line that stretches back for thousands of years. And if you trace that story, traveling with that little seed backward in time, you might find yourself tucked into an immigrant's hatband or sewn into the hem of a young wife's dress as she smuggles you from the old country into the New World. Or you might be clinging in the belly wool of a yak as you travel across the steppes of Mongolia. Or perhaps you are eaten by an albatross and pooped out on some rocky cropping, where you and your offspring will put down roots to colonize that foreign shore. Seeds tell the story of migrations and drifts, so if you learn to read them, they are very much like books.

—Ruth Ozeki, *All Over Creation*

The project on biological invasions that I have described in this section of the book was conceived as a joint project across the sciences and science studies, bringing the vast resources of the humanities and the biological sciences together to understand the natural world. After all, geographic origin and variation, alien and foreignness, are characteristics that can be shared by

all organisms and objects. And yet, this project has evolved into something much more profound, an uncanny confluence of the academic and the social, of identity, experience, biology, culture, and politics. Geographies, genealogies, and biographies of variation have all been caught in a long historical debate about the politics of place. All the different parts of me, my work and my life, seem to be singing to each other in some grand polysymphony—multivocal, multidisciplinary, multidimensional, multispecies, multicellular, multiorganelle, multigenerational. This then is a meditation not so much about the unity of the world—of others and mine—but rather about the ways in which the lives and fates of so much of the world, natures and cultures, are entangled with each other. In this short reflection piece, I want to explore how academic, intellectual, political, personal, natural, and cultural voices came into conversation with each other. As scientists, if we reflect on our personal lives, it is usually about triumph or failure, or about passion, satisfaction, insight, determination, or perseverance. We hear about striving against the odds, the serendipitous discoveries, the rigors, pains, and joys of a life in science and the sometimes varied and inspiring biographies. Rarely, however, do we explore the profound ways in which these same narratives of personal, cultural, political, and economic contexts and the various life experiences or the trials and tribulations of one's life can have a profound and uncanny influence on scientific epistemology and methodology. We intuitively know it to be true and saw this vividly in part I of this book where eugenic concerns of the scientists profoundly shaped their scientific views. The cultural contexts of science are not just a byproduct or curiosity but in fact can be the source of new insights, new theories, and new knowledge for science. Studying science in context affords a glimpse into the entanglements of the natural and cultural, the personal and professional, and the political and intellectual, entanglements that become a rich site for new knowledge and theory making.

I came to this project with brave visions of interdisciplinary research. Alas, these always need to be conducted in a disciplinary world. I brought the tools from the biological sciences to examine the biology of invasive species and the tools from the cultural studies of science to examine the cultural contexts of invasion biology. I became the embodied site of interdisciplinarity. As the project progressed, the biologist and women's studies scholar in me watched, observed, and analyzed the evolving collaboration. As a brand new entrant into women's studies, I had just recently been introduced to the ideas of women, gender, and race and their troubled histories with science. And then a strange thing happened. An aspiring interdisciplinary scholar, I began to be struck by the growing synergies of the narratives of the alien and foreign plants I studied

as a biologist and the emerging analysis of my own life grounded in ethnic, queer, postcolonial, and women's studies. Here then is a meditation on the affinities and affiliations of multispecies migrations in this contemporary moment of globalization.

I can still remember myself as the young girl who traversed the oceans to graduate school in the United States, straight out of college from India. Wide-eyed, exploring new geographies in a new country, a new world, new ecologies, new cultures, I could scarcely believe that someone would pay me to go to graduate school in the United States. Little did I reflect on the complex politics of the discourses of liberalism, third world development, and women's empowerment that helped me secure this opportunity. Never having left the country, I first had to secure a passport, that small booklet that declares one's national belonging, that marks the moment of legal and geographic belonging. The document also records one's exit from the geographic boundaries of the home nation and the entering of a new one. Armed with a passport, I visited the U.S. consulate to get official permission and a legal document securing entry, a visa to enter a new land. The usual questioning ensued. Why do you want to go? What is your purpose? Will you return? Yes? Are you sure? Student visa granted. A giant aircraft transported me across the oceans to a new land. Then on to the long immigration line in the airport for noncitizens of the United States. The passport was scanned through various security gadgets, piercing eyes stared intently at me as though boring into the depths of my soul. Passport accepted, visa acknowledged, and a stamp secured for a legal entry into the country. Then I had to confront the lines through U.S. Customs. Customs inquired, No living creatures? No fruits? No vegetables? No perishable foods? No visits to farms? Forms stamped and they let me go into the warmth of an American evening. Thus marked this legal process of migration of a human from one nation to another—from third world to first world. A sanctioned migration.

With a student visa, I completed my doctoral work. A postdoctoral opportunity arose. Then a job. So from a temporary student visa, to an H-1B visa, to a green card. From a legal alien to a resident alien to a permanent resident. Resident in one country, citizen of another. Then to a naturalized citizen, trading one passport for another, never ever to be a "native" again. Reflecting on these legal categories, I could not help but be struck by an analogous process among plants and animals. First the alien, the exotic, the foreign species, then the long-term resident, the exotic, and the naturalized species. In this age of global pandemics in many parts of the world, the border is a site of intense surveillance. If plant, animal, or human is suspected of an infection, some form

of quarantine or denial of entry is often instituted. The desire for the "pure" migrant, vetted and sanctioned, is shared across species lines.

The parallels between my own life and my increasingly kindred plants and animals grew. I saw that the sustained campaigns to raise awareness about the danger and destructive nature of alien plants and animals were eerily similar to the xenophobic narratives against alien human immigrations. Decrying the constant influx of exotic and foreign species into the nation, these campaigns against foreign flora and fauna all highlight the erosion of native and local habitats, their economic and social cultures, and the destruction of nature. Similarly, anti-immigration activists campaigned against foreign humans, highlighting the erosion of native communities, their economies and societies, and the erasure, dilution, and destruction of native culture.

As we saw in chapter 5, there are many parallels in the ways in which foreign plants and animals and humans are treated. As the project unfolded my sympathies and kinship with these species grew. Books and articles have proliferated into a veritable industry against invasive and exotic plants, and the xenophobic rants against human immigration have repeatedly reached fever pitch. Living as a brown-skinned individual in the United States after September 11, 2001, the surveillance and suspicion is palpable. Are they so different from the "wanted dead or alive" posters for alien plants or insects? Are they so different from the penetrating eyes of the people on the road? Or the xenophobic rants or casual comments that pass you on the street? All based on one's presumed nationality or religious affiliation by phenotype or assumption. I cannot help but feel a deep sense of kinship with the equally stigmatized bodies of plants and animals. Thus, humans, plants, and animals are vulnerable to the new modes of surveillance where citizens are encouraged to alert a government agency by calling a phone number or sending an image (through an iphone app) of the potential danger. This mode of citizen surveillance seems deeply corrosive in a world in a perpetual war on terror. How do we keep those terrorists, those invasive species, out? We can do it by being suspicious of all foreign and alien creatures. The Republication candidates for president of the United States in 2012 appeared to be competing for who had the proposal for the tallest, widest, and most lethal electric border fence—of course, the border with the brown national neighbor, not the white one. How surprisingly deep are these multispecies affinities, these cross-species geopolitical kinship, and how uncanny and unexpected these networks of belonging emerging out of an interdisciplinary collaboration across biology and science studies!

And yet on greater exploration, I realized the many easy elisions that enabled me to feel like a kindred spirit to the foreign plants and animals. The idea

of nativeness is developed from national states with historically demarcated geographic borders and boundaries with which they enforce who belongs and who does not. While it is true the native/alien definition in plants and animals comes from a nationalist spirit and a need to define national flora and fauna, there is, I discovered more than one way of defining the native. There are two forms of civil discourse—*jui solis* (right of soil or birthplace) and *jui sanguinis* (right of blood or inheritance) (Alonso 1995). Who is a native and who is a citizen and what rights each has depends a great deal on the national context and definitions of citizenship. Not all countries accord citizenship by birth within the nation-state. Even what is "native" requires a deeply contextual understanding. There are thus lots of different ways we can think about the native—through the geographic location of the origin of the species or taxon, through longstanding occurrence in a place, or through co-evolutionary or ecological relationships between the other species in the area. While each of these definitions shifts what we might consider native and alien, none get us out of the problematic notions of native and alien (Alonso 1995, Somerville 2005). It is through complex and fortuitous political histories that the plants, animals, and I, all find ourselves rendered alien in the United States.

Epistemologies of Kindred Subjectivities

What does it mean to increasingly identify as an alien studying aliens? How might such subjectivities, such alliances, be a source of productive knowledge production? There were several ways in which this shared subjectivity with alien plants and animals proved revelatory, enabling a deeper and a more expansive analysis.

The most profound insight was the recognition of the deeply entangled worlds of natures and cultures, that is, naturecultures. And indeed, the problem has been conceptualized as a fundamental question about similarity and difference. Do we want to live in a world where diversity and variation are celebrated or one that is homogeneous, monochromatic, and monocultural? Some have argued that we live in the epoch that can be called the "Homogocene" (Baskin 2002: 7). Some say that we should control alien species in the name of preserving diversity and variation. Just as cultural critics bemoan the McDonaldization of the world, so should biological critics bemoan biohomogenization by the entry of foreign species into native lands. Being against native species is not xenophobic but analogous to cultural critics asking to preserve rare languages or cultures. Being anti-foreign, they argue, is not the same as being xenophobic, but about preserving the "diversity of ecological assemblages" from the

homogenizing forces of globalization (Hettinger 2011). As someone who has followed both the biological and the cultural critics, I am unpersuaded by both. This is a false binary and for the most part a moot point. Globalization has been ongoing for millennia, plants and animals have been moved around for just as long—hybridity and multiplicity is all around us. Also, globalization does not automatically dilute distinctiveness in either the cultural or biological world. New configurations, new identities, new possibilities emerge (W. O'Brien 2006). This is not to suggest that cosmopolitanism—of the floral, faunal, or human variety—is easy or unproblematic (Jamieson 1995, Pollan 1994, Soulé 1990, Paretti 1998). Blind cosmopolitanism, like blind multiculturalism, is likely to bring along its own sets of problems.

But this is not to suggest that globalization has been always good or productive. Movements of humans, plants, and animals have always been in reaction to particular political, economic, and social forces, and one can trace these circulations. Alien plants and animals share a common set of natural, cultural, and political contexts, and all of us are sometimes caught up in geopolitical circuits of power. As Karen Cardozo and I have argued elsewhere, some plants, animals, and humans share historical, economic, and political histories. Using the term *Asian American* as a geopolitical frame, we demonstrate how the term should be understood as one that is not just human but rather one that is multispecies (Cardozo and Subramaniam 2013). Like Asian American humans, Asian American plants and animals also share in its complex geopolitics, its colonial legacies, the eras of trade, and its cultural and culinary circulations. For example, the much maligned and invasive Asian longhorned beetle (ALB) owes its origins to China's policies to combat soil erosion and deforestation, which resulted in the country planting massive rows of monoculture poplar plants as wind-breakers. The ALB favors poplar trees, and these monocultures allowed an explosion in growth of ALB populations. Soon after, when trade exploded in the 1970s and 1980s and there was need for wooden crates, China was well equipped to provide poplar wooden crates, which of course now carried the larvae of ALBs. These wooden crates were shipped worldwide, enabling the extensive circulation of these beetles. We need to remember the current problems with ALB are part of these complex circuits of ecological trade, environmental, and commerce policies (Alsop 2009, MacAusland and Costello 2004). And this is the context we should recognize as we are inundated with "wanted" posters in newspapers, magazines, movie theaters, billboards, and i-phone apps that call for its eradication and destruction.

The much famous Georgia peach also has its origins in China, being brought to the United States through the travels of USDA agents (Kaplan 1991). Of

course, we want to domesticate and appropriate the peach as our own, even calling it the Georgia peach, while the ALB is remembered for its destructive foreignness. We can tell similar stories of many other plants and animals, as we can about humans. Thus all of us, creatures of this earth, are caught up in complex and unexpected networks of entanglements.[1] As chapter 5 shows, it is astonishing sometimes how the rhetoric, ideology, and politics from one sphere quickly engulf another. The xenophobic rants of anti-immigrant activists can quickly be heard in environmentalist circles. It is a keen awareness of these kindred subjectivities, of broad interdisciplinary approaches, that allows us to trace these dense and vibrant circulations.

Nationalism, Race, and Xenophobia: Disciplinarity and the Circuits of Knowledge

Just as the geopolitics of Asia and America have generated a richly textured world of multiple species of Asian Americans, so have other forms of geopolitics. Conversely, this work allows us to recognize the limits of disciplinarity. The narrow lenses of the biological sciences see invasive species purely as a "biological" problem, and the narrow lenses of the humanities see xenophobia or racism as a human problem. Each fails to see how their disciplinary frames need be so much broader and more complex. There are deep links between the nationalization of nature and the naturalization of nation (Sivaramakrishnan 2011). In discussing the case of Europe, Zimmer notes that "as politicized nature, particular landscapes evolved into integral parts of historicism's search for national pedigrees, something that happened across Europe in the late 18th and early 19th century" (Zimmer 1998: 641). Tracing the rhetoric of invasive species brings the natural world squarely within race and immigration politics. As we have seen before, it is not accidental that historical moments of strong xenophobia in human cultures have been associated with panics about foreign plants, animals, or germs. Indeed, Olwig argues that such ideas of nationalist landscapes/cultures are drawn from a common epistemological template that can be traced back to the Renaissance, when methods of surveying and cartography were rediscovered (Olwig 2003). The links between plant/animal control and human control are well documented; perfection in gardens and peoples is rooted in an ongoing struggle against "difference" (Mottier 2008). And the vast resources of the humanities have amply demonstrated how Hitler's vision of pure human populations was accompanied by visions of pure gardens,[2] demonstrated in this quote by the German landscape architect Willey Lange:

> Our feelings for our homeland should be rooted in the character of domestic landscapes; therefore it is German nature that must provide all ideas for design of gardens. They can be heightened by artistic means, but we must not give up the German physiognomy. Thus, our gardens become German if the ideas for the design are German, especially if they are borrowed for the landscape in which the garden is situated. (trans. and qtd. in Groning and Wolschke-Bulmahn 2003: 79)

As Rodman notes, applying the native/alien binary runs the risk of "the precarious utopia of a racially pure Reich" (Rodman 1993: 152). In a context of racism, xenophobia, and nationalism, the ideology of "blood and soil" made deep links between pure humans and pure gardens. The ideas of national cultures and gardens emerge again and again and have appeal at various times across countries (Groning and Wolschke-Bulmahn 2003).[3] And indeed, these kindred analogies between humans and plants were also embraced by American landscape architects such as Jens Jensen, Wilhelm Miller, and Frank Waugh.[4] For example, Jensen is quoted in a 1937 article as saying:

> The gardens that I created myself shall . . . be in harmony with their landscape environment and the racial characteristics of its inhabitants. They shall express the spirit of America and therefore shall be free of foreign character as far as possible . . . The Latin and the Oriental crept and creeps more and more over our land, coming from the South, which is settled by Latin people, and also from centers of mixed masses of immigrants. The Germanic character of our race, of our cities and settlements was overgrown by foreign character. Latin spirit has spoiled our lot and still spoils things every day. (qtd. in Groning and Wolschke-Bulmahn 2003: 85)

The fact that American eugenicists pointed explicitly to the forest and gardens of Germany as the birthplace of the instinct for democracy is a chilling reminder of the origins of U.S. nationalism and nativism. The idea of "native" nations and plants and animals has a long history and is deeply embedded in a politics of purity. It should come as no surprise that with the rampant fear of immigration in the United States, there was a 53 percent growth in housing units in gated communities between 2001 and 2009. "Stand your ground" laws show one response to the calls for assimilation (Benjamin 2012).

Thinking natureculturally on the politics of purity, I see the connections of xenophobic rhetoric of invasive species to those that sometimes permeate discourses against new reproductive technologies, genetically modified organisms, or the movements for local foods. One of the reasons cited against

foreign plants is preservation of the "genetic integrity" of native and nations. The fear that foreign species might interbreed with natives yields discourses that have a familiar ring of anti-miscegenation policies (Smout 2003). Yet, as Forrest and Fletcher argue, when pressed for a definition of genetic integrity, "there is generally some reluctance on the part of those employing such terminology to come to the point, although emotive issues connected with the archival 'preservation of our priceless heritage' and perhaps a variety of 'ethnic cleansing' are seldom far from the surface" (Forest and Fletcher 1995: 99).

ROOTS OF COINCIDENCE: THE POLITICS OF PURITY

Fears of impurity usually grow alongside fears of pernicious sexuality, global miscegenation, and unbounded migrations. And indeed, living in the United States, I began to note the politics of fears in multiple sites, all feeding on familiar tropes of race, and nation (B. Hartmann et al. 2005). What is fascinating is that despite deep ideological differences, in three current issues— invasive species, GMOs (genetically modified organisms), and NRTs (new reproductive technologies)—positions of the political left and the right converge. Whether some individuals are looking for a return to an imagined nostalgic past or for a future without foreigners, individuals across the political spectrum make similar arguments. Some environmentalists want a pure nature. Some feminists are critical of reproductive technologies and their impact on women. Some religious conservatives are afraid that we are taking the place of "God." And some conservative environmentalists are afraid that we are destroying God's creations. Conversely, some environmentalists are critical about the purity discourse while conservatives embrace technology and the free flow of flora and fauna in the name of free markets and the free flow across borders. What do we make of such a convergence? Are the roots of these fears and anxieties the same? Does the common rhetoric belie an anachronistic political similarity between the right and the left? Or is it entirely coincidental? Briefly, I want to suggest four ways in which I believe the arguments of the right and the left converge as they express their opposition to alien biota, GMOs, and new reproductive technologies.

First, the creation of the "other." In each of the three cases, the resulting product—the proliferating invasive species, the genetically modified organism, or the technologicalized mother/baby—is viewed with deep suspicion and as "foreign." In the case of invasive species, the term *invasive* literally becomes synonymous with exotic/alien/foreign species—ruling out the possibility of native invasive species, which seldom get any publicity. Signaling the ultimate monster, GMOs are often even dubbed "Frankenfood" (Egan 2011). The many "accidents" of new reproductive technologies—where white women carry

black babies, black women carry white babies, grandmothers are pregnant with grandchildren, and women routinely carry multiple pregnancies—all warn of the "bizarre" and the creation of possibilities that are unlikely to occur in our peculiarly gendered and raced world. It valorizes women's bodies as the sacred site of motherhood. In each of these cases, the language "reinscribes" particular notions of the "other," simultaneously reinforcing the normative as the native, the natural, the pure.

Second, the "other," most often the female, is often attributed with "hypersexual" fertility. Invasive species are routinely ascribed with superfertility. Consider, for example, the title of an article on invasive species: "They Came, They Bred, They Conquered." Within the GMO literature, one sees the fear of transgenes quickly moving to other plants and even crossing species boundaries to create "superweeds" with superfertility. The case of NRT is more complex and interesting because the object of superfertility and primary beneficiary of NRT is the white woman—whose fertility our culture deeply desires.

Third, linked to this is a valorization of nature and the "natural." Fundamentally in this framework, "nature" is a realm that is seen as removed from human interference but also human-friendly, safe, and trustworthy, that is, products of nature are safe for humans. By tinkering with nature, humans are argued to assume an unparalleled arrogance and are accused of playing "God." In this vision, if respected and left undisturbed, nature nurtures native species, nature produces "wholesome natural products" with pristine seeds that are good for you. If, however, we disturb this co-evolved nature with its own checks and balances, we are at risk of unleashing monsters. Invasive species transcend the "natural" order by moving where they do not belong. GMOs enable unnatural gene mixing and NRTs threaten the "natural" process of women and reproduction. Interestingly, companies that produce transgenic plants and GM food have moved to use the same rhetoric to celebrate GM food because it will allow the "natural" to be more "natural." They suggest that producing varieties with higher yields will save biodiversity and ultimately conserve native forestland. Similarly, transgenes that bring pesticide and weed resistance to plants will reduce the use of pesticides and herbicides and ultimately create more "pure" nature and sustainable agricultural practices.

Fourth, the rhetoric of purity is striking in each of these discourses—"pure" nature, "pure species," "pure women," species fidelity. Anxieties abound about native and exotic species cross-breeding, thus "contaminating" the native gene pool and gene purity. The rhetoric emphasizes purity by highlighting "leaking genes," "genetic pollution," and "contamination." Activists and policy makers have created a purity index and have developed standards to measure "seed purity."

Similarly, the vast resources of biology also remind us of the complex interactions that make ecosystems. We have observed the profound impact of ecological managements when new species have been introduced to control pests or weeds and have caused more harm than good. Or at other times when foreign species have evolved to form new communities where native species have become dependent on the foreign species (Woods and Moriarty 2001). Disciplinary thinking fails to illuminate these interconnections and entanglements.

The same sentiments of purity inhabit disciplines as they systematically dismiss methods, methodologies, and theories from outside their disciplines as trivial or sloppy. Thinking natureculturally and interdisciplinarily unleashes the vast resources of the humanities, arts, social sciences, and sciences. It gives us access to the vast repertoire of tools, theories, methods, and histories. It opens up our imagination to the vast possibilities of the universe—of poets and naturalists, of fiction writers and science writers, of rhetoricians and physicists. It reminds us yet again that words and language are powerful—not transparent and apolitical but powerful tools that can be used toward divisive and violent ends or toward egalitarian, peaceful ones. For those working toward a better world, thinking natureculturally opens up the insights of conservationists and social activists to each other. It allows us to see that the multiple strategies of various social activists—pro-immigrationists, ecologists, humanists, internationalists, and globalists—can be learned and shared.

The Politics of Assimilation

Alongside a politics of purity, one also begins to see a call for a politics of assimilation. Biologists have long recognized the "naturalization" process of plants and animals and that many foreign species become "culturally native," deeply implicated in local cultural geographies. Some of the calls warning about the dangers of a rigid native/alien distinction come from those who recognize the positive contributions of many foreign species. In addition to many crops, vegetables, and economically important plants and animals, alien species have often naturalized into the biotic world in productive and intricate ways. The case of the eucalyptus tree that is now important to native monarch butterflies as well as several bird species reminds us that a vast number of foreign species have been in the United States for centuries, even millennia. These organisms have evolved to create new communities and new biotic interactions, at times creating new equilibria. The wholesale eradication of alien species is particularly unproductive in the face of climate change that is fundamentally transforming our Planet and local environmental contexts. What does it mean to harp on a

return to a past when the environmental contexts the plants evolved into no longer exist? It would appear that we need to move away from a clear separation of culture and environment and toward thinking in terms of relational geographies of plant/human interactions as global environmental change refigures circuits of plant, animal, and human migration, adaptation, adaptability, ecology, and evolution (Head and Atchison 2009).

All of these factors have pushed many to contemplate a less rigid and more flexible approach to the environment, driven less by arbitrary categories of native/alien and more by the empirical realities on the ground. In recent years, a productive site of dealing with invasive species has to do with modifying and expanding our culinary habits. Environmentalists have been getting people to combat invasive species by eating them. For example, in recent years they have tried to harvest crayfish in Lake Tahoe in order to improve the water quality through commercial harvesting. In Nevada, mostly made up of desert, availability of local seafood is exciting. "This is where science stops and you need people to step in and make a decision to improve the lake," a local scientist argued (Onishi 2012). While Asian carp, a delicacy in China, has been overfished there, it is reviled in the Midwest. Companies in the Midwest are now exporting carp to China (Frazier 2010). Locavore movements are popularizing recipes of invasive species (often considered delicacies in their homelands) within the United States. After all, Chilean sea bass, now a delicacy, was less palatable as the Patagonia toothfish! In similar moves, companies in Illinois are trying to convert carp into organic fertilizer as well as introduce products where fish meat is ground into products such as salami, bologna, and even jerky (*PBS Newshour* 2012). A recent *New York Times* story featured Ms. Wong, who having given up fighting her weeds, has instead turned to eating most of them. Moving beyond the narrow offerings of commercial vegetables and herbs, she has taken to growing weeds to wide acclaim and now is popularizing them through a new cookbook (Raver 2012).[5]

A more spiritual take on invasive species comes from those who see invasive species as healing a destroyed Planet. Arguing that many of the species considered invasive are in fact medicinal plants in their home country, they argue that invasive plants are in fact a great resource and boon. Rather than respond with toxic pesticides to control them as some restoration ecologists do, invasive plants can grow on damaged land and perform an essential ecological function to heal both the land and the humans who live on it. In such a view invasive plants transcend the good/evil binary to become the healers of a damaged and sick Planet and world (T. Scott and Buhner 2010).

The Politics of Knowledge and Knowledge Production

Is paying attention to this kinship between my foreign status and that of my objects of study dangerous? After all, isn't objectivity one of the key cornerstones of science? Despite all the claims of objectivity, we have seen again and again in history that science is far from objective. As we have seen in the introduction to this book, a vast literature in feminist science and technology studies shows us that objectivity is an illusion, a mirage that obscures the ways in which science is deeply embedded in its historical and political contexts. That said, a kindred subjectivity is not about a relativistic world where everything goes or where subjectivity comes to stand in for some idea of absolute truth. Rather, thinking natureculturally, thinking with and through kindred subjectivities, forces us to think reflexively. It enables interdisciplinary thinking, compelling us to consider the complex circulations of knowledge. It moves us away from dualities such as labeling all of one category of plants and animals as "evil." Rather, it allows us to understand how we have all come to this country because of complex histories. It allows us to understand that weekend campaigns to go pull out the latest undesirable species from the local pond will not solve the underlying problem. It forces us to acknowledge that we have to think more broadly about national and international environmental policy and how our local problems are connected to larger national policies of energy, development, and globalization. We need to work against an unproblematic scientism in environmental policy and take seriously the institutions of governance, systems of values, and ways of knowing (Jamieson 1995).

The world itself is not disciplinary—plants, animals, and humans are connected through complex histories and geographies. The interdisciplinary experiment I was involved in allowed me to show how moving past disciplinary thinking is helpful in our interdisciplinary interconnected world. I was able to transfer ideas across disciplines to explore the power of language and rhetoric; to bring insights from colonial and postcolonial studies into botany and zoology; to trace the historical, geographic histories of plants, animals, and humans simultaneously; to stretch narrative theory into telling new stories about our nonhuman co-inhabitants. Understanding this means opening ourselves up to a naturecultural world and the vast resources of interdisciplinarity. We cannot understand it any other way. Challenging the nationalist nativist landscapers we read earlier, the Jewish writer Rudolf Borchardt, who was persecuted by National Socialists and who wrote this in 1938, puts it particularly well:

> If this kind of garden-owning barbarian became the rule, then neither a gillyflower nor a rosemary, neither a peach-tree nor a myrtle sampling nor a tea-rose would ever have crossed the Alps. Gardens connect people, time and latitudes. If these barbarians rule, the great historic process of acclimatization would never have begun and today we would horticulturally still subsist on acorns . . . The garden of humanity is a huge democracy. It is not the only democracy which such clumsy advocates threated to dehumanize. (trans. and qtd. in Groning and Wolschke-Bulmahn 2003: 86)

All this is not to suggest that a nonimmigrant could not come to these insights. Indeed, many have. Nor is it to suggest that all immigrants would see these connections. Many do not. Rather, it is to suggest that our life histories, our experiences, our identities, that the vagaries of life can at times open up the world in particular and surprising ways. We should regard these as wonderful and rich opportunities to understand the world in new ways. I would never have seen these connections, never have been able to explore these connections, if not for the rich opportunities of a broad and interdisciplinary training in biology, environmental studies, feminist studies, ethnic studies, critical race studies, postcolonial studies, and queer studies. If our training in the humanities and the sciences could train our eyes, ears, and minds to be open to the world outside the discipline, our theories and knowledge about the world would be that much richer. Scientists and humanists are not removed from the context of their lives. Denying these connections is not objectivity, but rather a lost opportunity.

Toward a Multispecies, Multidisciplinary View of Life

If we open ourselves to a naturecultural world, we have new stories to tell, new narratives, new histories, new cartographies of knowledge. Listening to poets and scientists alike, the naturecultural world is teeming with insight and possibility. The atoms and subatomic particles connect all life and nonlife in this universe. Life on earth is connected through complex evolutionary histories, literally sharing a material connection through the helices of our DNA. And indeed, we are not individuals but multispecies entities ourselves, each of our cells a collection of multiple species that have over the centuries symbiotically evolved to create individual cells and subsequently whole organisms (Margulis 1998, Marguis and Sagan 2002). Yet, our biologies and cultural ideas resolutely center the individual (Gilbert, Sapp, and Tauber 2012). And what about science? We tell a unitary story of "western science" as a linear, progressive story of knowledge produced exclusively in the west (Teresi 2001). Yet, science itself

is the product of multiple miscegenations. Appropriating, embracing, and accumulating knowledge as it traveled through complex histories of colonialism, trade, and empire, science is the ultimate mutt. These pedigrees erased and forgotten, the mythologies of a pure "western" science continue to be told in colonial and colonized worlds. We can bemoan the colonial legacies, but if we continue to tell these stories of some pure entity called "western science" in the twenty-first century, we should also see it as an unfortunate and lost opportunity to tell new stories.

These are the mythologies we tell about science, about ourselves. Divided always, specialized always, each neatly packaged in our disciplinary boxes. Yet, we are connected through molecules, through the helices of our DNA, through histories, through geographies, through colonial travel, through vibrant trade, connected through an ever global, ever connected world. Oliver, a character in Ruth Ozeki's *A Tale for the Time Being*, creates an art project, a botanical intervention he calls the Neo-Eocene, a collaboration with time and place. He argues that the rapid onset of climate change will radically expand the term *native* to include formerly and even prehistorically native species. After all, native depends a great deal on how you define it. We might well have a return to older times!

Like the peach, the kudzu, the snakehead, and the carp, I find my own journeys and travels caught within these circuits of global capital. My own value and worth is tied to vast naturecultural assemblages. I began with noting how in moving from India to the United States, I was transformed from a native to an alien. Yet, my exotic status as the only South Asian graduate student in my department twenty years ago is now a rarity. Today, South Asians and Chinese are overrepresented in science and engineering departments. What was exotic once is now being transformed through the new geopolitical realities into the fear of India and China, the emerging powers of the future. My identity, my fortunes, and indeed all of ours are tied to these global networks and circuits of power. We cannot escape them. Aliens of the world unite! We are all aliens, we are all natives, in this vast entangled naturecultural multiverse.