biogenetic paradoxes of the nation

FINNCATTLE, APPLES, AND OTHER GENETIC-RESOURCE PUZZLES

sakari tamminen

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ABBREVIATIONS

ABGR	National Advisory Board on Genetic Resources
ANGR	animal genetic resources
ANT	actor network theory
CBD	Convention on Biological Diversity
EJA	Animal Breeding Research Group
FABA	organization of Finnish artificial insemination cooperatives
ISK	Eastern Finnish Cattle Breeding Society
LSK	Western Finnish Cattle Breeding Society
MAF	Ministry of Agriculture and Forestry
MENV	Ministry of the Environment
MTT	Agrifood Research Finland
PGR	Plant Genetic Resources Programme
PSK	Northern Finnish Cattle Breeding Society
PVPA	Plant Variety Protection Act
STS	science and technology studies
UPOV	Union for the Protection of New Varieties of Plants

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INTRODUCTION the new biopolitics of nature and the nature of (mis)stakes

It had already been a long day, but the sun was nowhere near setting. As is typical of late-summer afternoons at Nordic latitudes, it would take many hours to reach the horizon. Our day was not over yet. We had finally completed the scheduled lab session and headed back to a little office tucked away in the farthest corner of the building. When we stepped through the frosted-glass doors that separated the lab area from the domain of paperwork, the senior plant researcher sitting within passed me a document from her desk. I was looking at a black-and-white printout listing hundreds of names accompanied by variations on them and locations that had been prepared as part of the Finnish national Plant Genetic Resources Programme. Handwritten notes were jotted next to some of the entries. "That's the initial census of Finnish apples," explained Dr. Antonius. Then she described our mission: to compile the official list for the national mandate for laying claim to "native Finnish" varieties in global forums. "It's more work to do this properly for the plants than the animals because there are many more cultivar variations for a plant than there are breeds for a given animal species. But that you already know from working with the animal-program people, don't you?" she remarked. Dr. Antonius went on to clarify that it was by no means certain that all the cultivars on this initial list qualified for inclusion. The criteria were simple enough—the apple cultivars on the list needed to be alive and found living within Finnish territory. "Of course," she continued, "once we establish that, we need to prove that these apples are natively Finnish, genetically distinct from

Russian and Swedish cultivars." In 2005 "genetically distinct" would be determined through the techniques of genetic fingerprinting (to be explained in chapter 2); as time progressed, techniques for what counted as "distinct" changed, complicating matters. And so the seeds of our journey were planted.

This brief encounter was back in the summer of 2005, when I was conducting ethnographic fieldwork on Finland's national genetic-resource programs. As I reflect on these experiences from the fieldwork in 2004–2009 and my follow-up interviews between 2014 and 2017, I find that this encounter nicely conveys the key challenge facing these programs—that the identification of natural populations (plant varieties and crop cultivars, animal species and breeds, microbes, and so on) had become a national problem both scientific and political. On one hand these programs were aimed at the biological identification of living beings that were considered native to Finland. At the same time they had a goal of compiling population-level inventories and producing politically potent "mandate lists" that would be imbued with the power to represent a nation's native life forms in the global context of biodiversity protection and its legally enforced frameworks. In this wider context, the ethnographic account is not unique to one country. It is far from exceptional in how it reflects the attempts made—with a range of means—to protect natural resources in 173 United Nations member states as of August 2017.[1]

In particular, the account above lays out the first steps in the anthropological exploration of an emerging global biopolitics of nature both in global discourse and as implemented at national level. Thereby it highlights the central themes and related lines of inquiry that are followed in this book. What kind of politics of nature drives these large-scale efforts globally, or why do nations seek to define life forms as "native" in the first place? How do such identification programs deal with the seemingly fundamental contradiction rooted in the division that is so commonly drawn between "nature" and "culture" and wrestle with issues that stem from the historically contingent and constructed nature of the idea of nation in the context of natural life forms and their genetic differences? And what technological, legal, and institutional conditions enable the identification of national forms of natural life en masse?

The answer to these questions must be sought by uncovering the radical changes in how we think about, conceptualize, and govern nature and life at global level while charting a new, complex biopolitical terrain of nature conservation. A close examination of these changes points toward a clear conclusion: the stakes in global biopolitics have shifted.

Most discussions of biopolitics that are inspired by the Foucauldian tradition focus on human populations and fail to consider life forms beyond *Homo sapiens* that have long been central to the development of biopolitical ideas, techniques, and programs (see Pyyhtinen and Tamminen 2011). Others have looked at the so-called nonhuman actants in human networks (Callon 1986; Latour 1993), and some consider animals that have been created by biotechnology for medical research, as with OncoMouse, which was explored by Donna Haraway (1997), or work to understand basic biology through such bodies as *Drosophila* fruit flies (Kohler 1994) or reproduction with the aid of Dolly the sheep (S. Franklin 2007a). Others have looked at crop or animal breeds (hybrid wheat, genetically modified crops, cotton using Bt insecticidal properties, genetically modified soybeans and the like; see, for example, Stone 2010) or at breeds of working dogs or bovines (Derry 2003). An ecological perspective changes things radically, but few anthropologists or social theorists have seriously considered the larger institutional changes required. This book is an attempt to do so while examining efforts to rearrange the meanings of nationhood that tie in with these changes. While other works have offered symbolic analyses of nonhuman icons and national identity (as in Ohnuki-Tierney's [1987; 1993] examination of rice and monkeys in Japan), the interest there tends to lie less in the technoscientific elements as they are analyzed in this book.

A new scramble for resources was set off in 1992 when the Convention on Biological Diversity (CBD) entered the scene, even amid efforts to regulate and contain this predicted result. The CBD, hailed by many as the key symbol of a common global vision for saving what remains of Earth's biodiversity, was signed by 167 nations at the Earth Summit in Rio de Janeiro, Brazil. By 2017 the number of signatories stood at 192. With the goal of protecting biodiversity, the CBD began as an effort to empower and implement conservation biology via the tools of market discourse. By ushering in new articulations of natural objects, such as genetic resources, and reinventing political treaties through national sovereignty over genetic resources, the CBD led to a series of ethical dilemmas and legal aporias, however. And once let out of the box, these continue to stubbornly resist anything more than temporary rebalancing.

The dilemmas and contradictions stemming from the CBD and its implementation are also potent and generative in that they have unintended consequences radiating to adjacent fields of global nature politics such as biosecurity governance. From early on commentators warned that the CBD "has the potential to hamper disease monitoring" by making it harder to share samples quickly and smoothly across borders and seriously ham-

pering efforts to monitor drug resistance, outbreaks of *E. coli*, and so on, thereby creating roadblocks to synthetic biologists (Cressey 2014, 14). This was highlighted when the potential pandemic of avian influenza was raging and Indonesia refused to share samples with the World Health Organization in order to spotlight the inequity represented by the likelihood that such exchanges would lead to none of the much-vaunted benefit sharing benefit-returning, affordable medications to Indonesia (see Fischer 2013). Such developments in a post-CBD world create and in turn are shaped by the constant technoscientific rearrangements that are mediated by political treaties, administrative institutions, economics, and efforts to protect the commons. The unfolding results entail changes within and between the concepts that are at the heart of the most fundamental of our ecological, economic, and political relations. These dramatic shifts come about as new challenges emerge in managing open ecological futures, the dynamics of rights and sovereignty discourses, and historically manufactured legacy identities. I suggest that if one follows these challenges to their source, one finds a hot spring that pours forth radical but fragmentary lines of a philosophy of nature and the nation. A closer analysis reveals how vexing questions about global nature conservation and on issues such as access and benefit sharing are only the most visible symptoms—like the itching rash from a tropical disease—betraying a more far-reaching and experimental political philosophy that renders these discourses possible. In the end, what is at stake is the constitution of a new form of international biopolitics aimed at healing nature's body, a body with marks seared deep into its flesh by unevenly distributed strings of power in the global context.

This book uses four case studies for a multilocale or multisited ethnography of the Finnish effort to honor the mandates of the CBD and subsequent protocols. The aim in this is to explore the ethics dilemmas (attached to ideas of equity and benefit sharing) and legal aporias (nationalizing natural resources and creating ex situ and in situ genetic archives) of biodiversity preservation along with the encroachment of the problematic replacement of the biodiversity framework with the economic and political discourse of "genetic resources." The four cases involve plants, animals (historical and contemporary), and the experimental formulation of administrative policy and institution building. These all exist in parallel with the biopolitics of human populations, and they act in combination with said politics in co-constituting new forms of national imaginaries.

More concretely, the cases I use to contextualize and ethnographically address the Finnish implementation of the CBD cover, in addition to the effort, touched upon in the opening vignette, to establish a "Finnish apple"

by what is termed genetic fingerprinting (chapter 2), the transformation of a Finnish "native breed" that grew out of a nineteenth-century search for a "pure breed" in parallel with racial purity (chapter 1), all in conjunction with historical analysis. The work tells the story of how a national animal breed was literally built to mirror the key ideas of a nation. The next chapter in that story is one of writing life into a national digitally managed set of biobanks, both ex situ (as genetic information and physical samples) and in situ (with small live herds), in which parallels can be seen with a digitally managed national human health-care system (see chapter 3). With these building blocks in place, we can ascend the ladder to consider the high-level policy work and the tightrope it has walked between concerns of administrative and institutional economics (including national wealth) as articulated in the Ministry of Agriculture and Forestry and considerations of the Ministry of the Environment (which is presumably less economically driven, more ecologically driven, or at least more focused on the eco-body of the nation).

While the phenomena showcased are not unique to Finland, the country is well situated to show their patterns clearly and perhaps earlier than many others. Finland is one of the pioneering countries in biodiversity sciences; it is home to the first published studies on biological problems caused by the Green Revolution in both the animal and plant kingdoms. These date back to the 1960s. Today the research institute charged with implementing the CBD is the 1,400-scientist-strong Natural Resources Institute Finland (formed in the 2015 merger of Agrifood Research Finland [MTT], whose scientists I follow in this book; the Finnish Forest Research Institute; and the Finnish Game and Fisheries Research Institute), which features the largest biodiversity research institute in the Nordic region with offices in fifty-three locations across Finland. This network is enhanced by close cooperation with the Nordic Gene Bank and its globally branded Svalbard (Spitzbergen) Global Seed Vault in Norway, and its efforts are spurred on by the climate change that is evident in its Arctic regions. These factors combine to make the Nordic region one of the global centers for the future of global biodiversity thinking—materially, conceptually, and in terms of experimenting with institutional implementations. Echoes in larger patterns can be seen in the implications of negotiations over varieties of grain on the platform provided by the Consultative Group on International Agricultural Research (CGIAR), the International Rice Research Institute, and other such research and seed-banking institutions.

In addition, the historical perspective is rich here. Finland has well-maintained national archives pertaining to agriculture that accentuate

the fact that it has always kept detailed records of national life (Finland has more than 250 years of detailed records of its human population, and other life has long been part of the story). These are kept under the auspices of an important contemporary institution of another sort—the umbrella organization of Finnish artificial insemination cooperatives (FABA) is overseeing a new transformation in the political economy of plant and animal breeding.

The paradoxes evident in the Finnish work and beyond—ethics dilemmas and legal aporias created via the CBD—stem from unresolved contradictions related to the protection of the biodiversity commons by way of economics-anchored notions of commodifiable "genetic resources" that are placed under the sovereign control of nation-states. The aims behind the CBD were coded as three goals that (perhaps to some idealists or to those who saw profit in such cover terms) seemed compatible at first: biodiversity, sustainability, and benefit sharing.[2] Soon the dilemmas and aporias that arose were creating challenges for the unfolding of successive treaty conventions internationally, such as the Nagoya Protocol, and the deployment of institutions and administrative arrangements within domestic (national) power structures.[3] Genetic resources as conceptual, corporeal, and legal objects are difficult to manage because they cut across normal institutional arrangements and their political mandates.

The resulting turbulence, with rearrangements remaining in constant flux, is generated by three main paradoxes or contradictions among those three goals of the CBD and the later protocols (or, rather, the philosophies guiding such efforts more generally). The first tension is between scientific management for high productivity and, on the other hand, concerns over gene loss (forms of benefit sharing and sustainability) or of the hopes held out for the first Green Revolution in the 1960s and 1970s with the fears of threats to long-term biogenetic robustness. Those fears are stoked as monocropping faces challenges in response to issues of pest resistance and overreliance on fertilizers and irrigation and as industrial farming comes under similar pressure related to biochemical factors: antibiotic resistance, new viral infections, and overuse of hormonal stimulation. The second paradox emerged from the uneasy relationship between ecology and economics, in tension between the ideals of conservation biology and imperatives of the "genetic resources" stance. This contradiction was actually already present in conservation biology as soon as it began struggling to make its goals practically attractive, but the balance shifted with the CBD's enshrining of national sovereign rights and the value or potential of genetic resources. Paradox three is found in the conflict between the global commons and a

sense of national sovereignty wherein natural resources are increasingly seen as commercially exploitable, with powerful vested interests overriding the original intentions to save biological materials holding genetic diversity for the common good of humankind. This final tension is between wealth as conceived of by economic interests and something to be treated as a freely accessible, usable, and circulated source of biowealth.

In the remainder of this chapter I provide a brief introduction to the core idea expressed through the CBD and the Nagoya Protocol, set out the three biogenetic paradoxes proceeding from the related dynamics in more detail, explain how each of the empirical chapters elaborates on these, and discuss the methodological challenges of writing an ethnography of patterns developing around a global treaty such as the CBD and subsequent developments—from the crafting of the Nagoya Protocol to the handling of national implementation at higher levels or on the ground.

NATURE ACCORDING TO THE CBD

The idea of exploring, collecting, circulating, and banking nonhuman life—biowealth—is not new. Nonhuman life has been mobilized to the ends of empires and, more recently, nations through much of recorded history, and here the exploitation of exotic species is only half of the story. The export of familiar forms of life to new lands has been as extensive for colonial purposes as the import of exotic species for capitalization. Some claim that the whole colonial enterprise would not have been possible without mobilization of European nonhuman species for repopulation of conquered territories with familiar species. Nonhuman life served as the biological lifeline of colonial practices: "explorers" brought animals and plants along in large quantities and introduced them to the colonized territories. In his classic analysis, Alfred Crosby (1986) has called the effect of these large-scale mobilizations "ecological imperialism." Neither is the issue of the politics of nature, or power struggles over plants and animals of a certain human population, new, especially in the context of the historical accumulation of biowealth (see e.g. Grove 1996; Schiebinger and Swan 2005).

Since the waning of overt colonialism, nonhuman life—plants, animals, and even microbes—has become a focus of renewed global concern of a new sort. In the past five to six decades the practice of bringing animals and plants to new lands on one's travels, which evolved from the traditional approach to colonized territories in the early twentieth century, has given way to a worldwide network of "agricultural introduction stations" created for the ready collection and circulation of exotic materials. Among this modern colonial system's other underpinnings is the planting (introduction) of

newly bred high-yield varieties of plants ostensibly to advance Third World agriculture (Kloppenburg 1988; Pistorius 1997). These practices had effects also in the rapid spread of European human and nonhuman life at the expense of local forms of life, and they also extended the reach and speed of bioprospecting—which is typically described as the exploration and extraction of valuable local natural components for agribusiness and "big pharma" dominated by the global North (see, for example, Parry 2001; Hayden 2004b). With this network the international circulation of the extracted life forms and their valuable components has been convenient and, in most cases, highly lucrative, afforded by "friendly" economic mechanisms such as patents and licensing fees.

In 1992 the Convention on Biological Diversity changed most of that. The usual way to explain the CBD is through the three key objectives cited for it: the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising from commercial and other utilization of genetic resources. Yet even while its signing was hailed in public as a landmark event in the global management of biodiversity for sustainability and for fair and equitable sharing of benefits arising from that use, it brought powerful changes to international nature politics. In biology "biodiversity" is an umbrella term denoting differences found in nonhuman life on scales as far ranging as ecosystem, species, and population level. Within the CBD, however, the term predominantly performs functions other than that embodied in the call for preservation. It is employed for common application in the context of several problems of global ownership and issues of rights over nonhuman life. Here, it no longer denotes a shared global resource. It has become a contentious category of nature within a web of powerful international geopolitical interests and politics of nature. In many ways the convention is, as Corinne Hayden (2003b, 1) put it, "a living and much-contested document," not least because it deals in foundational elements and concepts that are open to alternative political and legal interpretations. The fact that many aspects of the CBD are contested should not come as a surprise since it is in part an international response to an outcry about alleged biopiracy and the practice of bioimperialism within the territories of a biodiversity-rich South by multinational companies based in the North. While this convention is only one on the long list of global instruments aimed at securing rightful distribution of the profits derived from natural resources among nations, it stands out in one key respect. In its assignment of rights and responsibilities related to various objects of nature, it is much more far reaching in its implications than are other global contracts. It cannot be readily ignored.

Article 15 of the CBD granted sovereign power over what it calls "genetic resources" to the signatory nations. Quite interestingly, the CBD remains decidedly ambiguous as to what counts as genetic resources. These are broadly defined as "genetic material of actual or potential value." This ambiguous definition gives the signatory nations an opportunity to claim sovereignty over nonhuman life of all kinds as long as they contain genetic material. The only condition, and a crucial one for the work presented in this book, is that the genetic material be native to ("originating from") the relevant signatory nation. Therefore the CBD potentially covers all nonhuman life that has a (scientifically) proven "country of origin," the condition set within the convention's text itself. With the CBD, then, the previous relatively free global mobilization and circulation of nonhuman life across national borders was restricted. This effect stemmed from three operational (re)definitions found within the convention.

First, with article 15, the only internationally recognized hard-law part of the treaty, biodiversity was effectively transformed from a biological understanding into something quite different. It became rearticulated through a genetic understanding of life with the concept of genetic resources, or as a collection of genetic material found in nature that could be turned into valuable resources—in actuality or potentially. Second, biodiversity became tightly enmeshed within particular political geographies of nation-states through this novel figure of genetic resources. By signing the convention, the parties (with the United States notably absent) decided that all nonhuman life in all its forms could be identified with a country of origin, or a nationhood, and that these forms should become objects of sovereign national genetic governance and should be subject to national-level policies on access and benefit sharing. Under the convention, all genetic materials exchanged (irrespective of their use or the presence or absence of a compensation agreement) between nations ("parties to the convention") must have prior informed consent for the exchange and a certificate of origin for the materials.

Finally, the signatory nations became bound to a new obligation to "as far as possible and as appropriate . . . identify components of biological diversity important for its conservation and sustainable use" (under article 7): they are to provide an identified inventory of their nationally distinct biodiversity "components," including species and communities, genes and genomes, all amenable to interpretation as being the nation's genetic resources. Previously at issue had been individual cases of animals and plants, species, and other forms of life, all representing nonhuman nationhood. With the CBD, however, we see a novel imperative to calculate the totality

of nations' nonhuman material across all traditional biological taxa (such as the plant and animal kingdoms). The convention compels every signatory nation to identify and produce a national inventory of "its" genetic material (or at least that of value), regardless of its place within the taxonomic system applied in the life sciences. With these new operationalizations, the differences in nonhuman life, as biodiversity, are defined through the politics of nationhood in the three senses explicated above within the politico-juridical sphere of the convention.

These are important political translations between nature and culture that have both symbolic and material effects. The CBD demarcates nature by national boundaries cast in terms of nonhuman genetics, and the scientific universality of "nature" is particularized by political divisions. Not surprisingly, the division of Earth's natural entities into collections of the nature of particular nations that is implied by the CBD—and even its sheer possibility—has been subject to heavy scientific and political criticism. The very concept has prompted moral outrage among natural science, social science, and legal scholars. This critique has come in many forms and shapes, beginning within the very bodies that prepared the first provisional drafts for the treaties (e.g., Kloppenburg 1988; Raustiala and Victor 1996; 2004). The scientific critique has focused mostly on problems derived from the twin concepts that are held as the core elements of the criteria for the nationhood of genetic resources under the CBD: the "country of origins" and the in situ element. These arguments hold that it is virtually impossible to determine the origin of a species since all species continue to evolve, mutate, migrate, and cut across political state and national boundaries. The CBD demands that besides fulfilling the "country of origin" condition, any nation claiming sovereignty over genetic resources must possess those genetic resources within in situ conditions. This concept suggests that genetic resources are found within their natural ecosystems and habitats—and, in the case of domesticated species, in the surroundings where they have developed their distinctive properties. Perhaps it need not be said that the definition of "distinctive property" is as unclear and open to interpretative flexibility as is the second criterion for nationhood mentioned in the convention.

Hence, with the convention biodiversity became tightly nested within the sovereignty of nation-states through the concept of national genetic resources. The global cartographic demarcation of nonhuman life took place as these objects of nature were grafted to the foundations of national sovereignty. Quite simply, they also became a new object of nations' politics over life, requiring a new form of nonhuman biopolitics.

This convention and its global effects still inform much of what is going on in global nature politics. The speed of signatories' adoption of the CBD; subsequent problems related to the global circulation of natural bodies that are now heavily restricted by restrictions based on access, use, benefit sharing, and ownership rights; and nations' slow movement toward adopting strict measures for conservation of nature beyond the legal protection of genetic resources have all come as a disappointment to many in the decades following the convention. In 2010, eighteen years after the Rio Earth Summit, the global call to action to save biodiversity (and genetic resources as its particular materializations) was subjected to new reflection by Achim Steiner, executive director of the United Nations Environment Programme (UNEP). In the third edition of *Global Biodiversity Outlook* (GBO-3), the official global letter from the Secretariat of the Convention on Biological Diversity (SCBD) reviewing the progress on biodiversity protection, Steiner expressed his disappointment with the governments' response to the action plans they had agreed upon via the CBD for stopping biodiversity loss at all levels by 2010. The director painted a gloomy picture of the state of biodiversity affairs: "A new and more intelligent compact between humanity and the Earth's life-support systems is urgently needed in 2010—the UN's International Year of Biodiversity. This was the year when governments had agreed to substantially reduce the rate of biodiversity loss: this has not happened" (Steiner 2010, 3).

Steiner continued by pointing out that failure in the global regulatory system had a negative impact on the way national governments reacted to the call to action: "A successful conclusion to negotiations on an international regime on access and benefit sharing of genetic resources is needed. This is the missing pillar of the CBD and perhaps its financial mechanism: a successful conclusion would indeed make 2010 a year to applaud" (Steiner 2010, 3). This "missing pillar" has been one of the most problematic aspects of the global contract since its birth, one that is still under consideration and review by the signatory states. Disagreements about the access to and benefit sharing in successful use of nature's most precious objects, genetic resources, stood in the way of what he termed an intelligent compact with nature.

The pillar missing from the CBD's original text was negotiated, drafted, and agreed on by the signatory states over the course of the first decade of the twenty-first century. The parties to the CBD first, in 2002, agreed on the Bonn Guidelines, a set of nonbinding global guidelines for the drafting of national legislation on the issues of access and benefit-sharing related to genetic resources (SCBD 2002). However, for reasons of inertia inherent

in global politics and decision making, the international work advanced slowly; the work culminated in the Nagoya Protocol only at the tenth Conference of the Parties (COP) held in Japan in 2010. That protocol defined fair and equitable benefit sharing to be based on terms agreed upon mutually between the provider and the user of genetic resources and addressed the terms of access, which was to be based on prior informed consent—all more or less articulated in the terms that had already been employed in the Bonn Guidelines and other preparatory documents.

The Nagoya Protocol brought, or was thought to bring, "legal certainty" to the access and benefit-sharing system of the CBD, and all signatories were assigned a target of national implementation by 2015.[4] This extension protocol to the CBD already shows well how the translation of discrepant global visions into an international agreement codifying one formalized vision in a binding way takes years or even decades to negotiate within global bodies of policy yet still has gaps. In all its legal certainty on the principles for access and benefit sharing, the protocol leaves other conservation measures and their national implementation as they were: unregulated and uncertain.

At the very same meeting in Aichi Prefecture, the CBD targets for a ten-year period (2011–2020) were revised and explicit goals for conservation action defined. The Aichi Biodiversity Targets were born. The conservation measures now extended to twenty more specific actions to be promoted globally, ranging from establishing awareness-raising campaigns to ensuring that the benefits of biodiversity are enjoyed by all of humanity, and beyond.[5] Quite interestingly, the name for the ten-year strategy that was agreed on in Aichi is "Living in Harmony with Nature," although many of the biodiversity target actions that it envisioned have less to do with "Nature" than with issues that are properly human: the global politics of nature and the economic and legal instruments guiding people toward the newly envisioned relationship with nature and laying down the rules for the use of its resources.

The CBD and the Nagoya Protocol are the output of three interlinked processes unfolding within their own trajectories, imbued with related crisscrossing discourses that allow for a reframing of nature and life: first as a system of biodiversity and then as genetic resources to be indexed, conserved, and used in accordance with global agreements. Here, life is simultaneously vital global capital to be utilized in agricultural and pharmaceutical business, corporeal life forms that are in danger of extinction and needing conservation by conservation scientists, and valuable matter that is subject to national policies and legal frameworks only to be governed by

globally agreed-on fair rules on access rights and benefit sharing. In these three processes, the figure of genetic resources has played a key role from the very beginning as a central symbol of the value of nature's diversity and the locus of global power politics. As such, it is the figure that best encapsulates today's unresolved paradoxes in the CBD and the related global protocols.

THE FIRST PARADOX: THE GREEN REVOLUTION × GENETIC EROSION

We can now begin delving into the factors at the heart of the three core paradoxes that are interwoven in the relations we explore. This necessitates a word first about how the factors fit together via the shorthand employed for referring to them. In my use of "×" in the section headings, I am indebted to Michael Fortun (2008) and his notion of the chiasmus in the graphic description of double-binding forces that bring to bear both conjunction and disjunction. The factors are signed largely for contradiction, but we also see a multiplication symbol characterizing the emergence of each paradox as a multiplicative outgrowth of its factors, loaded with many possible senses of production. The emerging relations and problems are *products* with roots in the apparent constituent elements, not *sums* of them.[6]

The first root of the CBD is an outgrowth of advances in green biotechnology and related technological advancements, the latest phase of which has been described as following "the molecular vision of life" (Kay 1993). The Green Revolution in agriculture that began in the 1960s rearranged nature through biotechnology's strivings toward genetic uniformity, toward greater control over and capitalization of the vital processes of nonhuman life. This process and its methods of producing genetic monocultures in plants and animals were so powerful that they prompted widespread scientific concern about genetic erosion and the need for genetic conservation starting very soon after that revolution began—late in the 1960s (e.g., FAO 1967)—and gaining prominence in the last decades of the twentieth century alongside the social inequalities and problems that they more directly generated (Shiva 1991).

Perhaps surprisingly, it was the agricultural scientists themselves who first raised the issue of genetic conservation of traditional animal breeds at the regular meetings of the United Nations Food and Agriculture Organization's (FAO) Animal Breeding Committee. One of the new key technologies of reproduction, the artificial-insemination techniques used for breeds' improvement, had already prompted concerns about unwanted "gene loss" and the emergence of local endangered breeds of animals at conferences in the late 1960s (Tamminen 2015).

One of the first to crystallize the concerns about the negative effects of the Green Revolution on breeding and the management of agricultural species was the young Finnish population scientist Kalle Maijala. In a paper he presented at the European Animal Breeding Committee meeting in 1967, he claimed that "before the beginning of rational animal breeding—that is, 50–100 years ago—there were numerous local native breeds of different species. . . . The problem arises mainly from the fact that effective utilization of the best animals today automatically means setting aside the poorer animals, strains, breeds, and even species." His main message was of a need to reevaluate the rationality of "rational breeding," with "the purpose [being] to consider (1) whether this elimination of genetic material will have undesirable consequences, and (2) if so, how these could be avoided" (Maijala 1971, 404). On the plant-breeding side, the FAO's Technical Advisory Committee to the CGIAR has been another key site of expressing the worry and ongoing struggles surrounding the conservation of diversity of plant genetic resources starting at about the same time in the late 1960s (Pistorius 1997).

For agricultural scientists the threat of genetic erosion meant less genetic material to choose from under the new paradigm of rational breeding, which needs raw material if it is to function. Suddenly, and after only a short while, with new breeding techniques, the diversity and genetic stock found in animal and plant populations began running low because of the introduction of more uniform, high-yield agricultural life forms, which were preferred. This genetic erosion resulting in uniform breeds and lines made them also more vulnerable to pests and plagues. The more daunting side effect of the accordant genetic uniformity and intensive farming was the simultaneous endangerment of species that were not suitable for agricultural production and the destruction of their natural habitats along with larger parts of natural ecosystems. Ecologies that were once suitable for a variety of life forms were transformed into standardized agricultural production platforms that were suitable only for advanced, highly bred forms of life.

Here the destruction of diversity in tandem with the drive toward more genetically uniform species is a symptom; it is visible testimony of the complex power relations found within agricultural policies that lead to such action. However, these actions become understandable only if one considers them in view of the relationships that are enacted in the historically intertwining development processes of agricultural science, business, and the other ideas affecting the desirability of particular forms of life in both its symbolic and material senses—such as the notion of the "purebred

production animals" or "native crops" that was born as a result of the dominant breeding logic.

After the Green Revolution, the animals and plants that were not initially seen as attractive for agricultural business and had been replaced by new, "better" breeds and varieties became important and interesting again to agricultural business. This time, however, the species that had given way to life forms producing a higher yield were valued for something other than their agricultural output qualities. These breeds and varieties were now seen as the raw-material pool of genes ensuring that industrial production could continue despite its tendency to restrict or homogenize the genetic makeup of production animals. The agriculture industry needed this raw material for its own continued existence. Therefore, native or nonbred animals and plants came to be seen as the embodiment of interesting genetic features to be conserved as genetic stocks, which could potentially be used in the creation of ever more productive life forms of the future.

In chapter 1, "Finncattle: Biowealth as National Life," I will take an in-depth look at how this process unfolded in Finland over one century, from the late nineteenth to the mid-twentieth century, with the aim of demonstrating how national biopolitics aligned a particular agricultural mode of production with the breeding sciences of the day and how a national animal breed was literally built to mirror the key ideas of a nation. This all served an explicit nationalistic ideology and created a "pure" national form of life, a bovine population that was articulated simultaneously in the economic and scientific terms of the time. Accordingly, chapter 1 tells the story of Finncattle by rereading the official histories of the breed (Kaltio 1958; Myllylä 1991) against the background of original documentary material found within the archives of the largest national historical archives pertaining to agriculture. These archives are maintained by FABA in Helsinki. With the permission and kind help of that organization's staff (mostly agricultural scientists), I spent about a month in 2005 going through the genealogy of Finncattle starting with the late nineteenth century. The archives were in a vault built into the cellar of the building, filled with the original herd books, letters to the breeders, yearly reports, and yearbooks about Finncattle-breeding activities. Thanks to these time capsules, I can reconstruct a story about the intertwined nature of a bovine breed and a nation in the making through analysis of those herd books and letters along with cooperatives' reports and breeding-association journals found in the FABA vaults. The narration is based on a discourse analysis of the material, with the findings contextualized with other research-based literature on the relevant historical development of Finnish agriculture.

Why start the empirical work here, especially in a book about the CBD and genetic resources? First, the Finncattle breed is one of the first reported examples of breeds falling victim to genetic erosion on the global stage and within the circles of agricultural scientists. In fact, this was one of the local breeds that Dr. Maijala cited early on at the 1967 European Animal Production Conference to exemplify the adverse effects of "rational breeding" on life forms that were bred for other values than just maximizing agricultural profit as defined by milk or meat yield (Maijala 1971). As such, Finncattle are among the first animals to embody the criticism of modern rational breeding practices and the concern about the genetic erosion of local breeds within the global discourse of animal production.

Further, this bovine breed came to embody some of the most central relationships that went into the making of an autonomous and independent nation of Finland in the latter half of the nineteenth century and the first half of the twentieth. The 1800s, the point in chronological history that has sometimes been called the springtime of nations, witnessed not only the emergence of national movements that affected human populations and were produced around them; the creation of national human populations and their demarcation from others were complemented by the emergence of new, nonhuman ones for nationalistic ends in Finland (as in other countries). I show how Finland was centrally concerned with this animal breed by offering an analysis of its codification in language through new scientific conceptualizations of heritage and old myths of the origins of the Finnish race, its corporeal breeding practiced in the name of purification of blood, and the social institutions that were built to stabilize its meaning and to foster the new economy built around its bioprocesses. The analysis also depicts how the breed literally became a part of the national wealth—an early form of biocapital in a globalizing world. In other words, Finncattle became the embodied nexus of relationships through which major parts of Finnish life were arranged: new professions, a new economy, new institutions, and novel links between certain human and nonhuman populations and territorial areas were molded together through its figure.

This breed is a good starting point for another reason, too. The story narrates a certain way of understanding national nonhuman life, how a certain matrix of intelligibility is created and mobilized for many purposes that are collected under the transparent wings of the theme of nationhood. Through the story, I try to show how a particular constitution of the nation with modern grids of intelligibility—a constitution emphasizing the split between nature and culture and another between past and present

forms of life—is made and mobilized as a legitimator of the authenticity of Finnishness in both its natural and cultural manifestations. What this empirical example shows well, I think, is how the three threads of national theory—Man, territory, and double-temporality (as conceptualized by Homi Bhabha 1996)—work in producing national forms of nonhuman life. The "double time" of the nation was constructed such that the continuity of the national genealogical past was readable in the bodies of these animals as far as the national history was rememberable. Finncattle were companion animals of Finns from time immemorial with their particular roots in Finnish territories. The carefully woven myths and the disciplined corporeality of the breed gave one form to the nation, thereby satisfying a "national longing for a form" (to appropriate Brennan's 1990 concept). Finland, once born, required also the birth of a particular nature: the idea that Finland consisted of particular national human populations was complemented with matching bovine breeds, naturalizing the whole idea of nationhood itself.

Case studies of the making of a national animal such as Finncattle are not particularly unique. Nonhuman biological entities have a long history of nativization for the purposes of nations and territorial bio-geopolitics (Ritvo 1992; Pauly 1996; Mansfield 2003; Raber and Tucker 2005; S. Franklin 2006). The story about the cocreation of the Finnish nation and Finncattle between the late nineteenth and mid-twentieth centuries serves here as a contrasting device for teasing out the differences in how nations' nonhuman lives are rearranged today. I claim that in Finland, as elsewhere, these instances of naturalization involved single species, such as varieties of trees, horses, and bovine species, until very recently. Also, it serves to point out the paradoxical relation between the drive toward the production of more efficient agricultural species by breeding genetically homogeneous populations and the need for keeping the species vital by preserving the genetic variation that the breeding practices are acting to reduce. In this biogenetic paradox, the most efficient breeding practice, aimed at reducing unwanted genetic variation, is fully dependent on its other, the genetic variation. The historical developments in the production and management of agricultural life forms, exemplified in this book through the genealogy of Finncattle, also contributed significantly to the emergence of the science of conservation biology in the mid-1980s (Meine 2010). This mission-oriented biological discipline is operating today as one of the drivers behind biodiversity conservation and its methods. I will explore these in detail in chapters 2 and 3, contextualized after the historical background below.

THE SECOND PARADOX: THE MISSION OF CONSERVATION BIOLOGY × THE MISSION OF THE CBD

Around the time when agricultural breeders recognized the problems they faced with excessively uniform populations, environmental biologists outside the agriculture business voiced their concerns about the effects of the Green Revolution on the broader ecological landscape beyond agricultural lands, and they found a way to articulate their worries effectively. They were successful in seeking political weight for the ideas of conservation by shifting from the previous discourses on practices and modes of operation of traditional biology that were interested in individual forms of life toward a system that draws heavily on the premises of ecological thinking, initially conceptualizing diversity as a function of energy flows, the "currency" within the circuits of ecology (Odum [1953] 1975). Yet, from nineteenth-century proto-conservationists to mid-twentieth-century prophets of approaching ecological peril, the arguments for conserving nature gained only a little support, largely among biologists themselves, who nonetheless saw the calls for conserving nature as ethically biased and in contrast to a more scientific, value-neutral approach (Takacs 1996).

However, the effect of the Green Revolution on all living beings, extending beyond agriculture, seemed to give justification for ethical concerns by providing real-life examples: shrinking natural habitats for wildlife and the actual loss of species. Thus, in the early 1980s a new scientific discipline and political discourse emerged. That discipline, which came to be called conservation biology, was ushered in by the First International Conference on Conservation Biology. Held at San Diego's Wild Animal Park in 1978 and organized by San Diego–based biologist Michael E. Soulé, the meeting was an interdisciplinary gathering that brought together "an odd assortment of academics, zoo-keepers, and wildlife conservationists" (Gibbons 1992, 20) and, belying the initial suspicions expressed in many quarters, proved successful. In the next few years the discipline gained ground. One of its early key figures, Stanley A. Temple, defined that the movement's mission was "to develop new guiding principles and new technologies to allow society to preserve biological diversity" (Gibbons 1992, 20), and later, in 1985, Soulé characterized the discipline he had helped found as unique in that it "differs from most other biological sciences in one important way: it is often a crisis discipline" (Soulé 1985, 727).

In 1985 David Ehrenfeld, a politically active biologist motivated by deeply rooted ecology ethics, took action, establishing the Society for Conservation Biology and its journal, *Conservation Biology*, first published in

1987. The explicit aim was the conservation of Earth's biological diversity, the pure difference found within nature and life. According to the mission statement, however, conservation biology should be seen not as wanting to turn nature into a museum of living beings but rather as advancing the idea of the sustainable management of natural resources, an idea borrowed from scientific management in business contexts. Sustainable management of the ecosystem ecology, eventually the whole planet, was the aim, which in its turn influenced related policies and governance. The conservation biologists moved out of the realm of science and into politics, and, indeed, environmental ethics and ecology quickly became a "mission-oriented" advocacy science (Takacs 1992; Escobar 1998; Meine 2010).

With the discourse of conservation biology comes the interesting issue of how science being both "pure" and an espoused aim of advocacy can be wedded or even seamlessly coexist. The very first general textbook on ecology, from 1953 (Odum [1953] 1975, 1–5), pointed out the close connections between ecology and economy on its first pages yet accorded them separate aims and methods. Conservation scientists instead, in efforts to gain more political power for the message of conservation and to demonstrate rationale beyond valuing the intrinsic value of nature and preserving its diversity (many considered "nature" too general and/or too romantic a notion), added the economic calculation of the value of biodiversity to their toolbox. An illustrative example of reasons cited for which the economic discourse should be adopted to further the causes of conservationists comes from the founder of the Worldwatch Institute, Lester R. Brown. He explained the reasons for the friendship between ecologists and economists thus: ecologists understand that all economic activity, indeed all life, depends on the Earth's ecosystem—the complex of individual species living together, interacting with each other and their physical habitats. These millions of species exist in an intricate balance, woven together by food chains, nutrient cycles, the hydrological cycle, and the climate system. Economists know how to translate goals into policy. Economists and ecologists working together can design and build an eco-economy, one that can sustain progress (L. Brown 2001, 4).

The language of conservation biology created a new discourse filled with idioms borrowed from liberal economics in the latter part of the twentieth century in order to speak of scientific ecological management and to "talk hard policy," to provide easy-to-understand cost-benefit calculations to conservation's ends, to help policy makers set conservation priorities based on the cost of the losses, and to create sustainable policies and further progress. Early articulations of this were presented by C. S. Holling

and W. C. Clark (1975). For nature to become manageable, it had to become rearticulated as a resource since resources can be assigned a market value—a value that needed to be protected in a liberal economy, optimally managed by the conservation community, and finally translated into policy measures. In his provocative book about conservation of biodiversity, Joseph Vogel went so far as to claim that biodiversity can be saved only when genetic information in genetic resources is privatized because "self-interest can achieve that which inadequate noble intentions cannot" (Vogel 1994, 7).

The mission-oriented science of conservation biology was also responsible for the introduction of the concept of biodiversity, which really took off when it gained institutionally powerful support. The concept was thrust into public and biological discourse in the 1986 National Forum on BioDiversity organized by the highly esteemed National Academy of Sciences (NAS) of the United States and cosponsored by the Smithsonian Institution. More specifically, the forum was first suggested by the senior program officer for the Board of Basic Biology, Walter Rosen. He managed to sell the idea to the notoriously conservative, neutral, and objectivity-focused NAS even though the notion of biodiversity already hinted at arguments on behalf of nature's conservation. He invited influential biologists such as E. O. Wilson and Peter Raven to be conference speakers early on.

Prominent biologist Daniel Janzen recalled the event some years later and admitted how, for researchers of his ilk, it was all about "coming out of the closet" to raise awareness of the impending destruction of nature's diversity: "The Washington Conference? That was an explicit political event, explicitly designed to make Congress aware of this complexity of species that we're losing. And the word [biodiversity] . . . was punched into that system at that point deliberately. A lot of us went to that talk on a political mission. We were asked, will we come and do this thing? So we did" (Janzen, cited by Takacs 1992, 37; see also Vogel 1994, 8–14).

Environmental groups and the ecological movement at large had found a useful concept in biodiversity, which was promoted in the media and became the meat of very successful lobbying in political institutions to bring a change in prevailing conditions and practices driving the loss of diversity, a shift toward more sustainable policies. As a concept, biodiversity entered print in 1988 in an edited book composed of the presentations given at the BioDiversity meeting. The book, simply *Biodiversity*, was edited by Wilson, who credited the invention of the term to Rosen. The key element in this part of the chronology is that while the idea of and research on biological differences found in nature long predates this conference, it is here that those differences were formulated simultaneously as

a "global resource, to be indexed, used, and above all, preserved" (Wilson 1988, 3).

With the CBD, and through redefinition of "global resource" in terms of nationally claimable genetic resources as described above, a point of contention has formed around whether and to what extent these efforts to conserve biodiversity are, in fact, thinly veiled forms of bioprospecting. Are genetic resources that are already collected, preserved, and commercially used in practice a resource that can be considered part of the global commons or not, and how should any access and benefit-sharing issues arising from the scientific and commercial prospecting and use of genetic resources be addressed? Quite a few works of various kinds have been written on the subjects of biodiversity, bioprospecting, and global contracts (Shiva 1993; Hayden 2003b; Agrawal 2005; Hall 2007). In addition, there are various treatises about their historical developments over the years within international institutions such as the UN and at high-profile botanical gardens (e.g., Pistorius 1997; see also Parry 2004, 201–11), none of which offer an easy solution to the questions above.

What has been left largely unexamined in previous studies is the way in which particular forms of life become nationally identified as genetic resources in the local practice of biodiversity conservation. The CBD not only rearticulated biodiversity as genetic resources but also translated the general mission of conservation biology into national missions that were enacted and supervised by the sovereign signatories to the convention. Thus, a new, complex territory of decision making emerges: How, with what technologies, and under which intersecting rationalities are the genetic resources brought to life and managed in the national implementation of the CBD? This question cannot be answered without consideration of two key challenges in the local implementation.

The first is this: How can particular species and breeds be identified as having a nationhood or belonging to a particular nation through genetic identification? Second, given our long-standing modern dichotomy of nature versus culture, how and by which technoscientific apparatus can nature become culture? How can nationhood be identified in and located within genetic difference? Once identified, how is the value of those national forms of life pragmatically managed and optimized through the selection-specific bodies representing the purest forms of national genetic resources (see Hayden 2003b, chap. 6)?

In simple terms, there can be no nationally valuable resources without the identification of distinct genetic profiles and the transformation of the life forms into practically manageable forms of life, all in order to

ensure that this vital material is available for processes of economic optimization and political naturalization. This bricolage work in a space of highly productive contradictions (K. Fortun 2001) is an expression of double-bind imperatives (Bateson 2000) that leads to ethical plateaus where national values, multiple technologies, and local decision-making practices meet the global Convention on Biological Diversity to create new configurations of national forms of life.[7]

Hence, what I am interested in are the articles of the CBD (especially article 15) as far as they are the basis for biological nationalization guaranteeing the internationally recognized genetic sovereignty of each signatory. National genetic sovereignty involves a novel redefinition of the signatory nations' natural resources and their boundaries with new instruments for identifying or fingerprinting all national "genetic material of actual or potential value" (in the words of the definition in the CBD's article 2). This amounts to literally inscribing the national identity in flesh, matter, and life. What is of interest in the protection of native rights under the biodiversity treaty is the recasting of those rights in economic and genetic terms. Value, potential or actual, is defined exclusively in terms of the origin claims of nations that are mediated by globally recognized institutional instruments of calculation and audit. The naturalization and indeed nationalization of nonhuman life translates the older or more mundane forms of biological national wealth into an explicitly genetic one. What is more, the nation itself, by the same token, becomes newly defined by these emerging nonhuman genetic corporeal boundaries. The new biotechnologies—the technoscientific means—that make this translation possible have, in human contexts, been sources of major debate in recent decades, especially with regard to the definition of national populations, the markers of difference at population level, and the sparking of questions about ethnic profiling at the level of the individual. However, they have not been fully examined with regard to nonhuman nationhood. If the Finncattle in chapter 1 are one way of showing how the totality of a nation's life—human and nonhuman—is connected and produced through various nature/culture interfaces creating each other, the rest of the book asks in what ways the practices by which the collective life of a nation is collected and reproduced now operate in a different mode, especially with regard to the definition of nonhuman populations, and how, in a very concrete way, novel space-times of nations are created, requiring a novel constitution of the nation.

With chapter 2, on the Alexander apple, my account of the national genetics programs starts to reexamine the three key threads of national theory that need to come together in the identification of nationally distinct genetic

features: population, territory, and the double time of the nation. These are explored thread by thread in relation to the question of nationally identified forms of life beyond human populations. First, following the crafting of nonhuman forms of life as made possible by new biotechnologies, I analyze in chapter 2 how genetic fingerprinting and the creation of national populations of plant genetic resources problematize the territorial rooting and historical explanations as principles in the identification of national forms of life. More specifically, I study how a variety of apple tree called Alexander is becoming genetically identified as part of Finnish nature. The chapter offers an account of the work of a population scientist employed at the national research institute that was assigned scientific responsibility for corporeal identification of Finnish plant genetic resources. The material for this chapter was collected between 2005 and 2007 through participant observation, with the documentation of field trips around Finland in search of apple varieties and the accompanying laboratory work aimed at their genetic profiling.

The chapter takes on the problematics of territorial and temporal dimensions of national theory within the context of twenty-first-century nonhuman nationhood. In the context of scientific fact making, Bruno Latour has argued that "most of the difficulties we have in understanding science and technology proceed from our belief that space and time exist independently as an unshakeable frame of reference inside which events and place would occur. This belief makes it impossible to understand how different spaces and different times may be produced inside the networks built to mobilise, cumulate and recombine the world" (1987, 228). Analyzing the ways in which DNA fingerprinting practices work in the identification of nonhumans, I argue that new genetic technologies and practices complicate national identification and reconfigure the creation of national nonhumans. Here, different times and spaces become relevant in comparison to the historical case of Finncattle. In short, another grid of spatio-temporal intelligibility is laid down for assessing the nationhood of nature's species inventory.

Developing this line of argument, chapter 3 ("Stilled Life") contextualizes the creation of genetic resources in the national and international political economy over nature and follows the construction of new infrastructures of life illustrated by animal gene banks. The empirical material for this analysis comes from extended participant observation over the four years I spent visiting the scientists working for the Animal Genetic Resources Programme. What took a long time for me to understand about the politics of genetic resources—the manner in which multiple rationalities

and values condition the living corporeal matter that will be recognized and optimized as representatives of nations' genetic resources—was something that is exemplified in the event I describe here. The chapter tells a story about a weeklong field trip taken in 2006 to the world's largest breeder of white Finnsheep, which was aimed at banking the gametes of this animal breed for conservation purposes. I ask how and under which matrix of reasoning particular gametes are selected as the purest representatives for the Finnish sheep breed stored in the national gene bank. To paraphrase Donna Haraway (1997, 7), I am extremely curious as to what kinds of bodies, what forms of frozen as well as motile sociotechnical alliances (also called social relationships), the nonhuman nationhood in Finland consists of in the twenty-first century—here embodied by the Finnsheep gene bank.

I claim that three central interests intersect within the materiality they embody and that these condition their identification processes all the way down to their corporeality. Thus, while different spatio-temporal configurations are required for the identification of national genetic resources, they are enacted by large-scale networks and gene bank infrastructures that are needed to guarantee their local figure—a rooting as national beings of nature. Paradoxically, these networks also provide for their easy global mobilization.

To unpack this argument, the chapter empirically analyzes the creation of the first national ex situ animal gene bank (which is usually the only conceptualization of gene banks applied in the popular media). I claim that two central matters of concern, the threat associated with ecological extinction and anxiety about economic losses related to diminishing global genetic variance, have merged into a distinctive field of global reasoning. Within this scientific-economic apparatus, ecological and economic interests are not readily subsumed by each other. My account follows how the concerns are translated into material interests that radically transform the Finnsheep breed by conditioning the process and the instruments by which particular genetic resources are collected, processed, and finally stored in the gene banks, the new infrastructure for conserving national life.

THE THIRD PARADOX: GLOBAL COMMONS × NATIONAL SOVEREIGNTY

Finally, the idea of biodiversity as a global resource, as defined by Wilson in the quotation above, is related to the development of the international politics question of commercial exploitation of natural resources, especially of genetic resources. The development of international nature politics has followed the paths of larger processes of globalization, questioning the idea of national sovereignty and its powers to control the flow of capital,

information, and—most importantly—corporeal forms of nonhuman life. In the latter part of the twentieth century, bioprospecting, the search for capitalizable forms of life, as perpetrated by the multinationals of the North within the territories of the biodiversity-rich South, disrupted the latter nations' old ways of protecting their national interests and led to accusations of systematic bioimperialism and biopiracy, or the unwarranted prospecting for and use of traditional knowledge and useful genetic materials (Shiva 1993; Moran et al. 2001).

Early international agreements on plant breeders' rights made in the wake of the Green Revolution, such as that in the 1961 formation of the International Union for the Protection of New Varieties of Plants (UPOV) among European nations and the 1970 Plant Variety Protection Act (PVPA) in the United States, helped identify ownership rights only for commercial varieties developed in the North while deregulating the raw material of those found in the South. This left both the nations and their plant (and other living) materials without international legal protection against one-sided bioprospecting (Kloppenburg 1988). Thus, the older agreements and acts functioned, and still function, as a fragmented global regime dictating the access to raw materials and derivate outcomes of some key forms of life that are vital to agribusiness while many other forms of life found in nature were left unregulated at the global level.

Aware of these previous developments, international nature-conservation institutions, such as the World Conservation Union (IUCN), the United Nations Environmental Programme, and in later years the FAO, too, explored a more ambitious global contract: they envisioned a political and legal possibility of setting up a global convention on biodiversity. In 1987 the UNEP Governing Council came up with an ambitious plan. It wanted to coordinate international efforts to protect biological diversity, and the ad hoc working group that was set up to identify the key elements for a globally coordinated action identified that a global treaty would be needed to bring the world together around the conservation of biodiversity. In the working sessions of the ad hoc group, the idea of conserving and protecting the rights to raw materials was extended beyond plants to animals, covering domesticated and wild species both in their natural habitats and in managed gene banks (or in in situ and ex situ conservation). It was in the preparatory meetings for the CBD that one of the working groups dealt with fundamental issues such as the scope for the convention and the legal obligations of the signatory parties. That group came up with the propositions by which "the scope for the Convention was gradually broadened to include all aspects and facets of biodiversity" (Glowka et al. 1994, 1–2).

Looking beyond the scope of the convention, another working group had been appointed, tasked with considering the conditions for the convention, especially the access and benefit-sharing rights related to biodiversity. Although the first working group came up with the proposition that biodiversity is a common concern of humankind, it was the second working group that then qualified this proposition. Thus, according to one of the negotiators who was present, the "proposition that biodiversity should be considered as the 'common heritage' of humankind was rejected at an early stage, since most components of biological diversity are situated in areas under national jurisdiction" (Glowka et al. 1994, 3). In other words, the negotiators ran into the global power politics between the North and South, between the technologically advanced but biodiversity-poor countries and the biodiversity-rich yet technologically less advanced ones.

What happened, then, was a rearticulation of sovereign rights over biological diversity, especially over valuable resources found in nature: genetic resources, in line with the earlier Stockholm Declaration, or the Declaration of the United Nations Conference on the Human Environment held in Stockholm in 1972. Principle 21 of that declaration proclaimed a global understanding that the signatory states had "the sovereign right to exploit their own resources pursuant to their own environmental policies." This right was articulated anew in the CBD's preparatory work, which again recognized the signatories' sovereign rights over their natural resources and, hence, also their sole authority to determine access to genetic resources—as long as these are recognized as "national" and embody "actual or potential value" (CBD, article 15).

Yet, and as is now obvious from the above, the "common concern" over the conservation of biodiversity was reframed in the final CBD text in language speaking of "a common responsibility to the issue based on its paramount importance to the international community as a whole" (Glowka et al. 1994, 3). This recognized that biological resources fall under the national legislation of each signatory country while simultaneously restating the moral global obligation to conserve biodiversity. The initial regimes for fair and equitable access and for benefit sharing that were envisioned in the CBD have attracted much critical commentary from legal, ethical, and social perspectives since even before the convention was opened for signature. At base, the argument goes that the CBD claimed to address key issues for the conservation and sustainable use of biodiversity but offered no valid mechanism for doing so and that the focus on ownership and genetic resources "delaminated" biodiversity, rendering other layers the focus of global politics. However, the key tension still revolved around the genetic

resources. The G77 group, the largest organization of developing countries in the United Nations, promoting the voice and economic interest of the countries of the South, repeatedly called for more specific and legally defined terms for access and benefit sharing related to genetic resources.

Eighteen years after the CBD's initial adoption, the G77 group stated in 2010 that the conservation of biological diversity "cannot be achieved without the sustainable use and the fair and equitable sharing of the benefit arising from genetic resources. . . . In doing so, an effective international framework must be in place," and "the Protocol on Access and Benefit Sharing at the next meeting . . . to be held . . . in Nagoya, Japan, is of a strategic importance" (Alsaidi 2010, 1). The Yemeni ambassador to the UN, Abdullah Alsaidi, also reiterated the call for all G77 countries to work toward the adoption of a globally binding policy on genetic resources. His message was that "the G77 and China takes this opportunity to underscore the need for great mobilization and political will such that we will be able to adopt the protocol on access and benefit-sharing and to ensure that the post-2010 [biodiversity] targets are able to be met" (Alsaidi 2010, 2–3).

And so the success of conservation measures and compliance with biodiversity targets were explicitly linked to the global recognition of sovereignty and ownership over biological resources by the G77 countries in 2010 in a process that led ultimately to the adoption of the Nagoya Protocol. That protocol, which entered force in October 2014, serves as a clarification and a more legally refined supplementary protocol to the CBD, specifying some of the aspects that the initial treaty left too open for implementation (see above, and the guide to the Nagoya Protocol in Greiber et al. 2012). Thus the Nagoya Protocol reiterated the legal sovereign power over biological resources that was specified in its mandate, and its reception has followed a path uncannily familiar from the mixed reports on the adoption of the CBD that were quoted earlier.

In 2014 a piece in *Nature* reported that "a major international agreement is coming into force to combat 'biopiracy'—profiting from biological products while failing to compensate the community from which they originate. The Nagoya Protocol aims to ensure that developing nations benefit when their plants, animals or microbes are used by foreign scientists" (Cressey 2014, 14). The author concluded that "new rules will also present challenges for synthetic biologists, who combine genetic code from many different organisms to create drugs or sensors" (Cressey 2014, 14–15). As is obvious, the tensions between countries and scientists, health officials, and biotechnology industry stakeholders are not going to be resolved with the simple introduction of the Nagoya Protocol, and perhaps they will never be

resolved in a satisfactory way. It is easy to see that the ethical plateau created by the intensified confrontation of power between the South and the North has continued after adoption of the Nagoya Protocol. Several excellent works have been written that explore the inherent tension of interests connected with access and benefit-sharing issues from the standpoint of various disciplines both in light of the CBD's entry into force (e.g., Brush 1998; Parry 2001; Hayden 2003b) and in the wake of the Nagoya Protocol (Kamau et al. 2011; Vogel et al. 2011).

What has been left largely unexamined in previous literature, however, is the distribution of power and renegotiation of the social contracts within the nations that are implementing the CBD. The CBD is not only a global, international political treaty but also a political challenge, an experiment in domestic implementation, for it questions the existing boundaries of national political institutions and their powers. As Philippe Le Prestre (2002, 270) has stated, the CBD "touches not only upon man's relationship with nature and international relations but on the distribution of domestic political power as well." Different interests and institutional topographies at the national level have a significant impact in shaping how genetic resources are naturalized as national objects of nature politics.

In the final, empirically oriented chapter, I follow the shaping of genetic resources within Finnish nature politics where policies on genetic resources are explicitly made: in the Ministry of Agriculture and Forestry. Although the CBD had already been signed by the European Union as a nonstate party in 1992, Finland was affected very little in its national implementation of the convention until the adoption of the Nagoya Protocol, after which an EU-wide regulation on genetic resources (Regulation [EU] no. 511/2014) was issued in 2014. In practice, this regulation still requires only that the EU member countries establish a minimal institutional framework to oversee national compliance, consisting of a national focal point for coordination with other relevant parties and a competent authority to check whether users of genetic resources comply with their obligations. Hence, regulation at the level of the EU region leaves most of the implementation in the hands of nation-states and their institutions. I wanted to look at what is forming in the space left to those actors.

Institutional observations within the national Board for Genetic Resources at the Ministry of Agriculture and Forestry provided me with access to the highest level of political decision making related to genetic resources in Finland—the drafting of policy and juridical evaluations of the appropriateness of the legal frameworks now in place. I first sat down in a cushioned chair in the ministerial meeting room in the spring of 2005,

and I completed my silent observations at the end of 2007. In that time I also gained access to the Access and Benefit Sharing subgroup, which was charged with the task of providing Finland with a draft policy on access and benefit-sharing issues related to national genetic resources. To draft the policy, this group had to survey the complex interrelations of national and international regulations pertaining to various natural entities and how these are connected with the novel objects of genetic governance.

I also followed the legislation-drafting process over the years and conducted follow-up interviews in 2014–15 at the time when the draft national legislation for genetic resources was about to be passed forward in its first form for official approval by the Parliament of Finland and again shortly after the law had been brought into force in 2017. The policies and political principles specified in the draft and in the final accepted text, together with the infrastructure in which it is embedded, constitute the key site where particular conditions of possibility for the nationhood of genetic resources are constructed. It is in this process that propositions are drafted in order for science to prove valid the domains of nature that are turned into genetic resources—simultaneously setting the stage for the political, juridical, and material emergence. It is here, in short, that the sovereignty of a nation is exercised through inclusions and exclusions of natural entities. I will explain these observations in more detail in chapter 4.

What becomes clear in following the unfolding of the national policies in the making is how much they, in turn, are conditioned by something more than the humans working at the ministry—how national interests are a matter of constant negotiation between actors with different potentiality for agency above and beyond each individual member of the working group for genetic-resource policies. The political infrastructure and national principles for delegating political power among ministries, the CBD and its partial reaffirmation in the Nagoya Protocol, the weighting between actual and potential value of genetic material, and the suggestion to bifurcate national nature through an amendment to the constitution all show how complicated and relational a figure of nature Finland's genetic resources really are. Indeed, not only is the ontological base of "genetic resources" questioned; so is the Constitution of Finland, providing clear categories of nature and culture. What is at stake here is not only the definition of rights of ownership over living bodies of animals, plants, microbes, and the information these contain within their genetic makeup but also the matter of how the sovereign might claim the right to decide on those rights in view of the fact that private ownership of fleshly living beings is at present ultimately protected in the national constitution.

My analysis focuses on the institutional and domestic power relationships and their effects on the definition of criteria applied in identification of genetic resources: some forms of nonhuman life are considered national while others are not. I conclude the chapter by analyzing Michel Foucault's claim that "sovereignty and discipline, legislation, the right of sovereignty and disciplinary mechanics are in fact the two things that constitute—in an absolute sense—the general mechanisms of power in our society" (2003, 39).

I strive to show how this is still one of the most important unresolved paradoxes of the living communities in the form of a "nation" and the biopolitics it is based on: to have a sovereign right to include select life forms within the communal sphere of the nation and as part of its natural body, to discipline and manage its vital forces, while at the same time excluding certain other life forms from entering the sphere of the nation. In application of the latter right, the sovereign renounces its sovereignty with regard to itself, and the paradox flows from the fact that the sovereign nation is the sovereign itself and cannot thus dismember or divide itself. The sovereign entity also must set limits with reference to the other, nonnational and alien forms of nonhuman life, in order to discipline and take care of the native species of Finland. Quite simply, this is a new articulation of the paradox of sovereign power in relation to biopower, the right to kill and to let live. According to Giorgio Agamben (1998), this is the "hidden foundation" of all politics. I will elaborate on and evaluate this claim, too, in chapter 4.

WRITING THE BIOGENETIC PARADOXES

The arguments presented in this work have grown out of experiences gained via participant observation, whether scribbled down in unorganized field notes or encapsulated by photos taken for visual evidence as authenticating devices. Only later were these to be cross-pollinated with archival and theoretical work. This confession is a reiteration of the classic distinction between field and home in anthropological practices, which has been contested as a spatial metaphor to situate research theoretically or in practice (Appadurai 1988; Gupta and Ferguson 1997a). As in most anthropological works, the distinction does not hold as a clear-cut boundary with natives associated with one or several bounded geographical locations. Yet I want to keep to this metaphor of location for several reasons.

During my fieldwork, I spent a considerable amount of time directly involved with genetic-resource-program activities—in and around laboratories, fields, meetings, and offices of scientists. My first experience with the genetic-resource programs was in the plant program (PGR) in January 2004.

I then met my first informant at her office at MTT's headquarters some one hundred kilometers north of Helsinki. She was Mia Sahramaa, the plant scientist nominated to be coordinator of the national efforts involving plant resources. She and her work became a very fruitful entry point to the large network of the national programs. Dr. Sahramaa provided me with interviews and contact information for the people and institutions directly and indirectly involved in the calculation of national genetic resources. She also took me to meetings that extended beyond the usual boundaries of her work as a scientist and required her to act as a top-notch networker. Most importantly, she made possible my access as an observer of the national Board for Genetic Resources under the Ministry of Agriculture and Forestry. With her kind support and interest in the work, I was brought into the fold of the ministry and gained access also to the internal draft documents that were produced and circulated between the meetings. However, Dr. Sahramaa left the post in 2006, and new coordinators took over her work.

Those new coordinators were two of her colleagues who both had many years of experience in genetic-resources work, Merja Veteläinen and Kristiina Antonius. I first interviewed Dr. Veteläinen in 2004 about the national genetic programs, around the time she returned to Finland after having spent several years with the Nordic Gene Bank in Alnarp, Sweden. She provided me with very insightful interviews and background support for my work before the actual fieldwork began. But it was Dr. Antonius who brought me closest to the scientific work performed in the PGR context. I followed her apple identification work—genetic fingerprinting as it is called—for almost as long as I did the field research.

I first entered her office in the spring of 2004 not knowing that one of the chapters of the book would be about her work. I began to take interest in her apples only a year and a half later. Since then, as chapter 2 makes clear, I shadowed her in the fields in the hunt for apples and also acted as her assistant in the laboratory. The prolonged observation period, almost three years of following her work, is explained by the seasonal rhythms of nature: not much work on apple identification can be done between late fall and late spring in Finland since the trees are hidden under a thick layer of snow and thus are practically unidentifiable or even unfindable. Because of these environmental conditions, the work must be performed during the right seasons, the summer months of June to August, to gain easy access to the trees and to their fruits, the apples.

My first contact within the Animal Genetic Resources Programme was with Juha Kantanen in the spring of 2004. The first meetings consisted mostly of interviews and of Dr. Kantanen pointing me to the basic literature

on animal genetics. He kindly granted me access to his research laboratory after my request to see the practical work he performs with the team. Since then, I have been a regular visitor to his laboratory and have accompanied him in his research with animals and on fieldwork travels around Finland. He also arranged a mentor for me in laboratory work, Ilma Karhu, who patiently initiated me in the secrets of genetic assays and thereby added further value to the lab access.

Most herds of animals such as of Finnsheep are kept by individual farmers who, from the viewpoint of the genetic-resources programs, provide outsourced shepherding for the national aims of conservation. The scattered herds are all easily calculated by the national programs since they are subject to nationwide controlled population management—all but a small fraction of the professional animal breeders are already enrolled in centrally managed national breeding programs run by the artificial insemination cooperative FABA. The constantly updated vital statistics of sheep populations are readily accessed via the internet, so they are at any given moment just a mouse click away. This simplifies the planning of the future direction of the breeding (with the central database and related calculation operations handled by associated software recommending mating partners within the flock), and it makes day-to-day practical breeding management very easy for the farmers (by allowing the comparison of current vital statistics of the flock with those of flocks owned by others). These benefits are also the main reason behind their enrollment in the programs. Together, these geographically separate animal populations form what is called the national herd of Finland, merged in databases and in the genetic-program calculations by the conservation scientists.

However, while the national herd is easy to compose digitally in the database and textually in planning documents aimed at maintaining genetic diversity in the genetic programs, genetic conservation of this flock—the transformation of live animals from their in situ mode of existence into genetic resources ex situ—is a tricky business. The aims of the individual farmers must be aligned with those of the animal program (for animal genetic resources), and, in more practical terms, the animals themselves must be willing to go along with the plans of the scientists. I learned this in the autumn of 2006 when I followed the construction of the first ex situ gene bank for the national sheep, Finnsheep. The week's fieldwork, which gives a real-world animal backbone to chapter 3, was done on a semiprivately owned farm in southern Finland.

Similarly, most Finncattle, also taken to be one of the native Finnish animal breeds, are in small herds around Finland. The interesting part

of the story here is that many of these animals are on two prison farms (in Pelso and Sukeva), where the in situ gene bank is maintained by the prisoners. I was along for two trips to these facilities in 2004 and 2005 during which Dr. Kantanen surveyed the cattle population and planned future conservation strategies. Besides the northern geographical location of the prisons, what is interesting here is the institutional location of the cattle. During the fieldwork I began to wonder whether there might be something more than a metaphorical connection between the human and nonhuman prisoners. In Foucault's classic work on the birth of the modern prison system, the overarching aim is made clear to be no longer that of punishment. It is disciplinary action aimed at making bodies docile and productive, to contribute to the national economy. With this theoretical analogy to jailbirds, I began wondering why the Finncattle were put in prison in the first place.

I returned to FABA's Finncattle archives with that question at the front of my mind. After systematic study and analysis of all available documents and some related interviews, the reason for the Finncattle's imprisonment slowly began growing more understandable. I will return to this issue by recounting the genealogy in chapter 1, so I will note here just that their imprisonment serves both as a metaphor and as a very real power effect on their corporealities that was brought about by the larger developments in agribusiness over the past two centuries. The same developments have been instrumental in transforming them from an animal breed into genetic resources, from a matter of fact to a matter of concern that is emblematic of the entire global family of genetic resources.

Finally, the institutional observations at the government ministries have provided me with a first-person view of how the genetic resources became a political concern in Finland. The focus of my observations was on two aspects of ministerial work in preparing the official background memo on the access and benefit-sharing issues related to valuable genetic material. That is reflected in the argument presented in chapter 4. On one hand, I traced how genetic resources became an issue for official politics and how the Finnish political infrastructure first identified valuable genetic material institutionally. Tellingly, it was the Ministry of Agriculture and Forestry rather than the Ministry of the Environment that was officially tasked with preparing the first national stance, even though the official representative of the latter was joint leader of the group in her capacity as secretary. The institutional location alone betrays how, at that time, genetic resources were considered primarily economic resources of the nation, not ecological objects of environmental concern. The institutional

location of the issue of genetic resources has shifted again in the 2010s, and drafting the first legislation proposition ended up being a task of the Ministry of the Environment. I wanted to find out how this institutional relocation affected the political framing of the issue, so in 2014 and 2015 I interviewed the key persons drafting the new legislation. Accordingly, my first observations were focused on the role of institutional location, the distribution of domestic power over nature, and the valuation processes related to the institutions and their political mandates. The second set of observations is about what gets written in the draft and preparatory documents and how, that is, the ways in which the issue of the ownership of genetic resources challenges the existing social contract between the citizens and the state, between private individuals and the body of the national community.

Thus, the initial site of this ethnographic study, a national program, emerges in the course of the work as a collection of multiple sites dispersed across various sets of spatial and temporal coordinates, as a heterogeneous network of various nationally relevant locations, and as novel emerging forms of life (Fischer 1999) in themselves. An early recognition in science and technology studies (STS) is that, of course, science and technology are not separate realms nested in, or situated outside, society but form part of the same social fabric and practices that coconstruct it (Latour and Woolgar 1986; Latour 1987; Woolgar 1988; Knorr Cetina 1999). The methodological mobility with regard to my field, or the makings of genetic resources as my object of study, is accounted for by the fact that, for the most part, this particular formation of culture and these novel objects of nature have been created in a constant movement back and forth between places.

This kind of ethnographic method can therefore be characterized best as what has been called a "multisited ethnography," also referred to as a "multilocale" or "multisite" ethnography (Marcus 1995; Fischer 1999; K. Fortun 2001; Sunder Rajan 2006; Callison 2014; C. Ozden-Schilling 2016; T. Ozden-Schilling 2016): it is very much a mobile ethnography aimed at following the actors through their multiple trajectories in a nation-gathering technoscientific enterprise. While observing this gathering practiced by scientists, my own narrative is a special kind of cultural gathering that itself loops back to the production of biowealth as a marker of accumulated national identity as wealth (Clifford 1988).[8] The challenge in this type of fieldwork-based research is the question of the borders of the field and the constitution of the object of study itself. Does the field travel with the scientists themselves, and what about the other key unit of analysis, the nation? The problem of the local and the global persists in the

anthropological literature as a question about the field of observations (e.g., Gupta and Ferguson 1997a; 1997b; Mitchell 2002; Tsing 2005), especially when scientific activity is taken as the object of observation.

Various metaphors other than that of the field have been suggested for science-in-action (E. Martin 1997) and the traveling facts of science. While the problems related to fieldwork are deconstructed in detail in anthropological literature of recent decades (fieldwork as authenticating device, the field as too limited a research object, the field as a narrated homogeneous fiction, and so on—see, for example, Clifford and Marcus 1986; Clifford 1988; Gupta and Ferguson 1997a; Clifford 1996), I wish to use it precisely because of its naturalistic connotations and to see how the metaphor sometimes falls in relationship to very literal field topographies during the work. In this, I am concerned not so much with asking what kind of narrative fiction the metaphor allows for as with purposes of locating the interplay between the narration and the material, the very articulation of what is thought to be social/cultural and natural/biological.

The work traces the links between spatially bounded, special sites of observed practices and is an attempt also to discuss these simultaneously with previously (predominantly) disparate theoretical locations. Thus, in the following stories refined ministerial boardrooms in the nation's capital are interwoven with the provincial barns where the national herd is kept, and the well-organized and spatially bounded laboratories that are equipped to read off genetic signs of nationhood are linked to locally contingent practices and to the vast geography of the dispersed knowledge of local breeds and varieties of nonhuman. In other words, they address the idea of the universality of biological sciences versus contingent differences in scientific reasoning that could be termed national in their pursuit of identifying national genetic resources as particular nonhuman forms of national life. Lately, questions about location and movement, about locality in its relation to the global, have been cut short within some of the arguments presented in science and technology studies, most notably in actor network theory (ANT), where the question is rephrased as being about the length of translations in strivings to resolve the problematic difference of scale.[9]

Here, of course, one may question the reason for performing any translations at all and what could be made of a pure description of them. I find Kaushik Sunder Rajan's (2006) argument about the inherent tensions in creating biowealth at the junctures of local and global rather illuminating with respect to the problem of articulating what is at stake here methodologically. His claim is that "it is impossible to write about global processes of exchange simply by localizing them to their manifestations at

particular field sites; but it is equally impossible to appreciate the complexities of these global processes without making them specific, since for all the hegemonic potential of globalization today, it does manifest in particular, tendential ways in particular, tendential places" (Sunder Rajan 2006, 233).

However, analytically, it would be too simple to resort to only this kind of methodological argument, specificity, which itself tends to naturalize difference in spatiality, in local differences assuming—and, perhaps even worse, justifying—a preconceived national/local existence. Writing is what all anthropologists ultimately do, and it is through this writing that "we become aware of creating more and more gaps. Hence our activities forever magnify a background of potential significance against which—whatever the scale—we try to actualize subtle re-imaginings, and build models that will take everything important into account" (Strathern 1991, 119). Therefore, rather than just assuming a specific localization and its assumed tendency for cultural difference, I am interested more in what makes a difference or how it is possible for a difference to manifest itself and how these differences are found in the nonhuman life that is made to constitute a genetic demarcation of a locality—a nation—from the rest of the world through a figure of genetic resources. As I will argue later, the existence of a nation consists of marking off boundaries in and through living bodies and the populations from which individual bodies are derived, a very Foucauldian standpoint. But to see how this empirically plays out requires a methodological orientation of seeking to understand how national genetic resources suddenly came to be in all their modalities of existence—conceptual, institutional, juridical, corporeal.

Numerous studies have shown that things called facts are constructed through meticulous practices across the boundaries between scientific fields. Although STS and the anthropology of science are more broadly considered to be approaches to rather than theories of scientific and technological practice in all its shapes and forms, they still are approaches that are tuned to understanding the emergence of the new in science and through technological means. Yet for seeing how and in what sense genetic resources are a novelty, I suggest, a dialogue with the theory of nation must be opened. Nation and nationhood as particular communities of life have been approached in the theory in terms of human identity, in the discursive sphere limited by an inherent humanism.

The discussion has for many decades been the domain of historians and historically oriented social scientists, and the gaze has seldom been directed toward the ongoing mundane practices by which nations are currently being reproduced. The early notion of nations as a "daily plebiscite"

became, of course, taken for granted after Ernest Renan's lecture in 1882 (Renan [1882] 1996), but insight into how our contemporary communities are continuously reproduced by a multitude of (scientific) practices is in the quantitative minority in the academic literature (but see Billig 1995). In taking part in the associated dialogue, I situate this book at large among the texts and approaches found within the anthropology of science and, more specifically, flag the kinship with the anthropology of emerging forms of life (Fischer 1999; 2003) and multispecies ethnography (Kirksey and Helmreich 2010). *Biogenetic Paradoxes* is about the practices of identification and negotiation required for assembling the nation in a new way—a new way to perceive and write about the intersecting worlds of the human and the other forms of life, of the simple species boundaries, the social communities and the interconnectedness of life within the sovereign sphere of the nation, and the new modes of governance within the global biopolitics of nature today.

NOTES

INTRODUCTION

1 The legislative, administrative, and policy measures related to the Convention on Biological Diversity and the subsequent Nagoya Protocol are tracked by the Access and Benefit-Sharing Clearing-House, provided by the United Nations. Through the clearing-house mechanism, records are made available online at https://absch.cbd.int/search/nationalRecords.

2 The call for equity is often dichotomized into a struggle between the global South and the global North, stereotyped as the former being the domain of genetic resources while the latter possesses the technoscientific processing apparatus. This book does not delve into the details of the strides being made in this direction in the form of efforts to provide a scientific apparatus to the global South—especially Brazil, India, and China.

3 "Aporias" here refers to paradoxes, contradictions, opposed imperatives, or double binds, to use the terms popularized in the anthropology literature by Callison (2008), Fischer (2003; 2009), K. Fortun (2001), M. Fortun (2008), Haraway (1991; 1997), Masco (2006), Sunder Rajan (2006), and others who are concerned with the ethics and power of technoscientific rearrangements.

4 "Legal certainty" is what the official documents of the meeting laud as a key achievement, but I flag the expression since nothing is as uncertain as legal certainty decided at a global level. I will explore the issue in depth in chapter 4.

5 See the strategic goals at https://www.cbd.int/sp/elements/default.shtml.

6 This book focuses on productive tensions resulting from the main aporias set forth by the Convention on Biodiversity and its three goals of sustainability, sovereignty rights, and access and benefit sharing. Similar focus on the productivity of contradictions, double binds, and paradoxes as can be found in earlier works by Gregory Bateson (*Steps to an Ecology of Mind*, 1972) and Kim Fortun (*Advocacy after Bhopal*, 2001); see also Fischer 2003. More recently, Michael Fortun (2008) has analyzed the productive contradictions stemming from the deal between Roche and DeCode Genetics Inc. of Iceland, and used "×" to signal the different tensions contained in the deal and beyond in the subheadings of the book, for example, by starting his introduction with "Lava × Land." I follow the same kind of graphic signaling of the three key tensions inherent in the CBD in the introduction.

7 In simple terms, these are temporarily stable configurations that ultimately get upset as values, technologies, and local decision making change, requiring new balancing work, after which a new ethical plateau is created, which, in its turn, remains stable for a time.

8 The words of James Clifford (1988, 215–20) may be instructive here: "Description of culture is itself a form of collection. . . . Some sort of 'gathering' around the self and the group—the assemblage of a material 'world,' the marking-off of a subjective domain that is not 'other'—is probably universal. All such collections embody hierarchies of value, exclusions, rule-governed territories of the self. But the notion that this gathering involves the accumulation of possessions, the idea that identity is a kind of wealth (of objects, knowledge, memories, experience), is surely not universal. . . . In the West, however, collecting has long been a strategy for the deployment of a possessive self, culture, and authenticity."

9 For Latour, "macro" and "micro," "local" and "global" are just poorly chosen ways to speak about the extent of an "actor network," wherein translations and various mediations create and extend the spatio-temporal existence of an event. Various mediators do not just "localize" interactions and channel, divide, centralize, or reduce. They also "globalize" them: they increase them, translate them, complicate them, and carry them forward (Latour 1996). With regard to the process of globalization in this sense, Latour has stated that a better name for actor network in describing the assemblage of connections and relations would be "actant-rhizome" (Latour 1996, 19), a concept referring to Deleuze and Guattari's (1987) work on rhizomes. A rhizome has neither a beginning nor an end; instead, it connects any point of passage to any other. In contrast to that of the rhizome, the metaphor of the actor network is not primarily spatial. It also incorporates the idea of temporal and agential heterogeneity (see Latour 2002a, 248–49).

1. FINNCATTLE

Epigraphs: Foucault 1979, 228; Wilmot 2007, 412.

1 See DAD-IS, http://dad.fao.org/.

2 Several studies have established clear links between nations and the management of their natural animal populations, be they cattle (Ritvo 1992; Taussig 2004), sheep (S. Franklin 2007b), salmon (Lien 2005), or any of various plants and trees (Schiebinger 2004). I continue an exploration of these linkages and expand the analysis historically to the early moments of nation formation in Finland.

3 The precursor to the Senate, a governmental council, was established in 1809 when the Grand Duchy of Finland was declared a political entity. Tsar Alexander I of Russia named the institution the Senate to mark out independence from the Russian Senate. The economic and judicial functions evolved and were reinstitutionalized, respectively, to the Cabinet working under the