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OPEN SOURCE FOODWAYS:

AGRICULTURAL COMMONS AND PARTICIPATORY ART

In The Consequences of Modernity, ANTHONY GIDDENS *suggests that a central attribute of postindustrialism is the political power and material wealth accrued by those who possess intellectual property.*[1] *Since the Second World War, industrialized agriculture and the nexus of institutions, technologies, and corporations organized under the sign of agribusiness (a term coined in 1956) have ushered in a food system that is postindustrial in this sense and whose epicenter has been the United States. Nowhere is this more apparent than in what the consulting firm Context calls the proprietary seed market, a $40 billion worldwide market whose scale and structure signal the decline of agricultural commons.*[2] *Both for the corporations that Context addresses and for environmental activists who oppose them, "proprietary" has come to signify, above all, patented transgenic seeds (i.e., GMOs): seeds engineered to contain gene sequences from other species as a means to achieve pesticide tolerance, insect resistance, drought tolerance, enhanced nutrition, or other ends.*[3] *Anti-GMO movements have mobilized against these biotechnologies via*

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moral arguments about the profits their patenting garners for corporations,[4] *the environmental and health risks they might pose, and their origins in research that seems to "play god in the garden."*[5] *Whether we view the market in patented GMOs from the perspective of agribusiness boosters or environmentalists, transgenic seeds have come to embody a radical break in the technologies and economics of food production.*

Triumphant or portentous in delivery, this GMO rhetoric overstates both the technical and sociocultural novelty of GMOs. The engineering and privatizing of seeds has unfolded over a long timeline that runs from the enclosure of grazing lands in eighteenth-century England through the growth of the commercial seed industry in the United States after the First World War. The latter development is a crucial point of origin for the contemporary enclosure of seed commons that corporations such as Monsanto have helped to realize. This history dates to the 1920s, when hundreds of companies formed in the U.S. to act as commercial seed developers and distributors.[6] Prior to this point, plant breeders working in public land-grant universities developed open-pollinated seeds that the U.S. Department of Agriculture (USDA) distributed for free to farmers, who could in turn save those seeds from future harvests and replant them.[7] The arrival of hybrid seed technology promised to increase yields, but because hybridized seeds do not breed true, farmers were newly compelled each year to purchase seed packets that eventually came with legally binding use licenses.[8] With the 1930 Plant Protection Act and subsequent 1970 Plant Variety Protection Act, first the cuttings of asexual plants and then sexually reproducible seeds became eligible for intellectual property protection. These laws laid the foundation for 1980 and 2001 Supreme Court rulings that eroded farmers' seed saving rights by affirming the constitutionality of corporate patents on biological compositions (like seeds) and individual genetic traits (like vegetable pigmentation).[9] The outcomes of this legal history have been several: plant breeding has been redefined as a branch of engineering; software has become an increasingly pervasive metaphor for seeds; and the balance between public and private with respect to American agriculture has dramatically shifted.[10] Today's proprietary seed market is thus best understood as the apotheosis of a slow-and-steady movement within the U.S. food system—and the food systems of other top GMO producers—away from the commons.

What constitutes a more radical break with the past than the rise of GMOs *per se* is an emerging set of activist and art communities who reimagine seeds as agents of public knowledge, exchange, and cultivation. These communities activate what I term *open source foodways:*[11] a model of ecologically-attuned food production that adapts the lexicon of a digital commons to agricultural projects that mix environmental science, amateur knowledge, and, most importantly for this essay, socially engaged participatory art as defined by Grant Kester and others.[12] By comparison, agribusiness boosters and anti-GMO groups both advance a vision of twenty-first-century food production that pits the power of biotech corporations against dogged efforts to revive regional foodways and traditional farming methods (efforts we might classify as part of the international slow food movement). Rethinking the stark conflict between "big ag" and "slow food," this essay maps a heteroglossic cultural field taking shape around seeds and their fellow travelers (spores, edible plants, and so on). From the Matsutake Worlds Research Project to the Open Source Seed Initiative to the urban farming prototypes of Natalie Jeremijenko, the works considered here are evidence of a vibrant arena of participatory environmental art and activism in contemporary American culture that confronts the privatization of seeds. While arguably only Jeremijenko's work is recognized as *art*work, these projects all exhibit aesthetic as well as political techniques for fostering new food commons that variously unsettle, parody, and reverse engineer the logic of agribusiness.

MUSHROOM WORLDS AND DIGITAL COMMONS

In a 2012 *PMLA* essay, Stephanie LeMenager and Stephanie Foote encourage researchers trained in literary studies and focused on environmental problems to rethink their approaches by taking cues both from digital humanities researchers and from artists, activists, and other "makers" of radical environmental culture:

> Artists who make the narrative and affective work that we do in the classroom visible to alternative publics help us to emphasize the argument that we, too, produce sustainable artifacts and socialities—not just take apart the objects of our culture. Now, when the need for new infrastructures feels keen, criticism must be reaffirmed as a kind of making.[13]

The approach that LeMenager and Foote sketch in this *PMLA* piece and facilitate in the pages of *Resilience: A Journal of the Environmental Humanities* (which they co-edit) calls for a recalibration of materials and methods. More pointedly,

they suggest that to be sustainable within the neoliberal university and to engage with environmental crises that are themselves consequences of capitalism, the humanities need to engage not only with authored texts and artworks but also with collectively produced media, happenings, and projects. LeMenager and Foote here question whether textual interpretation should be the *sine qua non* of humanities methods by invoking the hermeneutics of suspicion that came to define literary criticism and theory in the late twentieth century. In lieu of deconstructive analysis, they advance an academic form of "making" modeled not only on the digital humanities but also on modes of participatory art that have been on the rise, as Tom Finkelpearl observes, since the early 1990s and that have roots in but also depart from, respectively, "the European and Latin American avant-gardes, [. . .] civil rights movement [. . . and] twentieth-century performance and theater innovations."[14] One of the tasks of this essay is to contribute to an emerging archive of participatory environmental art and activism that LeMenager and Foote gesture toward with reference, for instance, to the Center for Land Use Interpretation (an organization that combines "digital archives housing photographs and facts about land use in the United States" with "public infrastructure tours and more traditional exhibits") and the LA Urban Rangers (a collective that has offered playful yet informative unofficial tours of the Los Angeles River and Malibu coastline).[15]

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While I find LeMenager and Foote's skepticism about text-centered deconstruction salutary, a key feature of the projects that I am including in this archive and further identifying with open source foodways is the integration of "making" (as in collaborative, creative construction) with deconstructive critique of market ideologies. For an illustration of this participatory yet critical praxis we can turn to Matsutake Worlds, a project co-led by feminist science studies scholar Anna Tsing that takes as its point of departure the commodification of foraged foods (an analogue to the proprietary seed market).[16] An international collaboration, Matsutake Worlds is seeding a geospatial and cultural map of the species

tricholoma matsutake that charts the biomes where the mushroom grows, the markets in which it circulates, and the communities it helps both to forge and, given its financial value, to disquiet.[17] Natasha Myers writes that the project thus charts "the rhizomatic relations that entangle [matsutake] in intimate and unstable ecologies and economies."[18] However, if we think of the rhizome not only in terms of Deleuze and Guattari's intellectual methodology— of mapping interconnected histories, sites, and ideas so as to stymie hierarchies and origin stories— but also in the botanical sense of subterranean plant stems that generate horizontal root systems and whose cuttings can generate new plants, a collective mapping project devoted to a mushroom species and the organisms and communities with which it coexists is not rhizomatic so much as mycorrhizal. That is, matsutake mushrooms rely on symbiosis with the roots of specific tree species found in parts of China, Japan, the Pacific Northwest, Scandinavia, and Southeast Asia, while the mushroom's communal nature and commercial value enmesh it in partly symbiotic, partly parasitic relationships.

These complex dynamics inform the Matsutake Worlds project, which can be understood as participatory art in Kester's sense of aesthetic work that is outside the "international network of art galleries and museums, curators and collectors" and that adopts a "process-based approach" involving a wide range of participants to catalyze conversation, community, and social change in contradistinction to "a market system that generates its own divisive schisms."[19] Critics of participatory art—and the kindred form known as social practice[20]—variously express concerns about the boundary between art and activism in such projects, identify some as naïve in their aspirations to social change, and worry that non-artist participants may be vulnerable to the changing whims (and funding) of artists.[21] A project like Matsutake Worlds is less open to these critiques in part because it is not led either by self-identified artists or by grassroots activists. Its status as art inheres instead in its use of storytelling and image making to exhibit and to create aesthetic experiences of mushrooming in addition to producing scientific, sociological, and ethnographic knowledge about matsutake.

While an interactive map is the centerpiece of Matsutake Worlds, this public tool serves as the gateway to a digital archive of video interviews. Each interview provides an evocative narrative of just one person's relationship to matsutake, but together the narratives imaginatively connect the diverse com-

munities around the globe that forage matsutake out of joy, wonder, and passion rather than strictly for the mushroom's economic value. These subtitled videos immerse viewers in the many locales of matsutake foraging—from Mt. Hood, Oregon to Kyoto and from the capital of Yunan Province (a city of over 6 million people) to Savukoski, Lapland (a Finnish community of just over 1,000 residents). They include a humorous account of how longtime Mt. Hood forager Leke Nakashimada learned to find and identify matsutake from a mentor during his adolescence; a camera-eye guided tour of the Lapland pine forest where Kaisa Aikioniemi-Stenberg, as a member of a Finnish foraging cooperative, collects matsutake (which culminates in her elated find of a large, unblemished, and hence rare specimen); an interview with Kyoto gourmet grocery store owner Koji Ueda; and, finally, Sofia Yeng Lo's narrative of the meaningful but precarious livelihood that matsutake foraging signifies for her Hmong community in the Oregon Cascades. Matsutake Worlds performs participatory art in two main ways: the project co-produces knowledge about matsutake through the collaboration of anthropologists, forest ecologists, videographers, film editors, cartographers, and user interface designers along with foragers, mycologists, mushroom buyers, and chefs; and it brings to life through multimedia storytelling a mushroom commons that inhabits and perhaps widens what Tsing calls the "seams" of neoliberal capitalism.[22] A commons built around cooperation, peer-to-peer knowledge, and amateurism (as well as cyclical and sometimes vulnerable livelihoods), local matsutake communities take shape in the project as globally interconnected without being entirely ensnared by global capitalism.

Matsutake Worlds thus challenges Garret Hardin's 1968 thesis that all commons invariably tend toward the degradation of both natural resources and cooperative communities.[23] The networks that knit local mycological communities together cultivate a liminal space between public trust and private interest.[24] This claim has a corollary: food commons that exploit the seams of global capitalism and, too, the seams of the postindustrial food system rarely exist entirely within a commons.

More apt as a framework for foodways like those that Matsutake Worlds showcases is *open source*, a concept that originated with the Free and Open Source Software (FOSS) movement in the late 1990s when a network of developers began to build an alternative to "the transnational intellectual property regime"

that was rapidly circumscribing the tech industry.[25] From these specialized efforts to create "public software licenses [that] allowed (re)distribution, free use and adaptation of software code,"[26] open source morphed into what Christopher Kelty terms "a zeitgeist" and what Antonio Ceraso and Jeff Pruchnic describe simply as "open source culture."[27] As a relatively recent social formation, open source draws on a utopian vision of the Internet as itself a commons. To quote Amy Elias in a recent theoretical account of "digital planetarity," "[t]he Internet may have been born of the military-industrial complex, but it was from the start considered by developers to be a commons space, and commons thinking fundamentally drove innovation in it."[28]

That said, from the Whole Earth 'Lectronic Link (launched in 1985 with the *Whole Earth Catalog* as its analog precursor) to Google's open-API Android platform, the Internet and all it supports are a special kind of commons—one in which financial mechanisms of venture capital, advertising revenue, patent filings, and data monetization coexist with movements around free software and "share-and-share alike" licensing. Ceraso and Pruchnic suggest that open source culture melds these two dimensions of the Internet by incorporating both "the *utopian* hopes for participatory cultural and economic production and the more *dystopian* analyses that detect some parallelism between expanded participation and expansive exploitation."[29] Or as Kelty, Morgan Currie, and Luis Felipe Rosado Murillo put it, open source "problematiz[es] the boundaries of established categories and oppositions, such as individual/society, material/immaterial, discourse/practice, private/public, gift/market, persons/objects, work/leisure, and code/expression."[30] It is in this sense that a *digital commons*—as in the open source, reciprocal, and subcultural communities that the Internet houses alongside massively profitable tech companies—serves as an analogue to and muse for open source foodways, which, as seen with Matsutake Worlds, "problematize the boundaries of established categories" and, above all, the categories of public and private.

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THE HEIRLOOM SEED MOVEMENT AND THE OPEN SOURCE SEED INITIATIVE

A critical site for an account of open source foodways is the heirloom seed movement, which is rapidly expanding in the early twenty-first century. The historical roots of this contemporary environmental movement reach into the nineteenth century, when family-owned companies—D. Landreth Seed Company and Burpee Seeds most prominently in the United States—propagated a wide variety of heirloom and novel seeds and made them available to the public through the medium of the mail-order catalog.[31] A form of print culture that yoked capitalist marketing to preindustrial traditions of gardening, cooking, and alchemy, the seed catalog had ties to the early modern herbal even as it dovetailed with the commodification of agricultural inputs that seed hybridization and patenting advanced during the twentieth century. For its part, the twenty-first-century heirloom seed movement works deliberately against the proprietary seed market by germinating, cultivating, and distributing open-pollinated and historically significant seed varieties (known as heirlooms). Deploying print and digital media as well as grassroots activism, the movement now encompasses entrepreneurial, non-profit, and amateur ventures.[32] To cite the mission statement of the Tucson-based Native Seeds organization, this motley community shares a sense of purpose as "collector[s] and preserver[s] of [. . .] endangered traditional seeds"[33] who resuscitate regionally specific domesticated plants that the postindustrial food system has threatened with extinction by privileging patented seeds intended for commodity farming (AKA monoculture). Heirloom seed organizations accordingly tout the large variety of their collections over and against the relatively scant number of commodity crop varieties—such as F1 hybrid corn and common wheat. Thus does Seed Savers Exchange underscore the "over 600 heirloom and open-pollinated varieties," from Oaxacan Green Dent maize to the Christmas Lima Bean, that sprout at the organization's Heritage Farm in Iowa. In a kindred vein, the Petaluma-based Baker Creek Heirloom Seed company highlights its "1,750 varieties of vegetables, flowers and herbs" along with its commitment to produce "non-hybrid, non-GMO, non-treated and non-patented" seeds.[34]

As is evident in such rhetoric, the heirloom seed movement adopts principles of environmental conservation in imagining agricultural biodiversity as an antidote to the proprietary seed market and the larger workings of agribusi-

ness. However, this investment in conserving a wide variety of seeds for their "genetic and cultural importance" is paradoxical on at least two counts.[35] First, in borrowing from conservation biology the concept of biodiversity and a concern with endangered species, heirloom seed groups paper over the inherently engineered character of agriculture writ large. However massive the differences may be between pre-industrialized and post-industrialized food production, the analogy of wild and domesticated species downplays the technology of domestication itself. Second, there is a tension within heirloom seed advocacy work between localism and planetarity. On the one hand, heirloom seed varieties are by definition regionally adapted (even if some have been cultivated in multiple locales or have entered diverse ethnic foodways), while open-pollinated seeds (heirloom or not) produce plants that evolve differently depending on their locale. On the one hand, then, the open-pollinated heirloom seed embodies the ideals of locally distinctive and self-sufficient food systems.[36] On the other hand, the heirloom seed movement is a networked community that, somewhat akin to matsutake foragers, disseminates edible organisms around the world. In the case of heirloom seeds, this dissemination occurs with the aid of print catalogs and digital media (ranging from podcasts and social media marketing to seed databases and online payment gateways). As a consequence, while the heirloom seed movement advocates for seeds to be freely shared, its members are also partially caught up in the forces of market competition and the attendant drives to monetize products and distribute local species globally—imperatives that the savvy branding of seed catalogs and seed packets make manifest.

This complex interplay of ideals and tactics around heirloom seeds speaks to the fundamental problem with which this essay opened: namely, that seeds and their fellow travelers have become global commodities to be engineered, licensed, branded, and sold—a paradigm that not only underwrites the business model of biotech corporations but also partly defines food commons like those around rare mushrooms and heirloom seeds. Enter the Open Source Seed Initiative (OSSI): a collective of university plant breeders, organic farmers, and backyard gardeners who in 2014 launched a communal venture to, in their words, "hack" the propriety seed market by reverse engineering rather than decrying directly its intellectual property protections and technocratic frameworks. The packets containing seeds that OSSI participants have germinated or saved include a pledge on the back that mimics the fine print legalese that now accompanies many patented seeds (such as Monsanto-owned Seminis's "SummerSlice™

Watermelon" packets)[37]. As journalist Lisa Hamilton explains, biotech companies like Monsanto have sought to literalize the seed-as-software metaphor by printing a "seller's licensing agreement [. . .] on the back of seed bags," which, as when computer users load the latest release of a Microsoft or Apple operating system, farmers and gardeners never sign but rather agree to *de facto* "by simply opening the package."[38]

This instrument for articulating intellectual property rights against the ancient custom of seed saving and sharing supports Rob Nixon's contention that neoliberal capitalism adopts as its guiding precept "the notion of an innately tragic commons."[39] It is this same precept that Paolo Bacigalupi's scifi novel *The Windup Girl* (2009) extrapolates into the future through a dystopian narrative of, on the one hand, megalithic "calorie companies" that have locked down the global food supply through their monopolies on patented GMOs and, on the other, a clandestine seed bank in Thailand containing rare nightshades believed to be extinct.[40] The OSSI contests these foregone conclusions about seed commons that agribusiness and dystopian scifi each assert. The group does so by building a network of land-grant plant breeders, open-pollinated seed organizations, organic vegetable farmers, and other supporters of what OSSI co-founder Jack Kloppenburg terms "seed sovereignty."[41] The group's goal is nothing short of rebuilding a promiscuous supply of free and public germplasm (bioscience speak for seeds). The OSSI pledge, to this end, unsettles the legal basis of the proprietary seed market while reimagining seed licensing (see Figure 1).

They achieve this intervention through a colloquial statement on the back of each OSSI packet that reads as follows: "This Open Source Seed pledge is intended to ensure your freedom to use the seed contained herein in any way you choose, and to make sure those freedoms are enjoyed by all subsequent users. By opening this packet, you pledge that you will not restrict others' use of these seeds and their derivatives by patents, licenses, or any other means."[42]

If the proprietary seed market looks to the for-profit software industry as its touchstone, the OSSI here retains the seed-as-software metaphor but hooks it not to the precedent of patented information technology but rather to that of Free Open Source Software and the more recent Creative Commons content licensing protocol. To this point, one of OSSI's founders struck on the idea of open source seeds after learning about the most famous examples of FOSS:

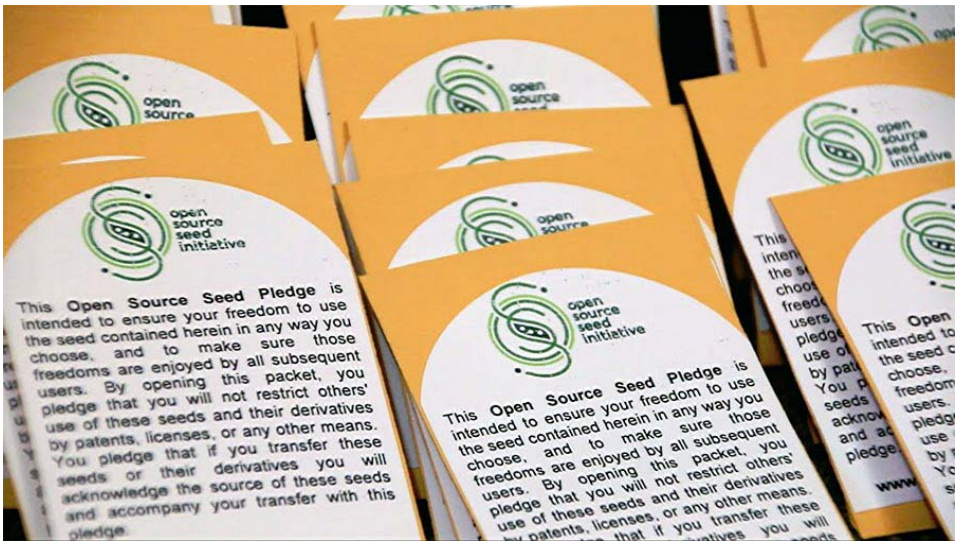

Figure 1.
Open Source Seed Initiative, Package with OSSI pledge. Courtesy Open Source Seed Initiative.

Linux. As Hamilton explains, "Linux came with a license that turned the concept of licensing on its head: Instead of restricting people from copying the product, it restricted people from restricting it or any of its offshoots. It marked the code indelibly as part of the commons."[43] It is this pledge to share freely—contra legal prohibitions against copying, adapting, remixing, and passing on—that has inspired the OSSI. However, as Hamilton details, this endeavor exposes the crux of the seed-as-software comparison on which both biotech corporations and OSSI rely:

> When computer code is written [. . .] the author automatically gets copyright. That ownership allows the author to then take out a copy*left* that says the material can be used freely. But plant breeding isn't governed by copyright law, and by breeding a plant one does not automatically own it. One would need to patent the plant first in order to then claim the "patent left" of declaring it open source. [. . .] [Plus] patents and licenses need to last for only one generation of plants; they say the seed can't be planted back, and that's that. But open source was supposed to allow the material to proliferate, which means OSSI would need to make sure that its license accompanied every new generation

> of plant—an exponentially expanding demand. Enforcing that viral replication would be nearly impossible. Without it, the seed would go right back to the unprotected commons, where anyone could claim it and patent it. The fluid nature of seeds, their natural impulse to regenerate, is both the impetus for the open-source concept and its legal undoing.[44]

Put simply, the OSSI pledge is on uncharted ground because, ironically, the seed-as-software notion that has informed the legal and policy basis for extending so-called utility patents to hybrid and transgenic seeds engineered for one growing season is an ill-fitted one from the outset, made all the more so when the goal is to *prevent* future patent applications on seeds that will genetically change in unpredictable ways over multiple generations and across disparate locales. All too aware of these legal and ecological barriers to creating a seed commons, the OSSI founders have morphed their vision of the project by re-conceptualizing open source licensing as open-pollinated activism: "Each time open-source seed was shared," according to this new vision for the project, "the message on the packet would germinate in new minds. [. . .] As the seed multiplied, so would the message. With three simple sentences, OSSI would propagate participants in the new movement like seedlings. They would breed resistance."[45]

This redefinition also marks the OSSI as participatory art in ways kindred to Matsutake Worlds. The plant breeders at the project's helm have come to think about their endeavor as performance art, but that label seems ill-fitted to the OSSI given that the collective operates fully outside art institutions and does not perform its work for an audience with the aim of altering the spaces and conventions of live performance. Rather, by designing seed packets to "propagate participants" in a nascent environmental movement, the OSSI at first glance seems more akin to civil disobedience. That said, *design* is a resonant descriptor of the project. It underscores that the aesthetic dimension of the OSSI (and specifically the "message" on the seed packets) is constitutive of the efforts to "breed resistance" to the techno-logic of agribusiness and to forge a seed commons.

Like Matsutake Worlds, the OSSI seed packets and attendant digital media (the group's homespun website as well as the interviews they have done with both mainstream news outlets and citizen journalists) do not just convey the

knowledge and labor of experts but also involve amateur communities as co-participants in giving voice to and cultivating a communal ethos around food production. In turn, the example of OSSI supports Ceraso's and Pruchnic's suggestion that open source culture can often be understood as a mode of participatory art. In developing this claim, Ceraso and Pruchnic draw on critic and curator Nicolas Bourriaud's concept of relational aesthetics. Although Bourriaud foregrounds museum- and gallery-based art in defining this term, his identification of contemporary aesthetic practices that "create open-ended opportunities for interactions between strangers" as *relational* can be extended to projects like OSSI, which no doubt incorporates those who receive seed packets "in the process of its construction" by facilitating "interactions between strangers." At the same time, as participants in the OSSI plant, adapt, save, and share seeds they might come to see themselves—as with the foragers, mycologists, and chefs whom Matsutake Worlds connects—not as strangers at all but as members of a commons.[46]

Here, OSSI resonates with Ruth Ozeki's narrative of a fictional heirloom seed group in her 2002 novel *All Over Creation,* a story that orbits around conflicts in a rural Idaho community between conventional farmers who plant hybrid and transgenic potatoes and a rag tag group of activists who call themselves the Seeds of Resistance. With the PR and legal machines of a fictionalized Monsanto looming in the background of this conflict, *All Over Creation* depicts the networked structure and multimedia tactics of the Seeds of Resistance as informed by open source culture. As Seeds of Resistance leader Geek tells a new member of the group, the heirloom seed movement must organize itself as "a network of cells . . . [k]eeping information and energy flowing . . . like a seed bomb."[47] Prescient of the OSSI's real-world endeavor to germinate a network of open-pollinated seed activists that grows and morphs much like a "seed bomb," the fictional Seeds of Resistance rejoin the intellectual property of biotech corporations by releasing seeds and staging protests in farming communities wherein hybrid and transgenic seed economies have become dominant.

As a contemporary novel, *All Over Creation* exemplifies a return to social realism that taps into early-twentieth-century American muckraking as well as postcolonial narrative.[48] Along with Ozeki's 1998 story of feedlots and agribusiness, *My Year of Meats, All Over Creation* can in this sense be classed with recent envi-

ronmentally-oriented realist novels such as Jonathan Franzen's *Freedom*, Amitav Ghosh's *The Hungry Tide*, and Jonathan Safran Foer's nonfiction work *Eating Animals*. But *My Year of Meats* and *All Over Creation* are also outliers within this constellation of realist environmental narratives, given their reception within actual environmentalist communities as primers for activism. In the years following the publication of *All Over Creation*, Ozeki was invited to deliver keynote talks at gatherings on "Food and Biodiversity" and "Women and Food" that identified her not only as an accomplished novelist and filmmaker but also as a member of the international slow food and heirloom seed movements.[49] Ozeki's writing has made this migration into the world of food activism in part because of how her two novels about agribusiness and its dissenters model participatory environmental art within their pages. In *My Year of Meats,* this model takes the form of a documentary film exposing the environmental and health consequences of industrialized meat production that character Jane Takagi-Little crafts in collaboration with vegan activists, sustainable agriculture buffs, and feedlot operators themselves. In *All Over Creation*, Ozeki even more explicitly depicts environmental activism *qua* participatory art through the Seeds of Resistance, who circulate flyers in supermarkets that parody the rhetoric around GMOs and whose "Garden of Earthly Delights" website melds naked images of one of the group's leaders (imagined as an earth goddess) with heirloom vegetable images as a seductive if kitschy prompt to join the radical "cells" of an open source seed commons.

Contra the emancipatory and revolutionary rhetoric of both the OSSI and Ozeki's fictional Seeds of Resistance, however, Ceraso and Pruchnic caution against romanticizing open source culture and the participatory art practices it inspires. In particular, they contend that the Internet age is "a time when 'constructed conviviality' [another term from Bourriaud] operates more as a norm of everyday social experience than as its alternative."[50] Echoing critiques of postmodern aesthetics on the part of Fredric Jameson, they conclude that the capacity of art to "refract[t] rather than merely reproduce[e] social forms" (and so provide what Theodor Adorno termed the "social antithesis of society") continues to erode in the digital era.[51] One root of this problem may be the ubiquitous nature of open source culture itself, with its "ever-tighter feedback loops between production, consumption, and contribution."[52] The structure of open source culture, that is, suspends participants in projects like OSSI between the roles of social agitator, product consumer, and unpaid producer.

These potential pitfalls in applying the tactics and tenets of digital commons suggest that open source foodways might rest uneasily between the longstanding history of food commons and the emergent idea of the sharing economy. A term that hails from finance and sociology, the sharing economy has come to signify "an emerging socioeconomic groundswell" whereby "traditional sharing, bartering, lending, trading, renting, gifting, and swapping [are being] redefined through technology and peer communities."[53] The sharing economy has become a buzzword and, not surprisingly, mass media uses of the term tend to be celebratory, as the gloss above (taken from business journalists Rachel Botsman and Roo Rogers' 2012 book, *What's Mine is Yours: The Rise of Collaborative Consumption*) shows. But the social forms that fall under the sharing economy are highly disparate, including as they do open source programming (think: Code For America), citizen science (Zooinverse), crowdsourced labor (Amazon's Mechanical Turk), crowdfunding (Kickstarter), carsharing (Zipcar), free online education and MOOCs (edX), garden swaps (Backyard Harvest), coworking spaces (WeWork), maker spaces (Tech Shop), peer-to-peer lodging (Airbnb), and, most notoriously, app-driven transportation networks (Uber).[54] If, like the OSSI, groups such as Backyard Harvest and Tech Shop coalesce impassioned communities in order to share resources and knowledge with one another for free, then corporations such as Uber and Amazon profit hugely from what amounts to "digital sweatshops," to cite a term that Internet law scholar Jonathan Zittrain coined.[55] Contradictions and fault lines abound, then, in the cross-pollinations occurring today among the sharing economy, open source culture, and participatory art. It is this minefield that the heirloom seed network—within which the OSSI arguably represents both an activist and an artistic vanguard—must navigate in order to sow from the seeds of open source culture the ground for a lasting alternative to the proprietary seed market and postindustrial food system writ large.

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URBAN MINI-FARMS AND THE BIOART OF NATALIE JEREMIJENKO

On a parallel track to both Matsutake Worlds and the OSSI are a community of bioartists[56] who have made food cultivation central to participatory aesthetic practices that emerge from the net.art movement of the 1990s and 2000s and that, to cite Lisa Lynch, "draw little or no distinction between conceptual art and social action."[57] Coined in 1997, bioart has come to describe the work of visual artists, experimental writers, and social practice collectives who work critically and playfully with what Joanna Zylinska terms the "soft technologies" of biology. In the United States, bioart has arguably centered on food, as with collectives such as Critical Art Ensemble, The Center for Genomic Gastronomy, EcoArtTech, FutureFarmers, and, finally, Jeremijenko's Environmental Health Clinic + Lab. In taking up the biotechnology and biopolitics of food production, however, such collectives vary widely. For example, under this heading we could include Critical Art Ensemble's "Free Range Grain" (a rudimentary molecular biology lab installed in 2004–2005, first at Esc Gallery in Graz and then at MASS MoCA, that allowed exhibit goers to test foods from their pantry for GM traces), EcoArtTech's Ecologies of Inconvenience (a mixed-media project on the part of Leila Nadir and Cary Peppermint that includes "Open Source Food Fermentation" workshops held in parks and schools as well as gallery settings), and the Environmental Health Clinic's "Cross-Species Adventure Club" (a culinary happening that integrated foraged plants and fungi important to *nonhuman* diets with molecular gastronomy cooking techniques and gadgetry). These projects coalesce in stimulating what the late bioartist Beatriz da Costa called "public amateurism," often through parody rather than outright protest of agribusiness.[58]

A particularly resonant bioart project in the context of open source foodways is an urban agriculture experiment that Jeremijenko launched in 2010 known as the Farmacy. One of the Environmental Health Clinic's tongue-in-cheek "Rx Clinical Trials," the Farmacy seeks to seed a "distributed urban farm"—or, more accurately, a network of urban mini-farms—in New York City and beyond through the free release of what Jeremijenko calls "AgBags" (see Figure 2). As Australian artist Keith Armstrong describes them, the AgBags are "portable grow bag technologies" engineered out of reclaimed high-density Tyvek mail carrier bags.[59]

The Farmacy repurposes these durable, inexpensive, and lightweight bags from their role in global shipping to function as containers for soil and seeds on urban balconies, windowsills, parapets, and building facades.

Characteristic of both Jeremijenko's irreverent method and multidisciplinary training, the fabrication of the AgBags reflects at once a pragmatic product design choice[60] and a provocation to redress the social and environmental ramifications of an industrialized food system (such as the correlation between income and food access in American cities or the mounting evidence that insecticides associated with hybrid and transgenic corn farming may be responsible for recent catastrophic die-offs among pollinating bees).[61] To quote Jeremijenko's own account of the project, the Farmacy is "a participatory public experiment [. . .] to support pollinators (in pollinator crisis), improve air quality (and the cardio-vascular health of each of us), and explore delicious highly nutritious flower based foods."[62] This "Clinical Trial" thus highlights a facet of bioart that Robert Mitchell has noted: as compared to net.art, bioart develops an expanded conception of media that includes not only information storage and communication (such as the schematics, web forms, and video and text documentation that support the Farmacy) but also biological "generation" (evident in the soil-nourishing "biochar" formed from city dwellers' composted junk mail that Jeremijenko packages for Farmacy participants).[63]

Figure 2.
Edible flowers and herbs planted in AgBags, photograph by Natalie Jeremijenko. Courtesy of the artist.

Now in their fifth "growing season," the AgBags constitute one prong of Jeremijenko's ambitious, evolving endeavor to shape what she calls "the five thousand year urban plan." [64] Informed centrally by anthropogenic climate change, this plan for very long-term "biodiverCITY" seeks to make cities rich habitats for microbial, plant, and animal life and, in turn, keystone sites for car-

bon sequestration. Central to this plan as Jeremijenko imagines it is a scalable network of miniature urban food plots, for which the AgBags have been a kind of beta test (see Figure 3).

While an urban agriculture movement is well underway internationally through the work of community organizers, architects, chefs, and homesteaders, Jeremijenko stands out within the movement with her twin focus on *prototyping* socially and ecologically sensible infrastructure (the AgBags can be sited on a wide variety of structures and surfaces at little cost and with no "nutrient run off"[65]) and *galvanizing* a social practice. That is, Farmacy combines the methods of product engineering, citizen environmental science, and participatory art to actualize an urban food system that both relies on and helps to form mass participation. Far from the "interactions among strangers" that Bourriaud sees in relational aesthetics, Jeremijenko's project creates the occasion and structure for intimacy. More pointedly, the Farmacy aims to bring into being a tightknit community of urban dwellers who cultivate food for sustenance and shared purpose and whose "Ag Bags" comprise so many plots in a interdependent food commons.

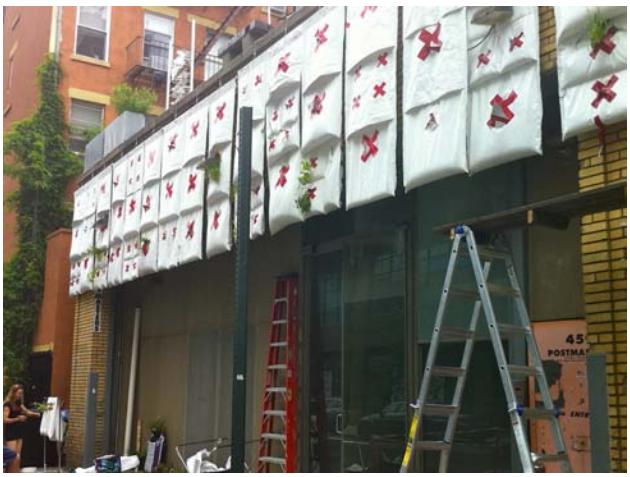

Figure 3.
Large array of AgBags installed on a building overhang in New York, photograph by Natalie Jeremijenko. Courtesy of the artist.

Humor is a critical component of how this ambitious if still inchoate project has taken shape. Consider the online invitation to join the "Clinical Trial of Farmacy AgBags" (see Figure 4). Formatted as a memorandum, this document parodies the protocols of pharmaceutical trials by outlining the process that participants must follow and by gesturing toward possible "side effects"—such as the "snail habitat" that may take root if one chooses to plant cucumber and strawberry plants.

Those who contact Jeremijenko to participate are also told on the project site that they will receive a complete mini-farm "kit" with, in addition to the Tyvek AgBag itself, "instructions for safety use," "soils, foam, and irrigation system," a time-lapse camera, and access to a cloud-based collaboration platform where they will be able to upload the time-lapse video footage of their AgBag's growing cycle.[66] As another online document notes, the combination of biological and digital tools that come with the AgBag kit "is designed to evaluate the growth responses of various plants in different urban situations" while also encouraging "diverse 'impatients'" (a pun on that edible flower variety) beyond the human urban farmer to "get involved in using vegetation to improve environmental performance."[67] Thus, in parodying "Big Pharma," the project documentation ultimately deconstructs the workings of agribusiness, with its investments in monoculture commodity farming and commercial farming inputs, and draws attention to the gap between its own safety claims and "side effects" of agribusiness.

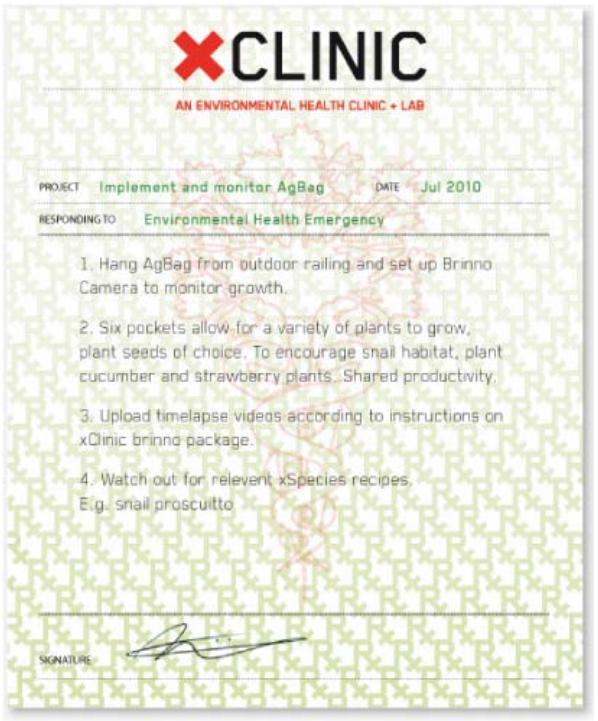

Figure 4.
Clinical Trial prescription, Environmental Health Clinic + Lab, 2010. Courtesy of Natalie Jeremijenko.

The Farmacy is here in step with the Open Source Seed Initiative and its fictional counterpart in *All Over Creation*. If more tacitly than the OSSI founders and Ozeki's Seeds of Resistance, Jeremijenko deploys written and visual narratives about the Farmacy that encourage participants who receive AgBags to grow food from open-pollinated seeds and to plant a diverse array of heirloom germplasm. Installations of the AgBags that Jeremijenko has herself curated act as models for participants by showcasing little known and densely nutritious edible plants that are, more often than not, classed as heirloom. For example,

a photograph of one such installation that Jeremijenko recently provided to an Australian online magazine of "small footprint living" shows a lineup of three AgBags growing edible nasturtium flowers (varieties of which can be found in the Baker Creek *Rare Seeds* catalog) along with the hard-to-find tayberry plant (a berry whose flavor is between a raspberry and a blackberry) (see Figure 5).[68]

There is a playful but radical parody at work in this curation / cultivation of tiny, diverse heirloom gardens—a parody of large-scale monoculture farms that depend on the proprietary seed market. In tacit (but one hopes eventually explicit) dialogue with the OSSI, the horizon of this parody is the formation of a new food commons. The open invitation to participate in the AgBag Clinical Trial, similar to the OSSI pledge that farmers and home gardeners agree to, calls on city dwellers to contribute to what Jeremijenko calls a "participatory socio-ecological system" and "U-farming community" in which members collaborate with their neighbors "to create a share-farm [. . .] and help to explore the social experience in how we best aggregate microplots for our mutual benefit."[69] Refusing the specialized expertise and commodified products of plant breeders, soil scientists, geneticists, farmers, gardeners, and others, the Farmacy thus promises to realize the ecological and social possibilities of open source foodways.[70]

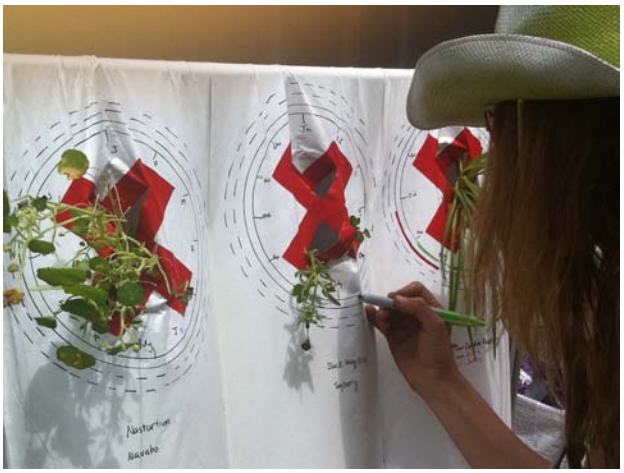

Figure 5.
AgBags planted by Jeremijenko with nasturtium, Navaho berry, blackberry, and tayberry starts grown from seed. Courtesy of the artist.

CODA

In the environmental humanities and sciences it has become a commonplace to define the contemporary period as the crisis point of the Anthropocene—a term now subject to robust academic debate for its framing of planetary environmental precarity as the responsibility of a universalized human subject. The

projects that this essay has investigated suggest that environmental scholars must also think about the contemporary period in terms of the cultural and ecological ramifications of digital times: times in which tech corporations (including the biotech conglomerates that monopolize the proprietary seed market) shape nearly every cultural arena as well as times in which the environmental impacts of those same tech corporations often go unremarked or unregulated. In rightfully focusing on cultural responses to climate change, extinction, and extractive industries, the environmental humanities risks overlooking the ramifications of the Net's evolution into the "Internet of Things": the rapidly-expanding infrastructure of objects and bodies that transmit data, from Monsanto's computerized seed chipper that conducts genetics analysis on farmer seeds before they are planted to the time-lapse video cameras Jeremijenko ships with AgBags. This essay has sought to reveal such entanglements between data and organisms and between cyberculture and the environment. It has done so by conceptualizing open source foodways—exemplified in the provisional commons and participatory art surveyed above—as a promising site for what LeMenager and Foote term "the sustainable humanities," a site that invites cross-cutting investigations of, on the one hand, the arts of the present (to invoke this journal's rubric) and, on the other, social practices that apprehend the interdependencies between the environmental and technological realities of our present world and seek to transmute them.

Notes

[1] Anthony Giddens, *The Consequences of Modernity* (Stanford, CA: Stanford University Press, 1990).

[2] "Global Seed Market Values Grow by 10 Percent to Nearly $32b," *Seed Today*, May 11, 2010, http://www.seedtoday.com/info/ST_articles.html?ID=93590; "Global Seed Market Value at $37b: Context Network Releases 2011 Analysis of the Global Agricultural Seed Market," *SeedQuest*, July 5, 2011, https://www.seedquest.com/market.php?type=market&id_article=18823&id_region=&id_category=332&id_crop=.

[3] As one illustration of this point, 85 percent of all corn acreage planted in the United Estate is now transgenic. Jorge Fernandez-Cornejo et al., *Genetically Engineered Crops in the United States* (Washington, D.C.: United States Department of Agriculture: Economic Research Service, 2014), 10.

[4] Among biotech companies, Monsanto, Dupont, and Syngenta account for an estimated fifty percent of the worldwide proprietary seed market; Monsanto alone has

cornered approximately ninety percent of the global transgenic corn market. See "The World's Top 10 Seed Companies," ETC Group, October 30, 2007, http://www.gmwatch.org/component/content/article/10558-the-worlds-top-ten-seed-companies-who-owns-nature; Peter Whoriskey, "Monsanto's Dominance Draws Antitrust Inquiry," *The Washington Post*, November 29, 2009, http://www.washingtonpost.com/wp-dyn/content/article/2009/11/28/AR2009112802471.html.

[5] Michael Pollan, "Playing God in the Garden," *The New York Times Magazine*, October 25, 1998, http://www.nytimes.com/1998/10/25/magazine/playing-god-in-the-garden.html?pagewanted=all

[6] "Beginning in 1930, approximately 150 companies formed to produce hybrid corn seed and some 40 existing seed companies expanded their businesses to include production of hybrid corn seed. While most firms were established to produce and sell seed, some also instituted in-house research and breeding programs to improve existing hybrids," writes Jorge Fernández-Cornejo in *The Seed Industry in U.S. Agriculture: An Exploration of Data and Information on Crop Seed Markets, Regulation, Industry Structure, and Research and Development* (Washington, D.C.: United States Department of Agriculture: Economic Research Service, 2004), 25.

[7] At this program's apex in 1897, the government sent an estimated 20 million seed packets to farmers in a single year. Muriel Lightbourne, *Food Security, Biological Diversity and Intellectual Property Rights* (Surrey, England: Ashgate, 2009), 42.

[8] Several recent studies suggest that land-grant colleges and universities, for which the 1862 Morrill Act of Congress set the policy foundation, served as vital public research sites until the Great Depression; in turn, non-commercial plant breeding and seed development became an emblem and battleground for populist politics. See Scott M. Gelber, "The Populist Vision for Land-Grant Universities, 1880-1900," in *The Land-Grant Colleges and the Reshaping of American Higher Education*, ed. Roger L. Geiger and Nathan M. Sorber (New Brunswick, NJ: Transaction Publishers, 2013); Christopher P. Loss, "The Land-Grant Colleges, Cooperative Extension, and the New Deal," in Geiger and Sorber, *Land-Grant Colleges*; and Scott M. Gelber, *The University and the People: Envisioning American Higher Education in an Era of Populist Protest* (Madison, WI: University of Wisconsin Press, 2011).

[9] The 1980 Diamond v. Chakrabarty and 2013 Bowman v. Monsanto Supreme Court cases are particularly pivotal rulings on this score. As Olga Sezneva and Sébastien Chauvin explain, "In *Bowman v. Monsanto Company* (No. 11–796, May 13, 2013), the court found that Vernon Hughes Bowman, an Indiana farmer, could not plant and harvest copies of Monsanto's 'Round-up resistant' soybeans and condemned Bowman to a significant fine." Olga Sezneva and Sébastien Chauvin, "Has Capitalism Gone Virtual? Content Containment and the Obsolescence of the Commodity," *Critical Historical Studies* 1, no. 1 (2014): 142. For other accounts of this intellectual property history see Michael S. Carolan, *Decentering Biotechnology: Assemblages Built and Assemblages Masked* (Surrey, England: Ashgate, 2010), 35, 55, 57, 68-69; Bruce L. Gardner, *American Agriculture in the*

Twentieth Century: How It Flourished and What It Cost (Cambridge, MA: Harvard University Press, 2002), 8, 160, 243-44; Lisa M. Hamilton, "Linux for Lettuce: Hacking the Seed Industry," *VQR: A National Journal of Literature & Discussion* 90, no. 3 (2014), http://www.vqronline.org/reporting-articles/2014/05/linux-lettuce; Adam Liptak, "Supreme Court Supports Monsanto in Seed-Replication Case," *New York Times*, May 13, 2013, http://www.nytimes.com/2013/05/14/business/monsanto-victorious-in-genetic-seed-case.html?_r=0; Mark L. Winston, *Travels in the Genetically Modified Zone* (Cambridge, MA: Harvard University Press, 2002), 177, 79, 82; and Bowman V. Monsanto Co. Et A., 569 U.S. __ (2013).

[10] By 1979, private research expenditures in what *Science* magazine then termed "the agricultural input, food processing, and distribution industries" were nearly $2 billion annually, while equivalent public investments on the part of the USDA and the county agriculture extensions affiliated with land-grants hovered at just $1.2 billion. During the past two decades, the latter figure has declined by another twenty percent, while private agricultural R&D expenditures have increased to $11 billion. Vernon W. Ruttan, "Changing Role of Public and Private Sectors in Agricultural Research," *Science* 216, no. 4541 (1982): 23.; Paul Heisey, Sun Ling Wang, and Keith Fuglie, *Public Agricultural Research Spending and Future U.S. Agricultural Productivity Growth: Scenarios for 2010-2050* (Washington, D.C.: United States Department of Agriculture: Economic Research Service, 2011), 3; Keith Fuglie et al. "Private Industry Investing Heavily, and Globally, in Research to Improve Agricultural Productivity," United States Department of Agriculture: Economic Research Service, June 5, 2012, http://www.ers.usda.gov/amber-waves/2012-june/private-industry.aspx#.VcklzvlVikr.

[11] Following the use of "foodways" in anthropology, cultural geography and food studies, I take this term to signify the socioeconomic, political, aesthetic, and technological practices of food production and consumption within particular cultural contexts.

[12] Grant Kester, "On the Relationship between Theory and Practice in Socially Engaged Art," *Fertile Ground*, July 29, 2015, http://www.abladeofgrass.org/fertile-ground/between-theory-and-practice/; Grant Kester, "Conversation Pieces: The Role of Dialogue in Socially-Engaged Art," in *Theory in Contemporary Art Since 1985*, ed. Zoya Kucor and Simon Leung (Oxford: Blackwell, 2005), 76-100. See also Tom Finkelpearl, "Participatory Art," in *Encyclopedia of Aesthetics*, ed. Michael Kelly (Oxford: Oxford UP, 2014), doi: 10.1093/acref/9780199747108.001.0001.

[13] Stephanie LeMenager and Stephanie Foote,"The Sustainable Humanities," *PMLA* 127, no. 3 (2012): 574.

[14] Finkelpearl, "Participatory Art," n. pag.

[15] LeMenager and Foote, "The Sustainable Humanities," 573.

[16] For a summary of the global market that has formed at a breakneck pace around foraged foods in large part due to high-profile restaurants such as the Copenhagen based Noma, see Edna Ishayik, "Inside the Intensely Secretive, Ultracompetitive World of

Restaurant Foragers," *Grub Street*, June 23, 2015, http://www.grubstreet.com/2015/06/secrecy-of-the-foraging-economy.html.

[17] The project site can be found at: http://www.matsutakeworlds.org/. For a theoretical and methodological overview of the project, see Anna Tsing, "Unruly Edges: Mushrooms as Companion Species," *Environmental Humanities* 1 (2012).

[18] Natasha Myers, "Poaching Mushrooms: Lessons from the Matsutake Worlds Research Group," *Kroeber Anthropological Society Papers* 100, no. 1 (2011): 139.

[19] Kester, "Conversation Pieces," n. pag.

[20] "Social practice" is a term that describes publicly-engaged, participatory work by artists who "blur the lines among object making, performance, political activism, community organizing, environmentalism and investigative journalism." Randy Kennedy, "Outside the Citadel, Social Practice Art Is Intended to Nurture," *New York Times*, March 20, 2013, http://www.nytimes.com/2013/03/24/arts/design/outside-the-citadel-social-practice-art-is-intended-to-nurture.html.

[21] See especially Claire Bishop, *Artificial Hells: Participatory Art and the Politics of Spectatorship* (London: Verso, 2012); Miwon Kwon, *One Place after Another: Site-Specific Art and Locational Identity* (Cambridge: MIT Press, 2002).

[22] Tsing, "Unruly Edges."

[23] Hardin made the case that commons (whether grazing lands or the sky above cities) increasingly tend toward tragedy due to exponentially increasing human populations wherein "ruin is the destination toward which all [people] rush, each pursuing [their] own best interest in a society that believes in the freedom of the commons." Garrett Hardin, "The Tragedy of the Commons," *Science*, 162, no. 3859 (1968): 1244.

[24] A recent exposé draws attention to just how commodified foraged foods have become in the early twenty-first century due to, among other factors, the global fame of forest-to-table restaurants like Copenhagen-based Noma. Ishayik, "Restaurant Foragers."

[25] Morgan Currie, Christopher Kelty, and Luis Felipe Rosado Murillo, "Free Software Trajectories: From Organized Publics to Formal Social Enterprises?" *Journal of Peer Production*, no. 3 (2013), http://peerproduction.net/issues/issue-3-free-software-epistemics/peer-reviewed-papers/free-software-trajectories-from-organized-publics-to-formal-social-enterprises/.

[26] Currie, Kelty, and Murillo, "Free Software Trajectories."

[27] Christopher M. Kelty, "Afterword::Recompiling," *Criticism* 53, no. 3 (2011): 471; and Antonio Ceraso and Jeff Pruchnic, "Introduction: Open Source Culture and Aesthetics," *Criticism* 53, no. 3 (2011): 337-75.

[28] Amy J. Elias, "The Commons . . . and Digital Planetarity," in *The Planetary Turn: Relationality and Geoaesthetics in the Twenty-First Century*, ed. Amy J. Elias and Christian Moraru (Evanston, IL: Northwestern University Press, 2015), 40.

[29] Ceraso and Pruchnic, "Open Source Culture and Aesthetics," 369.

[30] Currie, Kelty, and Murillo, "Free Software Trajectories."

[31] William Woys Weaver, "The Landreth Seed Company: Testing Ground for a New American Cuisine," *Gastronomica: The Journal of Food and Culture* 11, no. 2 (2011).

[32] These include Comstock, Ferre & Co.'s seed house (dating to 1811), Seed Savers Exchange (founded in 1975), High Mowing Organic Seeds (founded in 1996), Victory Seeds (the subsidiary of a hundred-year-old family farm), Baker Creek's *Rare Seeds* (formed in 1998), the Seed Library of Los Angeles (launched in 2010), Basalt Seed Library (a public circulating collection opened in 2012 at a local public library and spearheaded by the Central Rocky Mountain Permaculture Institute), and Native Seeds/SEARCH (a major seed bank in Tucson, Arizona that ethnobotanist Gary Paul Nabhan began in 1983).

[33] "Our Approach," Native Seeds/Search, accessed August 10, 2015, http://www.nativeseeds.org/our-approach .

[34] "Free Seed Savers Exchange Printed Catalog," Seed Savers Exchange, accessed August 10, 2015, http://www.seedsavers.org/Catalog.html; and "About Us," Baker Creek Heirloom Seeds, accessed August 10, 2015, http://www.rareseeds.com/about/.

[35] "Our Approach," Native Seeds/Search.

[36] For more comprehensive accounts of the so-called locavore movement/diet, see: Allison Carruth, *Global Appetites: American Power and the Literature of Food* (New York: Cambridge University Press, 2013); David A. Cleveland, Allison Carruth, and Daniella Niki Mazaroli, "Operationalizing Local Food: Goals, Actions, and Indicators for Alternative Food Systems," *Agriculture and Human Values* 32, no. 2 (2014); David Goodman, E. Melanie DuPuis, and Michael K. Goodman, *Alternative Food Networks: Knowledge, Practice and Politics* (New York: Routledge, 2012); Julie Guthman, "Fast Food/Organic Food: Reflexive Tastes and the Making of 'Yuppie Chow,'" *Social and Cultural Geography* 4, no. 1 (2003); Julie Guthman, "Bringing Good Food to Others: Investigating the Subjects of Alternative Food Practice," *Cultural Geographies* 15, no. 4 (2008); David Hanson and Edwin Marty, *Breaking through Concrete: Building an Urban Farm Revival* (Berkeley, CA: University of California Press, 2012); and Gary Paul Nabhan, *Coming Home to Eat: The Pleasures and Politics of Local Food* (New York: W.W. Norton, 2002).

[37] The back of one Seminis vegetable seed packet reads, for example, "NOTICE TO PURCHASER: Use of this seed indicates your acceptance of the following terms. If you do not accept these terms, you may return the seed for full credit. By opening this container, you agree (a) not to save any seeds, plants, plant parts, genetic material, parental line seed or plants or plant parts which may be found herein, and resulting produce ("MATERIAL"); (b) to prohibit any selection of MATERIAL from the field by anyone other than SEMINIS or for purposes of harvesting the produce for commercial sale; and (c) not to use any MATERIAL for any breeding, research, seed production, reverse engineering, molecular or genetic analysis or other purposes not specifically allowed herein."

[38] Hamilton, "Linux for Lettuce."

[39] Rob Nixon, "Neoliberalism, Genre, and 'The Tragedy of the Commons,'" *PMLA* 127, no. 3 (2012): 597.

[40] Paolo Bacigalupi, *The Windup Girl* (San Francisco: Night Shade Books, 2009).

[41] Dan Charles, "Plant Breeders Release First 'Open Source Seeds,'" *The Salt*, NPR, April 17, 2014, http://www.npr.org/sections/thesalt/2014/04/17/303772556/plant-breeders-release-first-open-source-seeds ; Jack Kloppenburg, "Impeding Dispossession, Enabling Repossession: Biological Open Source and the Recovery of Seed Sovereignty," *Journal of Agrarian Change* 10, no. 3 (2010); Jack Kloppenburg and Daniel Lee Kleinman, "Seed Wars: Common Heritage, Private Property, and Political Strategy," *Socialist Review*, no. 95 (1987). Other key members of the Open Source Seed Initiative include Jim Myers (a plant breeder from Oregon State University unhappily involved with a Seminis patent application involving a broccoli variety he originally created), Steve Jones (a wheat breeder at Washington State University who heads up a first-of-its-kind bread lab), and Irwin Goldman (a breeder at the University of Wisconsin who himself holds three seed patents—two for beets and one for carrots—to protect their use in industrial dyes and filed at behest of his university).

[42] Hamilton, "Linux for Lettuce"; "Home," Open Source Seed Initiative, accessed August 10, 2015, http://osseeds.org/.

[43] Hamilton, "Linux for Lettuce."

[44] Ibid.

[45] Ibid.

[46] Quoted in Ceraso and Pruchnic, "Open Source Culture and Aesthetics," 354.

[47] Ruth L. Ozeki, *All Over Creation* (New York: Penguin Books, 2003), 257.

[48] For sustained analyses of an observed return to realism in the decades since the heyday of postmodernism, see especially: Ramón Saldívar, "Historical Fantasy, Speculative Realism, and Postrace Aesthetics in Contemporary American Fiction," *American Literary History* 23.3 (2011): 574-599 and Robert Rebein, *Hicks, Tribes, and Dirty Realists: American Fiction after Postmodernism* (Lexington: UP of Kentucky, 2001).

[49] In my book *Global Appetites,* I have discussed this facet of Ozeki's public reception and stature at length. Allison Carruth, *Global Appetites: American Power and the Literature of Food* (Cambridge: Cambridge UP, 2013), 119-122.

[50] Ceraso and Pruchnic, "Open Source Culture and Aesthetics," 356.

[51] Ibid., 357-58.

[52] Ibid., 358.

[53] Rachel Botsman and Roo Rogers, *What's Mine Is Yours: The Rise of Collaborative Consumption* (New York: Harper Business, 2010), xv.

[54] Janelle Orsi, "The Sharing Economy Just Got Real," *Utne Reader*, September 20, 2013, http://www.utne.com/economy/sharing-economy-just-got-real.aspx.

[55] Jonathan Zittrain, "The Internet Creates a New Kind of Sweatshop," *Newsweek*,

December 7, 2009, http://www.newsweek.com/internet-creates-new-kind-sweatshop-75751.

[56] For extended discussion of the origins and approaches of bioart, see Allison Carruth, "Culturing Food: Bioart and In Vitro Meat," *parallax* 19, no. 1 (2013), and "The Green Avant-Garde: Food Hackers and Cyberagrarians," *Resilience* 2, no. 1 (2014); Oron Catts and Gary Cass, "Labs Shut Open: A Biotech Hands-on Workshop for Artists," in *Tactical Biopolitics: Art, Activism, and Technoscience*, ed. Beatriz da Costa and Kavita Philip (Cambridge, MA: MIT Press, 2008); Beatriz da Costa, "Reaching the Limit: When Art Becomes Science," in *Tactical Biopolitics: Art, Activism, and Technoscience*, ed. Beatriz da Costa and Kavita Philip (Cambridge, MA: MIT Press, 2008); George Gessert, review of Arthur C. Danto, *Unnatural Wonders: Essays from the Gap bewteen Art and Life*, *Leonardo* 41, no. 4 (2008); Natalie Jeremijenko and Eugene Thacker, *Biotech Hobbyist* (London: Locus Press, 2004); Susan McHugh, "Real Artificial: Tissue-Cultured Meat, Genetically Modified Farm Animals, and Fictions," *Configurations* 18, no. 1 (2010); Robert E. Mitchell, *Bioart and the Vitality of Media* (Seattle, WA: University of Washington Press, 2010); Jennifer Willet, "Bodies in Biotechnology: Embodied Models for Understanding Biotechnology in Contemporary Art," *Leonardo Electronic Almanac* 14, no. 7-8 (2006), http://leoalmanac.org/journal/Vol_14/lea_v14_n07-08/jwillet.asp; and Joanna Zylinska, *Bioethics in the Age of New Media* (Cambridge, MA: The MIT Press, 2009).

[57] Lisa Lynch, "Culturing the Pleebland: The Idea of the 'Public' in Genetic Art," *Literature and Medicine* 26, no. 1 (2007): 189.

[58] da Costa, "Reaching the Limit," 373.

[59] Keith Armstrong, "Re-Imagining Utopias: The Bat/Human Project," *Leonardo* 47, no. 3 (2014): 284.

[60] As the documentation about the project explains, "The high tensile spun olefin (HDPE) material is antimicrobial; fire retardant and provides a puncture-resistant waterproof membrane well known in the construction industry and complaint with existing regulation and code. It is biodegradable and recyclable, yet the UV stabilized material can be used for long-term (decades-long) outdoor installation." Natalie Jeremijenko, "What Is an Agbag?," http://environmentalhealthclinic.net/farmacy/agbag/.

[61] For recent accounts of food access, food justice, and urban "food deserts" in the United States (and particularly the urban U.S.), see Alison Hope Alkon and Kari Marie Norgaard, "Breaking the Food Chains: An Investigation of Food Justice Activism," *Sociological Inquiry* 79, no. 3 (2009); Goodman, DuPuis, and Goodman, *Alternative Food Networks*; Robert Gottlieb and Anupama Joshi, *Food Justice* (Cambridge, MA: The MIT Press, 2010); and Guthman, "Bringing Good Food to Others." Among many other sources, scientific and lay studies of Colony Collapse Disorder include Chengsheng Lu, Kenneth M. Warchol, and Richard A. Callahan,"*In Situ* Replication of Honey Bee Colony Collapse Disorder," *Bulletin of Insectology* 65, no. 1 (2012); Alexei Barrionuevo, "Bees Vanish, and Scientists Race for Reasons," *The New York Times*, April 24, 2007; and

Hannah Nordhaus, *The Beekeeper's Lament: How One Man and Half a Billion Honey Bees Help Feed America* (New York: Harper Perennial, 2011).

[62] Natalie Jeremijenko, "Farmacy AgBags and FlowerXFood," FOODshed, http://www.nataliejeremijenko.com/.

[63] Mitchell, *Bioart and the Vitality of Media*.

[64] Eugenia Lim, "The Science of Citizens: Natalie Jeremijenko," *Assemble Papers*, March 17, 2015, http://assemblepapers.com.au/2015/03/17/the-science-of-citizens-natalie-jeremijenko/.

[65] The online documentation for the AgBags notes, "the closed and coupled systems principals of Farmacy and the AgBags specifically, demonstration an agriculture system with NO nutrient run off which means NO degradation of local ecosystem or water quality: a demonstration that food production need not externalize the environmental costs, like fertilizers, contaminants or other additives (take, for example, snail poison)." Jeremijenko, "What Is an Agbag?"

[66] Ibid.

[67] Ibid.

[68] Lim, "The Science of Citizens: Natalie Jeremijenko."

[69] Jeremijenko, "What Is an Agbag?"

[70] To this last point, Jeremijenko's awareness of and involvement with open source culture have been well documented. Most recently, her status within open source culture has been recognized by her invitation to join the advisory board of the new Open Lab for Journalism, Technology and the Arts (an initiative created by BuzzFeed Founder Jonah Peretti to create new tools for journalists, media makers, and new media artists and releasing them as open source). Jessi Hempel, "Buzzfeed Founder Launches New Lab for Open-Source Invention," *Wired*, May 27, 2015, http://www.wired.com/2015/05/buzzfeed-founder-launches-new-lab-open-source-invention/.