



# Unruly Edges: Mushrooms as Companion Species

for Donna Haraway

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**ABSTRACT** Human nature is an interspecies relationship. In this essay, Haraway's concept of companion species takes us beyond familiar companions to the rich ecological diversity without which humans cannot survive. Following fungi, we forage in the last ten thousand years of human disturbance history with feminist multispecies company. Cereals domesticate humans. Plantations give us the subspecies we call race. The home cordons off inter- and intra-species love. But mushroom collecting brings us somewhere else—to the unruly edges and seams of imperial space, where we cannot ignore the interspecies interdependencies that give us life on earth. There are big stories to tell here, and they should not be left to the human triumphalists who control the field. This essay opens a door to multispecies landscapes as protagonists for histories of the world.

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Domination, domestication, and love are deeply entangled. *Home* is where dependencies within and among species reach their most stifling. For all its hyped pleasure, perhaps this is not the best idea for multi-species life on earth. Consider, instead, the bounteous diversity of roadside margins. Consider mushrooms.

This essay is indebted to Donna Haraway not only for the concept of 'companion species' but also for the permission she offers us all to be both scientist and cultural critic—that is, to refuse the boundaries that cordon nature from culture—and besides, to dare tell the history of the world in a single sentence, or certainly a short essay.<sup>1</sup> In this spirit, my essay begins with companionate experience and biology before moving to the history of domestication, European conquest, and the politically-and-biologically diverse potentials of the seams of global capitalism. These materials present a fungal argument against too avid an ideal of domestication, at least of women and plants.

## Mushrooms in a multi-species landscape

*Wandering and love of mushrooms engender each other.* Walking is the speed of bodily pleasure and contemplation; it is also just the speed to look for mushrooms. After the rains, the air smells fresh with ozone, sap, and leaf litter, and my senses are alive with curiosity. What better than to encounter the orange folds of chanterelles pushing through the dark wet or the

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<sup>1</sup> Donna Haraway, *The Companion Species Manifesto: Dogs, People, and Significant Others* (Chicago: Prickly Paradigm, 2003). Haraway expands the pet-lovers' term 'companion animal' to speak about interspecies relationships.

warm muffins of king boletes popping up through crumbly earth. The excitement of colour, fragrance, and design—not to speak of pride to be the first to find them—well up. But of these delights the best, I think, are two: first, the undeserved bounty of the gift; and second, the offer of a *place* that will guide my future walks. These mushrooms are not the product of my labour, and because I have not toiled and worried over them, they jump into my hands with all the pleasures of the unasked for and the unexpected. For a moment, my tired load of guilt is absolved, and, like a lottery winner, I am alight with the sweetness of life itself. *Bismillah irachman irachim*.<sup>2</sup>

Delight makes an impression: an impression of place. The very excitement of my senses commits to memory the suite of colours and scents, the angle of the light, the scratching briars, the solid placement of this tree, and the rise of the hill before me. Many times, wandering, I have suddenly remembered every stump and hollow of the spot on which I stood—through the mushrooms I once encountered there. Conscious decision can also take me to a spot of past encounters, for the best way to find mushrooms is always to return to the places you found them before. In many cases, the growing body (mycelium) that gives rise to mushrooms as its fruits lasts from season to season; besides, some mushroom growing bodies are life-long companions to particular trees. If you want to find chanterelles in central California, you must look under oaks—but not just any oak: You must look for *the* oak that lives with chanterelle mycelium, and you'll know it because you have seen the mushrooms there before. You visit the spot enough, and you know its seasonal flowers and its animal disturbances; you have made a familiar *place* in the landscape. Familiar places are the beginning of appreciation for multi-species interactions.

Foraging worked just this way for most of human history. To find a useful plant, animal, or fungus, foragers learned familiar places and returned to them again and again. High-powered rifles and fish-overstocking make it possible to succeed in killing something in a random pass through the countryside; but sportsmen still do better with a local guide. Through their familiar places, foragers learn not just about ecological relations in general, but also about the stochastic natural histories through which particular species and species associations happened to flourish in particular spots. The familiar places of foraging do not require territorial exclusivity; other beings—human and otherwise—learn them too. Their expansive and overlapping geographies resist common models, which divide the world into 'your space' and 'mine.' Furthermore, foragers nurture *landscapes*—with their multiple residents and visitors—rather than single species. Familiar places engender forms of identification and companionship that contrast to hyper-domestication and private property as we know it. You who search for a world of mutually-flourishing companions, consider mushrooms.

*Mushrooms are well known as companions.* The concept of 'symbiosis'—mutually beneficial interspecies living—was invented for the lichen, an association of a fungus and an alga or cyanobacteria. The non-fungal partner fuels lichen metabolism through photosynthesis; the fungus makes it possible for the lichen to live in extreme conditions. Repeated cycles of wetting and drying do not faze the lichen, because the fungal partner can re-organise its

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<sup>2</sup> In the name of God, the most bountiful and the most merciful.

membranes as soon as water appears, allowing photosynthesis to resume.<sup>3</sup> Lichen may be found in frozen tundra and on parched desert rocks.

For mushroom lovers, the most intriguing interspecies companionship is that between fungi and plant roots. In *mycorrhiza*, the threads of the fungal body sheathe or enter the roots of plants. Indian pipes and other plants without chlorophyll are supported entirely from the nutrients they gain from fungi in their roots; many orchids cannot even germinate without fungal assistance.<sup>4</sup> Here plants gain sustenance from fungi; in more cases, however, the fungus obtains sustenance from the plant. But a mycorrhizal fungus is not just selfish in its eating. It brings the plant water and makes minerals from the surrounding soil available for its host. Fungi can even bore into rocks, making their mineral elements available for plant growth. In the long history of the earth, fungi are responsible for enriching soil thus allowing plants to evolve; fungi channel minerals from rocks to plants.<sup>5</sup> Trees are able to grow on poor soils because of the fungi that bring their roots phosphorus, magnesium, calcium, and more. In the area I live, foresters inoculate the roots of the Douglas fir seedlings they plant with *Suillus* (slippery jack) to aid reforestation. Meanwhile, many of the most favoured mushrooms of cuisine are mycorrhizal. In France, truffle farmers inoculate tree seedlings in fenced plots.<sup>6</sup> But, of course, the fungi are perfectly capable of doing this work themselves—but with a more open geography. And so we mushroom-lovers wander, seeking the companionship of trees as well as mushrooms.

Fungi are not always benign in their interspecies associations.<sup>7</sup> Fungi are dauntingly omnivorous in their carbon conversion habits. Various fungi subsist on live as well as dead animals and plants. Some are ferocious pathogens. (*Cryptococcus neoformans* kills many AIDS patients.<sup>8</sup>) Some are irritating parasites. (Think of ringworm or athlete's foot.) Some slide through their hosts' intestines innocuously waiting to arrive in a pat of dung in which to flourish. Some fungi find totally unexpected substrates: *Cladosporium resinae*, originally found in tree resins, has found a taste for airplane fuel, causing blocked fuel lines.<sup>9</sup> Some hurt one host while living happily with another: *Puccinia graminis* bonds with the barberry bush and feeds flies with its nectar to produce the spores that will kill as they grow on wheat.<sup>10</sup> Fungal appetites are always ambivalent in their benevolence, depending on your point of view. The ability of fungi to degrade the cellulose and lignin of dead wood, so feared in protecting wooden houses, is also fungi's greatest gift to forest regeneration. Otherwise, the forest would

<sup>3</sup> D. H. Jennings and G. Lysek, *Fungal Biology*, second ed. (Oxford: Bios Scientific Publishers, 1999), 75. Recent studies of interspecies mutualisms emphasise the active and strategic work of all involved species. For example, studies of nitrogen-fixing bacteria in the root nodules of soybeans show that soybeans discourage bacterial strains that deliver less nitrogen—by limiting their oxygen (E. Toby Kiers, Robert Rousseau, Stuart West, R. Ford Denison, "Host Sanctions and the Legume-Rhizobium Mutualism," *Nature* 425, 4 September (2003): 78-81.

<sup>4</sup> Orchids were a fashion in nineteenth century botany; mycorrhiza were first appreciated by Western scientists when it was found that many orchids depend on fungal partners. G. C. Ainsworth, *Introduction to the History of Mycology* (Cambridge: Cambridge University Press, 1976), 102-4. Indian pipes: Clyde M. Christensen, *The Molds and Man* (Minneapolis: University of Minnesota Press, 1965), 50.

<sup>5</sup> Nicholas Money, *Mr. Bloomfield's Orchard* (Oxford: Oxford University Press, 2002), 60.

<sup>6</sup> Money, *Bloomfield's Orchard*, 85.

<sup>7</sup> The term *fungi* refers to a larger biological classification (a *kingdom* contrasted with *plants* and *animals* among others) of which mushrooms form one part. All mushrooms are fungi; not all fungi bear mushrooms.

<sup>8</sup> Money, *Bloomfield's Orchard*, 25.

<sup>9</sup> Jennings and Lysek, *Fungal Biology*, 67, 138.

<sup>10</sup> Money, *Bloomfield's Orchard*, 172-79.

be stacked with dead wood, and other organisms would have a smaller and smaller nutrient base. Meanwhile, the role of fungi in ecosystem renewal makes it more than obvious that fungi are always companions to other species. Species interdependence is a well-known fact—except when it comes to humans.

*Human exceptionalism blinds us.* Science has inherited stories about human mastery from the great monotheistic religions. These stories fuel assumptions about human autonomy, and they direct questions to the human *control* of nature, on the one hand, or human *impact* on nature, on the other, rather than to species interdependence.<sup>11</sup> One of the many limitations of this heritage is that it has directed us to imagine human species being, that is, the practices of being a species, as autonomously self-maintaining—and therefore constant across culture and history. The idea of *human nature* has been given over to social conservatives and sociobiologists, who use assumptions of human constancy and autonomy to endorse the most autocratic and militaristic ideologies. What if we imagined a human nature that shifted historically together with varied webs of interspecies dependence? *Human nature is an interspecies relationship.* Far from challenging genetics, an interspecies frame for our species opens possibilities for biological as well as cultural research trajectories. We might understand more, for example, about the various webs of domestication in which we humans have entangled ourselves.

Domestication is ordinarily understood as human control over other species. That such relations might also change humans is generally ignored.<sup>12</sup> Moreover, domestication tends to be imagined as a hard line: You are either in the human fold or you are out in the wild. Because this dichotomisation stems from an ideological commitment to human mastery, it supports the most outrageous fantasies of domestic control, on the one hand, and wild species self-making, on the other. Through such fantasies, domestics are condemned to life imprisonment and genetic standardisation, while wild species are ‘preserved’ in gene banks while their multi-species landscapes are destroyed. Yet despite these extreme efforts, most species on both sides of the line—including humans—live in complex relations of dependency and interdependence. Attention to this diversity can be the beginning of an appreciation of interspecies species being.

*Fungi are indicator species for the human condition.* Few fungi have found their way into human domestication schemes, and only a few of those—such as fungi used for industrial enzyme production—have had their genomes badly tampered with. (Supermarket button mushrooms are the same *Agaricus bisporus* as those growing in meadows.) Yet fungi are ubiquitous, and they follow all our human experiments and follies. Consider *Serpula lacrymans*, the dry rot fungus, once found only in the Himalayas.<sup>13</sup> Through their South Asian conquests, the British navy incorporated it into their ships. *S. lacrymans* flourished in the unseasoned woods often used in ships for naval campaigns, and thus it traveled around the world. By the early nineteenth century, the decay of wood in British naval ships was called a “national

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<sup>11</sup> An important exception to this generalisation is the medical and ecological literature on human diseases and parasites, in which the co-existence of species is of central concern. Yet this exception underlines the problem. As long as the relevant other species are found—at least sometimes—inside the human body, we can study them in relations of co-habitation and dependency. If the other species is outside the human body, that is, part of the ‘environment’ for humans, analysis suddenly switches to a discourse of human impact, management, and control.

<sup>12</sup> Haraway’s work on dogs is a key interruption. See Haraway, *Companion Species*.

<sup>13</sup> Jennings and Lysek, *Fungal Biology*, 138.

calamity," and panic ensued until the introduction of ironclad war ships in the 1860s.<sup>14</sup> Dry rot, however, just kept spreading, as the fungus found new homes in the damp basement beams and railroad ties of British-sponsored civilisation. British expansion and dry rot moved together. As in this example, the presence of fungi often tell us of the changing practices of being human.

The domestication of humans is one place to begin.

### **The origin of the family, private property, and the state<sup>15</sup>**

*Cereals domesticated humans.* The love affair between people and cereals is one of the great romances of human history. One of its most extreme forms began some ten thousand years ago in the Near East, where people began to cultivate wheat and barley. In this nascent domestication, people transferred their affection from multi-species landscapes to shower intimacy upon one or two particular crops.<sup>16</sup>

The most curious thing about Near Eastern grain domestication is that through most of this area it has been perfectly easy to gather large quantities of wild wheat and barley without the hard work of cultivation. Even in the 1960s, large stands of wild grain made foraging simple.<sup>17</sup> The story we tell ourselves about the 'convenience' and 'efficiency' of growing crops at home is just not true; cultivation almost everywhere requires more labour than foraging. There were probably many reasons—from religion to local scarcity—to try experiments in domestication; but what maintained and extended grain cultivation was the emergence of

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<sup>14</sup> Ainsworth, *Mycology*, 90-93.

<sup>15</sup> Engels' classic just-so story emphasises the role of pastoralism in developing notions of private property; the first property, he argues, was in herds. Frederick Engels, *The Origin of the Family, Private Property, and the State* (New York: International Publishers, 1972). Notions of property used to regulate the reproduction of herds inspired male control of reproduction in human families, ushering in "the world historical defeat of the female sex." Feminist thinkers such as Eleanor Leacock and Evelyn Reed brought this classic back into circulation in the 1970s, where it entered lively discussions of the long history of social inequality, particularly in feminist anthropology. See, for example, Rayna Reiter, ed., *Toward an Anthropology of Women* (New York: Monthly Review, 1975); Michelle Rosaldo and Louise Lamphere, eds., *Woman, Culture, and Society* (Stanford: Stanford University Press, 1974); Mona Etienne and Eleanor Leacock, eds., *Women and Colonization: Anthropological Perspectives* (New York: Praeger, 1980); Eleanor Leacock, "Introduction," in Engels, *Origin*, 7-67.) By the mid-1980s, feminist anthropology had turned to the specificity of ethnographic research to learn more about the cultural construction of gender. While this has led to many important insights, it has also left the field of long-duree storytelling to misogynists, including sociobiologists, medical doctors, and s-f writers, most of whom are not well read in history and anthropology. Perhaps it is time for feminists to re-enter the fray.

<sup>16</sup> The transition from a focus on landscapes to a focus on crops may be long and incomplete: The management of multi-species landscapes to favour certain game or wild plants has often been a step toward crop domestication. Harold Brookfield, *Exploring Agrodiversity* (New York: Columbia University, 2001), 64-69). Furthermore, a broad-spectrum multi-species foraging focus can itself be seen as a historical product. In the Near East, a shift toward gathering multiple small-grain grasses is associated with the 10,000 years before domestication. Ehud Weiss, Wilma Wetterstrom, Dani Nadel, and Ofer Bar-Yosef, "The Broad-Spectrum Revisited: Evidence from Plant Remains," *Proceedings of the National Academic of Sciences, USA* 101, 29 June (2004): 9551-9555. It is also not completely fair to imagine domestication as limiting farmers' attention to just one or two crops; Near Eastern domestications produced legumes, fiber crops, and green vegetables as well as several cereal grains. Some of these came to farmers' attention first as farm weeds, and they tended to retain a secondary status in field management. Wheat and barley established precedence and held pride of place in farmers' hearts.

<sup>17</sup> Crop scientist Jack Harlan tried the experiment of harvesting Near Eastern wild wheat, using a flint-bladed sickle modeled after ancient tools; he collected the equivalent of one kg of clean and highly nutritious grain per hour. Jack Harlan, *Crops and Man* (Madison, Wisconsin: American Society of Agronomy and Crop Science Society of America, 1975), 12, 172.

social hierarchies—and the rise of the state. Intensive cereal agriculture can do one thing better than other forms of subsistence: support elites. States institutionalise the confiscation of a share of the harvest. Across Eurasia, the rise of states and their specialised civilisations is associated with the spread of intensive cereal agriculture. In some places, states followed agriculture; in other places, agriculture followed states. In each case, states promoted agriculture through their symbols and armies. Sometimes they criminalised other forms of subsistence; only outlaws would refuse the gift of state fertility. And for those inside state heartlands, this gift of fertility could maintain itself, at least in good times, through love.<sup>18</sup>

The biological transformation of people and plants that accompanied intensive cereal agriculture is best understood, then, through the rising tide of hierarchical social arrangements—and the entanglement of the state. States encouraged sedentary, stable farms. States encouraged family-based households and guaranteed the forms of family property and inheritance that drew lines within and between families. The *pater familias* was the state's representative at the level of the working household; it is he who ensured that taxes and tithes would be drawn off the harvest for the subsistence of elites. It is within this political configuration that both women and grain were confined and managed to maximise fertility.<sup>19</sup>

The grains selected through domestication had big, high-carbohydrate seeds; high carbohydrate diets allowed women to have more children. Instead of working to limit fertility, as most foragers do, people suddenly wanted as many children as possible—not only because of the fetish of fertility but also because the family needed more labour for the cereals. The cereals did not care whether family or non-family labour raised them, and there was no dearth of *people*; but state-supported *property* encouraged labour inside the family, i.e., children. Having lots of children was not just nature at work; not all animals work to maximise reproduction. Out-of-control and non-sustainable human reproduction is a feature of a particular human domestication: the love affair between people and cereal grains. This obsession with reproduction in turn limited women's mobility and opportunities outside of childcare. For all its matriarchal possibilities, it seems fair to call this interspecies love affair, echoing Frederick Engels, "the world historical defeat of the female sex."<sup>20</sup>

As farmers have intensified their efforts to feed larger and larger human populations, they have turned toward an ever-narrowing range of crops—and of family forms. Yet the standardisation of crops and their human families has nowhere been complete. Wherever the

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<sup>18</sup> Richard O'Connor argues that intensive rice agriculture was the key element allowing successful state formation in mainland Southeast Asia. "Agricultural Change and Ethnic Succession in Southeast Asian States: A Case for a Regional Anthropology," *The Journal of Asian Studies* 54, no. 4 (1995): 968-96. Clifford Geertz's *Negara* (Princeton: Princeton University Press, 1980) illustrates the practical autonomy of intensive rice agriculture in pre-colonial Bali; state power did not mean control of irrigation arrangements, but rather of the aesthetic structure of power and love. I show how state expansion created grain-intensive landscapes in Southeast Asia in "Agrarian Allegories and Global Futures," in *Nature in the Global South*, eds., Paul Greenough and Anna Tsing (Duke University Press, 2003), 124-69.

<sup>19</sup> The ambiguous nature of this form of love is suggested by the fact that ancient Near East grain cultivators have been associated with the nearest approximation to a 'matriarchal' religion that most historians can come up with. The fetishisation of reproduction made fertile women icons of the sacred. Women's other potential talents may not, however, have been equally appreciated—and woe to the barren woman.

<sup>20</sup> See footnote 15. It would be incorrect to imagine that the confinement of women associated with cereal agriculture initiated a time of ease for the female sex. On the contrary, the work of preparing crops—especially grain—for food or storage required ever-greater investments of female labour.

power of the state attenuates, landscapes of greater biodiversity and greater social diversity continue to flourish. However, the idealised model of sedentary confinement has been powerful *in itself* in keeping margins marginal. During my research with shifting cultivators of Kalimantan, Indonesia, some women said of my wealth and privilege: “If I had what you have, my feet would never touch the ground.” Women’s confinement is the center of a beautiful dream of order and plenty.

*Fungi are the enemy of monocrop farms and farmers.* Since ancient states encouraged intensive agriculture, there have been many and varied pressures to standardise crops. Since the nineteenth century, scientific agriculture has surpassed the efforts of earlier domestications in standardising crops; it has made standardisation itself the “modern standard.”<sup>21</sup> Today, only standardisation allows farmers to market their crops. Yet standardisation makes plants vulnerable to all kinds of disease, including fungal rusts and smuts; without the chance to develop resistant varieties, the crops may all go down at once. The emergence of vast fields of grain offered fungal plant parasites a field day—and a reputation as the enemy of civilisation and, later, progress. As the cultivation of non-grain crops has been modeled on the ideals of intensive cereal agriculture, they too have succumbed to every sort of mold and blight: a warning to us all.

The most famous fungal catastrophe may be the Irish potato blight. Potatoes were grown in Ireland with monocrop zeal—but a zeal forged in the reverse image of state-led grain expansion. British colonisation had driven Irish to the most marginal lands; military raids burned and confiscated grain crops; only underground tubers allowed Irish survival. By the late eighteenth century, potatoes had become the Irish staple. When politically motivated landlords opened new land for tenant cultivation, tiny farms proliferated. The resulting family tenants, supported by potatoes, married sooner and had more children. The human population grew from five to eight million in fifty years, even as the economy staggered under colonial control, enforcing dependence on potatoes.<sup>22</sup> Monocultivation exacts a toll. Europeans had imported just a few of the several thousand landraces of potatoes domesticated by South Americans.<sup>23</sup> *Phytophthora infestans*, potato late blight, was first reported around 1835 as a local problem in England. The fungus slowly built up until the rainy, muggy summer of 1845, when suddenly

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<sup>21</sup> Jan van der Ploeg describes the starting point of modern crop science as an “ideal plant type.” This ideal sets a standard of superiority, organises breeding, and requires remaking the entire agricultural operation to fit its requirements. Van der Ploeg contrasts the science of potato standardisation with local knowledge about potatoes in the Andes, which allows heterogeneity. “Potatoes and Knowledge,” in *An Anthropological Critique of Development*, ed. Mark Hobart (London: Routledge, 1993), 209-27.

<sup>22</sup> Redcliffe Salaman, *The History and Social Influence of the Potato* (Cambridge: Cambridge University Press, 1985) [1949], Chapters XI-XVI.

<sup>23</sup> Salaman, Chapter X, reports on European imports and the varieties developed from them. After the Irish famine, new varieties multiplied as European breeders sought resistance. However, the goal has always been to find the one *best* variety rather than to encourage diversity in the field. In contrast, Jonathan Sauer, *Historical Geography of Crop Plants* (Boca Raton: CRC Press, 1993), 145-55, discusses South American cultivars. Noting the still-large varietal diversity of subsistence farming, he writes, “A village may have over 100 clones with names recognized throughout the village” (148). On potato late blight, he comments, “Like other successful parasites, the fungus is apparently not usually lethal where it and its hosts have long coexisted. The blight was recognized as a problem in South America only after development of commercial potato monoculture, e.g., in Chile and Peru about 1950” (152).

every Irish plant was infected, as well as all the tubers in storage. Famine resulted; a million people starved, and perhaps two million emigrated to the United States.<sup>24</sup>

As genetic manipulation and cloning have affected more and more crops, the fungal alarm sounds again and again. Consider the acacia plantations that our wise developers have thought could replace the tropical rainforests of Borneo: Grown from a single clone, they are uniformly susceptible to a heart rot that hollows out their centers.<sup>25</sup> Why anyone would think to grow them then is another story—and one that takes us to the dynamics of European conquest and expansion.

*Plantations were the engine of European expansion.* Plantations produced the wealth—and the *modus operandi*—that allowed Europeans to take over the world. We usually hear about superior technologies and resources; but it was the plantation system that made navies, science, and eventually industrialisation possible. Plantations are ordered cropping systems worked by non-owners and arranged for expansion. Plantations deepen domestication, re-intensifying plant dependencies and forcing fertility. Borrowing from state-endorsed cereal agriculture, they invest everything in the superabundance of a single crop. But one ingredient is missing: They remove the love. Instead of the romance connecting people, plants, and places, European planters introduced cultivation through coercion.<sup>26</sup> The plants were exotics; the labour was forced through slavery, indenture, and conquest. Only through extreme order and control could anything flourish in this way; but with hierarchy and managed antagonism in place, enormous profits (and complementary poverties) could be produced. Because plantations have shaped how contemporary agribusiness is organised, we tend to think of such arrangements as the only way to grow crops. But this arrangement had to be naturalised until we learned to take the alienation of people from their crops for granted.

Consider sugar cane, a key participant. No one loves plantation sugar cane. Puerto Rican cane workers go out to “defend themselves” (*se defienden*) and “do battle” (*bregando*) with the cane.<sup>27</sup> Yet between the seventeenth and the nineteenth centuries, sugar cane plantations produced much of the wealth that fueled European conquest and development. The cane was moved across the warm zones, redefining regions; and so too came owners, managers, and laborers.<sup>28</sup> Slaves were sent from West Africa to the New World. Contracted

<sup>24</sup> The blight affected all of Europe, but only Ireland was devastated because only Ireland was completely dependent on potatoes. See Salaman, *History Potato*, Chapter XVI. For the biology of blight: Jennings and Lysek, *Fungal Biology*, 136; Money, *Bloomfield's Orchard*, 184-86; Christensen, *Molds and Man*, 98-103.

<sup>25</sup> Harold Brookfield, Leslie Potter, and Yvonne Byron, *In Place of the Forest: Environmental and Socioeconomic Transformations in Borneo and the Eastern Malay Peninsula* (New York, United Nations Press, 1995), 105.

<sup>26</sup> The European-sponsored plantation system also wrested the force of agricultural expansion and control away from states for the interests of capital, thus establishing the first context for the political hegemony of capital. This was a long and messy process, and most histories of the imperial world from the sixteenth through the nineteenth century are filled with the arguments among planters, mercantilists, slavers, colonial administrators, and proponents of ‘free trade’ through which this shift was torturously negotiated. Increasingly, profit rather than state-making became the goal of agricultural development.

<sup>27</sup> Sidney Mintz, *Worker in the Cane* (New York: W.W. Norton and Co., 1974), 16. In contrast to plantation battles, sugar cane in a smallholder economy is an object of love. In upland Southeast Asia, for example, cane is a sweet refreshment, not a race to the refinery. Human-cane antagonism is not inherent in the nature of cane plants.

<sup>28</sup> Sauer, *Crop Plants*, 236-50, traces the global travels of humans and non-humans in the history of cane cultivation. New geographies of cane types as well as human types were formed. Fungal pests were important participants in this travel; in 1882, for example, ‘red rot’ was introduced to West Indian plantations from a case of sample cane



coolie labour from India and China moved into the Pacific. Peasants were conquered and coerced in the Indies. And in forging a new antagonism to plantation plants, humans changed the very nature of species being. Elites entrenched their sense of autonomy from other species; they were masters not lovers of nonhuman beings, the species Others who came to define human self-making. But for planters this was only possible to the extent that human subspecies were formulated and enforced: Someone had to work the cane. Biology came to signify the difference between free *owners* and coerced *labour*. Coloured people worked the cane; white people owned and managed it. No racial laws or ideals could stop miscegenation, but they could guarantee that only those of the white race could inherit property. Racial divisions were produced and reproduced in each dowered marriage and inheritance.<sup>29</sup>

From the first, fungi were there, ready for niches to fill. Fungi constrained smallholder sugar cane; after it is cut, cane must be processed immediately to avoid fungal fermentation. The huge scale of cane plantations, and their savage labour discipline, are in part a response to fears of fermentation, which inspire on-site, expensive mills—and the desire to keep them running continuously. Yet fungal fermentation turned out to be a gift to the planters. It didn't take Caribbean planters long to observe that molasses, a byproduct of sugar milling, suited ubiquitous local yeast spores and quickly changed to alcohol. Rum was born, and the deadly but profitable 'triangle trades' proffered rum for more African slaves, and thus more sugar production, and thus more distillers and financiers in England or New England. Long before sugar became an object and symbol of mass consumption (thus cementing the expectation of species-autonomous publics whose species-unrecognisable foods mysteriously appeared from afar), fungally fermented rum made plantation sugar profitable—spreading it across the field of European conquest.<sup>30</sup>

At the edge of respectability, rum charged sea-faring masculinities in which trade became adventure. Fermentation thus detracted attention from the cruelty of shore-bound domestication, both human and nonhuman.

*White women became agents of racial hygiene.* By dividing us firmly into races, plantations remade human species being, the practice of being human. Racial separation—depending as it does on marriage and family organisation—required additional transformations of gender. In the plantation zones, with their unsettled mixtures of native and foreign, free, bound, and enslaved, wild and tame, disease and plenty, things could so easily go awry. Here white women became responsible for maintaining the boundaries—of homes, families, species, and the white race. Tropical fungi were one small part of their problem; molds and infections

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sent from Mauritius. J. H. Galloway, *The Sugar Cane Industry* (Cambridge: Cambridge University Press, 1989), 141).

<sup>29</sup> Verena [Stolcke] Martinez-Alier details how such a system was developed in Cuba in response to the eighteenth century sugar boom that multiplied the fortunes of planters and brought large numbers of slaves to the island. Race, she argues, came to stand for the plantation division of labor in nineteenth century Cuba. Verena Martinez-Alier, *Marriage, Class, and Colour in Nineteenth-Century Cuba* (Ann Arbor: University of Michigan Press, 1989).

<sup>30</sup> Sidney Mintz traces the history of sugar, showing how it became an object of general consumption in England only in the eighteenth century—well after the rum-oiled 'triangle trades' were established. He also shows how Caribbean sugar plantations formed a proto-industrial labor model that shaped nascent industrialisation in Europe with its social forms as well as its wealth. Sidney Mintz, *Sweetness and Power: The Place of Sugar in Modern History* (New York: Penguin Books, 1985).

could get out of hand. Keeping their homes free of mildew, mosquitoes, and miscegenation, white women in the tropics became models of species and subspecies alienation.<sup>31</sup>

By the late nineteenth century, discourses of scientific hygiene and eugenics informed white women's species segregations. Pasteurian germ theory was tested and boosted in the tropics, where white-controlled spaces could be organised as laboratories, with microorganisms stopped at the border of white homes. White women were called to follow their husbands to the tropics to keep things clean.<sup>32</sup> Re-imported to the metropole, such public and private hygiene charged class dichotomies, informing distinctions between those women Ehrenreich and English once contrasted as the "sick" and the "sickening."<sup>33</sup> Vulnerable upper class women became the angels of the house; poor women were blamed as the agents of infection. Both received renewed mandates to reproduce. Poor families needed more labour, particularly where child labour kept many adults alive.<sup>34</sup> Privileged families were charged with the advancement of the race; women must bear its heirs.

The boundaries of the home became the expected boundaries of love. With the fetishisation of the home as a space of purity and interdependence, extra-domestic intimacies, whether within or between species, seemed archaic fantasies (the community, the small farmer) or passing affairs (feminism, animal rights). Outside the home, the domain of economic rationality and conflicting individual interests reigned. Moreover, this kind of family fetish reappeared in mid-twentieth century U.S. mass culture—and once again in our times now—as the United States assumed a global leadership that allowed it to draw from older regimes of colonial culture. Here love is just not expected outside family walls. Within the family, other species can be accepted; pets are models for family devotion. But the model of the loving and beloved pet does not spread love; it holds it tight inside the family.

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<sup>31</sup> As 'the tropics' became defined in relation to problems of medical and racial hygiene, white women were asked to play a larger role in maintaining healthy families—and the white race. David Arnold, *The Problem of Nature: Environment, Culture and European Expansion* (Oxford: Blackwell, 1996) discusses the colonial formation of the tropics. Ann Stoler shows how the transformation of gender was key to emergent ideologies of race and medicine. Ann Stoler, *Carnal Knowledge and Imperial Power: Race and the Intimate in Colonial Rule* (Berkeley: University of California Press, 2002).

<sup>32</sup> As Bruno Latour explains, the main problem for showing the importance of Pasteurian germ theory was the necessity of creating laboratory-like hygienic conditions in which people and their domesticates could be kept away from the generally ubiquitous environment of disease microorganisms. Latour suggests that colonial armies in the tropics—where disease ran rampant, limiting colonial conquest—were the first living laboratories for Pasteurian medicine. *The Pasteurization of France*, trans. Alan Sheridan and John Law (Cambridge: Harvard University Press, 1986). Warwick Anderson discusses the application of hygienic theories in governing the colonial tropics in "The Natures of Culture: Environment and Race in the Colonial Tropics," in *Global South*, eds., Greenough and Tsing. Ann Stoler, *Carnal Knowledge*, shows the centrality of the importation of white women to the tropics to the new eugenics of the late colonial period.

<sup>33</sup> Barbara Ehrenreich and Deirdre English, *Complaints and Disorders: The Sexual Politics of Sickness* (Old Westbury, NY: The Feminist Press, 1973).

<sup>34</sup> In the peasant-worked sugar cane plantations of the Netherlands East Indies, for example, families needed labour for both subsistence rice production and colonially mandated cane labour. Family size quickly boomed in response to these colonial labour demands. There were plenty of *people*, but because families were units of corvee labour, every family needed their own. Child labour often supported the whole family. Benjamin White summarises his research and that of others on this question in "'Agricultural Involution' and its Critics: Twenty Years After," *Bulletin of Concerned Asian Scholars* 15, no. 2 (1982):18-31. Nineteenth-century population booms across the colonial south need to be considered in relation to plantation exactments.

U.S. publics learn to imagine themselves as compassionate, moral people because they love their children and their pets. They learn that this love makes them ‘good people’—unlike terrorists, who only hate. They imagine that this love equips them to make decisions for the whole world; it creates a moral hierarchy in which American ‘goodness’ is qualification for global leadership. Other peoples, and other species, are judged by their ability to live up to U.S. standards of domestic intimacy. If they are properly engaged with family love, they may deserve to live. Others risk becoming ‘collateral damage’ in U.S. projects to improve the world; to eliminate them may be unfortunate but not ‘inhumane.’ Under this tutelage, our species being is realigned to stop Others at home’s door.

Given the power and pervasiveness of this biosocial plan, it is amazing that a still-rich diversity of species and populations remains in existence on earth. But such richness can no longer be taken for granted.

### **Mushroom collecting in the seams of empire**

*Biological and social diversity huddle defensively in neglected margins.* In urban jungles as well as rural backwaters, the jumble of diversity that imperial planners tend to consider excessive still teems. Small farms have consistently higher biological diversity than large, capital-intensive farms—and not just in their crops. Even soil fungi, and other microorganisms, prefer small farms.<sup>35</sup> Despite the frantic pace of commercial genetics, evolutionary process in zones of neglect continues to produce more useful species and species interactions by many orders of magnitude. Fungi are representative. What can manage to flourish in the contamination of mines? Many mycorrhizal mushrooms—from the dainty *Laccaria laccata* to the disturbing dead man’s foot (*Pisolithus tinctorius*)—accumulate heavy metals, protecting their forest partners, the plants, from contamination.<sup>36</sup> New radioactive fungi have colonised the walls of the reactor room in the ruins at Chernobyl; should someone decide to sequester the radioactivity, such species will be needed.<sup>37</sup> Of course not all species development is benign, but only in the tumble of diversity is adaptation possible. Yet most everywhere a negative correlation exists between diversity and the intensity of capital investment and state control! For those who love diversity, perhaps a project of capital-and-state unmapping is required.

Such projects operate best in the obscurity they seek to spread. For work that intends publicity, we might undertake to know something of the point of view from disordered but productive edges—the seams of empire.

*The mushrooms we eat congregate at edges.* Fungi are ubiquitous, but edible and medicinal mushrooms only grow in a few places. Many favoured mushrooms flourish in agrarian seams: between fields and forest, and at the margins of zones of cultivation. King boletes and chanterelles are forest- and trail-edge species; they like light even as they grow with trees. Others, such as the meadow mushroom, prefer grassy fallows. Such mushrooms are still good reminders of the pleasures of variety beyond the domestic. Meanwhile, many species are abundant in the forests and mountains that surround intensively agrarian valleys. Since ancient days, mushroom collectors have combed montane and forest edges of grain-fed

<sup>35</sup> John Vandermeer and Ivette Perfecto, *Breakfast of Biodiversity: The Truth about Rain Forest Destruction* (Oakland: Institute for Food and Development Policy, 1995).

<sup>36</sup> John Dighton, *Fungi in Ecosystem Processes* (New York: Marcel Dekker, 2003), 323-39.

<sup>37</sup> Dighton, *Fungi*, 350-51. Some fungi have developed ‘radiotropism’: They direct their growth to sources of radioactivity!

kingdoms: in southwest China and adjoining Southeast Asia; in Korea; in Eastern Europe and the Eurasian north. In contemporary North America, immigrants from these agrarian margins are still most likely to collect mushrooms for the market. Meanwhile, the global mushroom market has distributed collecting around the world. The Japanese delicacy *matsutake* takes collectors not only to traditional Asian margins but also to mountain margins across the Pacific: British Columbia; the U.S. Northwest; the mountains of Oaxaca.<sup>38</sup>

Commercial mushroom collecting allows us to see the seams of global capitalism. Not only are places differentiated and products specific; forms of knowledge and resource management are wildly divergent and only tentatively connected in the mushroom commodity chain. Southeast Asian families compete for territories in Oregon; Japanese connoisseurs develop regional hierarchies of taste. There is too much contingency and variation here to imagine a simple calculus of supply and demand. Immersion in this space does not remove one from the world of capital, class, and regulation. This is no place to search for utopia. Yet *noticing the seams* is a place to begin.<sup>39</sup>

In protected homes across the empire, humans have curled up in their armchairs with their pets and their species-simulated snacks to watch the destruction of the rest of the world on TV. It is hard to know whether any humans will survive such domestic dreams. Fungi are not taking a position. Even the hardy lichens are dying from air pollution and acid rain.<sup>40</sup> When they take up radioactivity from nuclear accidents, they feed it to the reindeer, who in turn feed it to human herders.<sup>41</sup> We can ignore them, or we can consider what they are telling us about the human condition.

Outside the house, between the forests and fields, bounty is not yet exhausted.

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<sup>38</sup> The Matsutake Worlds Research Group (Tim Choy, Lieba Faier, Michael Hathaway, Miyako Inoue, Shiho Satsuka, and myself) was convened in 2005 to take up some of the issues raised in this essay. For some of the worlds we have had the privilege to peek into, see <http://www.matsutakeworlds.org/>

<sup>39</sup> Anna Tsing, *Friction: An Ethnography of Global Connection* (Princeton: Princeton University Press, 2005).

<sup>40</sup> Dighton, *Fungi*, 322.

<sup>41</sup> Dighton, *Fungi*, 352-53.

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