



# H-Environment

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## H-Environment Roundtable Reviews

Volume 8, No. 3 (2018)  
<https://networks.h-net.org/h-environment>

Publication date: August 16, 2018  
Roundtable Review Editor:  
Christopher F. Jones

**Courtney Fullilove, *The Profit of the Earth: The Global Seeds of American Agriculture* (Chicago: University of Chicago Press, 2017). ISBN: 9780226454863**

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## Introduction by Christopher F. Jones, Arizona State University

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Svalbard offers a fitting image for an era in which apocalyptic and dystopian narratives permeate the zeitgeist. This seed vault in Norway near the North Pole is “built to stand the test of time – and the challenge of natural or man-made disasters” per the web site of the international Crop Trust that manages it.<sup>1</sup> Should climate change, nuclear war, or even the zombie apocalypse arrive, those hardy humans that survive can rebuild civilization by utilizing the seeds carefully stored beneath the permafrost. Svalbard presents a popular, and per **Courtney Fullilove**, charismatic view of seeds. But it is one that is deeply problematic, she reveals in *The Profit of the Earth*. Reducing plants and their genetic diversity to individual seeds erases the long and deep human relationships we have forged with the plants we eat. It presents seeds as objects of nature, when they really are objects of culture. Seeds, Fullilove argues, are deep time technologies: to understand them, we need to engage with histories of human labor, ecosystem change, capital, and property rights.

To unpack these dynamics, *The Profit of the Earth* oscillates between close readings of specific moments and broad sweeps through time and space. Each of the book’s three sections (Collection, Migration, Preservation) analyzes particular episodes: the role of the nineteenth century Patent Office in gathering seeds from around the world and distributing them to American farmers; a set of wheat fields in Kansas where Mennonite farmers planted amber waves of grain and unleashed a myth of frontier exceptionalism; and the writings of Ohio pharmacist John Uri Lloyd, who lamented the loss of biodiversity accompanying the rise of monocropping. In these sections, details such as the size of the Patent Office building, the contracts signed by Mennonites with railroad companies, and the painstaking processes of gathering echinacea for medicines challenge simplistic narratives and demonstrate the complexity of American agriculture.

Each of these moments, though, can only be understood in a global context. The seeds that came into the Patent Office were delivered by men such as James Morrow, who accompanied Matthew Perry’s mid-19<sup>th</sup> century gunboat expedition to Japan. Mennonite farmers traveled to Kansas as part of a long migration that included stays in Germany and the Russian Steppes. Moreover, Fullilove includes three “Field Notes” sections describing her participant-observer work with seed collectors and preservers. The narrative, then, spans continents and millennia, with visits to the Russian Caucasus, Syria, Norway, and the United States; temporally, we are transported to the early stages of the Neolithic revolution all the way to the present.

Integrating insights from numerous fields—a partial but incomplete list includes environmental history, history of science, history of capitalism, and plant genetics—*The Profit of the Earth* packs a great deal into a slim volume. In recognition of its

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<sup>1</sup> <https://www.croptrust.org/our-work/svalbard-global-seed-vault/>. Accessed August 9, 2018.

accomplishments, the book was awarded Honorable Mention for the Frederick Jackson Turner Award for best scholarly book by a first-time author in the field of American history by the Organization of American Historians in 2018.

**Deborah Fitzgerald** opens the roundtable, praising the author's ambition and success in tackling crucial questions in a novel manner while also asking about how to think about seeds beyond their genetic content and whether chain migration in agriculture could be studied more generally in the manner Fullilove analyzes the Mennonites. **B. R. Cohen** notes the remarkable travels in the book, both historical and contemporary, while raising questions about what new political and ethical stands can be taken when the margins and erasures of history are brought to the center of our attention. In her remarks, **Jenny Leigh Smith** invites methodological reflections about the distinctions between national, international, and global history as well as the potential influence of the agroecological framework. Finally, **Jeremy Vetter** frames his comments around keywords in the book's title, using them to delve deeper into topics of political economy, ecosystem change, and the politics of knowledge production.

Before turning to the first set of comments, I would like to pause here and thank all the roundtable participants for taking part. In addition, I would like to remind readers that as an open-access forum, *H-Environment Roundtable Reviews* is available to scholars and non-scholars alike, around the world, free of charge. Please circulate.

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**Comments by Deborah Fitzgerald, Massachusetts Institute of Technology**

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This is one of the first books that tries to understand and explain contemporary agricultural practices in the context of ancient and global patterns of farming, a feat that few new scholars would even attempt. For Courtney Fullilove, however, this broad canvas is exactly what is needed to break through many time-honored yet questionable tropes regarding agriculture in American history. This is a book that crackles with original ideas and insights.<sup>2</sup>

Fullilove's work ranges quite broadly, both geographically and disciplinarily. It is difficult to pigeonhole her into any particular sub-genre of history. She explores 19<sup>th</sup> AND 20<sup>th</sup> centuries as well as the contemporary era; America AND western Europe, AND the Slavic countries AND parts of Asia; she participate in the history of science, the history of technology (which do not have a great deal of overlap, interestingly), environmental history, diplomatic history, Atlantic history, agricultural history, plant genetics, preservation biology, and more. Readers need to be on their toes if they want to follow what sometimes seems like a blizzard of people, places, and plant varieties that comprise her story.

Fullilove is one of the most ambitious young scholars I have encountered. She is quite fearless in tackling tough historical problems, and certainly does not constrain her inquiry to a clear set of materials. *The Profit of the Earth* aims to uncover the many layers of forgotten and ignored history that tell the complex story of the origins of wheat. Historians have tended to tell this story as a small and triumphant tale in which Western, scientific plant breeders are the heroes, and the story itself reaches rather shallowly into the last 100 or so years. Fullilove's key insight is that the real history is neither linear nor easily known, but rather reflects the constantly changing circumstances of farming over the last 10,000 years and over much of the globe. There really is no single line of, e.g., Turkey wheat, or any other kind, because as a seed it is easily lost, combined with other seeds of unknown origin, traded, eaten, blown away, hidden in tombs and barren landscapes. The history of cultivation, she essentially argues, has been written by the victors, a story pressed and flattened into a single dimension. What has been lost is the far messier, and far more interesting, stories in which plants have multiple uses, in many geographic and historic contexts, carried by people with many different goals and interests. What Fullilove is trying to do here is to reintroduce the complex power of these lost plants, opening a door into a radically different agricultural future.

In telling this story, Fullilove breaks with many scholarly conventions. Her manuscript is divided into three roughly chronological parts consisting of eight chapters, an epilogue, and three "field notes," basically riffs and reflections linking the material covered and still to come, a commentary about some of the larger issues raised by her historical materials. Chapter 1 explores the historical question

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<sup>2</sup> Some of the comments offered here can also be found in my review of this book in the *Journal of American History* 105: June, 2018, p. 145.

of what makes a seed valuable. Does the value lie in its ability to produce food? in its trade value? in its symbolic evidence of global reach and power? Here Fullilove lays out the basic tension between seeds as commodities and seeds as sustenance and community cohesion. Chapter 2 follows this with a study of the first national American seed collection effort, located in the United States Patent Office. She describes the internal conflicts that obtained between farmers, legislators, and emerging seed dealers, and argues that the primary importance of this institutional home was in establishing the federal government as the key agent in the international seed trade, and in demonstrating forcefully that the preservation and trade in seed was of national importance. Chapter 3 centers on the strange and little-known story of tea cultivation in the American South, an effort doomed by narrow and wrong-headed patterns of land ownership, labor, and agricultural knowledge (the view that seeds were really all that mattered). This is followed by the second field note, on pastoralism. Here Fullilove makes a great point in arguing that “early farmers,” the pastoralists, knew a lot about nature not because they had lived for many years in a particular place, but because they moved and travelled through landscapes, learning about similarities and differences as they did so. This is an important corrective to the way historians typically understand “local knowledge.”

In the second part of the manuscript, Fullilove focuses upon migration itself. Chapter 4 looks at the story of Russian Mennonite farmers who emigrated to America, who have been memorialized as the fathers of Turkey Red wheat, the wheat that made American farmers successful. By digging deeper into this creation myth, Fullilove demonstrates both the likely origins of what was known as Turkey wheat, and also the ugly circumstances of population removals and massacres that provided immigrants with the delusional belief that they alone had heroically succeeded in managing the American landscape. In Chapter 5, Fullilove continues her examination of the Mennonites’ success, finding that their superior wealth and organization allowed them to do well when everyone around them failed miserably. The notion that anyone could immigrate to the Midwestern U.S. and become a successful farmer is here laid to rest, a hugely important contribution. She then follows this with another field note, this one setting up the contemporary tension between preservation of seed for local use and cultural history, on the one hand, and preservation of seed for corporate profit, a theme that is extremely important right now in international agricultural circles.

Finally, in part three of the manuscript, Fullilove turns to plant preservation. Chapter 6 introduces Ohio pharmacist John Lloyd, who becomes Fullilove’s vehicle for discussing the rise and fall of botanic medicine in America. In this chapter Lloyd discovers and attempts to capitalize on the healing power of echinacea, a plant that now graces most American gardens as an ornamental rather than an herb or medicinal plant. As she explains, the cultivation and use of medicinal plants was a far more common phenomenon than most historians of medicine would allow. In Chapter 7 she looks at Lloyd’s brief foray into advising the federal government on tax policy regarding proprietary medicines and pharmaceuticals, a topic that

illustrates the categorical complexities of 19<sup>th</sup> century medical practitioners. This chapter also considers Lloyd's foray into science fiction, which helped him address the perils of scientific certainty, and his concerns that as knowledge became more scientific, it also became less honest and true to life as we find it. Chapter 8 is a more philosophical reflection on the nature of seeds and the problems of reductionist thinking about what she calls a "deep time technology." The manuscript closes with an epilogue on plants as genetic resources, and what we have to gain and lose by such a description.

I think that this is an important book. Fullilove should be credited with both conceptualizing this project and carrying it out so beautifully. But as with all good books, several issues bear further discussion. One is plant preservation. Fullilove notes at length the jarring disconnect between saving seeds as information, packages of DNA and intellectual property (think Svalbard, the remote Norwegian island that hosts a global seed vault deep in the permafrost), and saving seed as evidence of human, historical change over deep time. The reductionist impulse is evident all around us. As historians of plants, as well as citizens interested in preserving complex ecosystems, how should we think differently about seeds and plants? And what should we do?

Secondly, Fullilove's critique of the Mennonite farmers offers a fascinating and provocative reassessment of frontier farming. Our steady diet of cinematic westerns and antiseptic television frontier families have lulled us into being much less critical than we should be about who early farmers in America were, and why they did or did not succeed. How would Fullilove extend this critique to other ethnically cohesive farming communities? Did chain migration in general lead to more success, or was success borne only from prior knowledge of soil and climate conditions?

The book is not always perfect. The writing style can seem a little piled up, with too many adjectives and adverbs disguising the main points, and a little too much riffing for my taste. But these are very small issues. More importantly, Fullilove set her sights on a big, meaty question, and answers it in a lively, creative, and stimulating way.

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**Comments by B. R. Cohen, Lafayette College**

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**“Margins and Tensions and the History of Seeds”**

I've had an unintentional syllabus in seeds of late, for which I'm grateful. My son's high school science project two years running has involved Henderson's Bush Lima Bean seeds. While I won't go into the nuances of the silver-trayed system he set up on the window sill, nor the watering regime dictated by his bean-tending protocol, nor the long month those rusting trays remained on the sill after the project was over, I will say that it was a secret delight everyday to watch the seeds sprout, unfurl, rise, and arc to the light. We were on the far end of the seed industry, unaware of how the seeds got into that packet. We were removed from the world of the seed industry that made it easily available at the farm bureau down the road. The pack told us "the country of origin: USA." It gave the packing lot number. It had "Non-Genetically Engineered (GE) Seeds" stamped on the flap. Beyond that, I didn't know much or think much about their identity or meaning.

Coincidentally, I am currently advising a student's senior thesis about seed saving and food justice. Her work deals heavily with various forms of seed saving organizations and the ways they promote the securing, distribution, management, and cultivation of seed varieties. She is after an understanding of how her case study organizations are built on principles of justice, how they got to those points, and what that tells us about the future of biodiversity and agricultural identity. Thus, thanks to her, I have a better understanding of seed libraries, seed savers, seed banks, and the like, at least more understanding than I got from the window-sill bush beans. My prior framework had Thoreau's "faith in the seed" at one historical end, probably Jack Kloppenburg's *First the Seed* in the middle, and proprietary battles over genetic modification and corporate control of seed distribution at the other, current end.<sup>3</sup> The thesis study was expanding that framework.

And then Courtney Fullilove's *The Profit of the Earth* came to my desk. And now I have a far greater appreciation for and understanding of the "deep time technology" that we call seeds. Fullilove's work is a whole other dimension of explanation and exploration. If the Henderson Bean packet is the far end of the consumer world of commodity seeds, and the thesis work on seed saving and food justice adds a sophisticated degree of cultural and environmental analysis, *The Profit of the Earth* is the book that sits underneath all of it. It builds necessary context, political economic analysis, and historical environmental explication to show "how seeds and knowledge about them were acquired, melded, and trafficked within the context of the burgeoning, nationally and internationally oriented economy of the nineteenth-century United States" (1). Yes, as Fullilove writes, "the seed itself is a marvel and has a grammar" (194). Reading that grammar can bring risks, a point I'll end on later,

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<sup>3</sup> J. Kloppenburg, *First the Seed: The Political Economy of Plant Biotechnology*. (Madison: University of Wisconsin Press, 2004 [1988]).

but there is much to be made of the new openings in the history of science, technology, capitalism, and the environment that come from taking those risks.

Fullilove points to a few conceptual themes in the introduction that are important for the book. These include giving space to the margins of history, dealing with the tensions between assumptions of seed stability (or the lack thereof) and the dynamism that comes from the actual non-linear lifecycles of seeds and harvests, and paying attention to the relationships between knowledge, culture, and political economy. In fact, metaphors of margins, tensions, and instability recur throughout the book. In kind, those of “connectivity, entanglement, and flux” (199) are more important than linear narratives of individual heroics. All of them, collectively, provide a sense that using seeds “for writing the history of modern agriculture” gives us an agricultural history that is necessarily indirect and complicated, full of tensions more than singularities (4).

The first of two chapters in Part I addresses the historical exchange of seeds as diplomatic gifts as a way to establish, in part, the first tension, that between seeds as property and seeds as forms of exchange. That tension led to a second one right on its heels, between ownership of seeds and educational research about them. A seed as a form of cultural (and agricultural) exchange—like the wampum in *Changes in the Land*—is different than a seed as an economic entity. One has thicker, experiential, and social meaning, the other is reduced to a thin financial transaction. One is part of a lived identity over time and space, the other is removed from “geographic, material, and social contexts” (41). The second chapter carries this point forward with attention to imperial expansion across North America. Seeds, we find, were “instruments of national growth” (44). With that status they also placed seed researchers in a more commanding position than the farmers themselves, adding to a broader turning point in agriculture history toward placing knowledge claims into the hands of politically authorized expert officials instead of grounded practitioners.

This second chapter also works to confirm the political economy of seeds: the seed was both an element of federal political aims (expansion, control, land management) and economic structures of property and ownership. That private-public strain (here is a third tension) came out in the difference between the recipient-based, privatized exchange networks of naturalists and “models of seed sharing as mutual aid” (50). We find throughout the story of the patent office that plants were considered products of nature, this as opposed to “artifacts of accumulated knowledge and technological practice” (65). Thus, in what reads as a pretty deep pre-history of genetic modification technology, readers encounter commoditized seeds in the private marketplace built on the backs of public funding and research and leading to the idea that plant breeders should be able to patent seeds. Put in a more cursory way, if Elizabeth Warren in 2011 and Barak Obama in 2012 would say “you didn’t build that” by yourself as a way to show the necessary public infrastructure that made private innovation possible, then they were echoing the story of seeds and the patent office of the 1800s. This was capital improvement



based on the foundation of work funded through public coffers. Throughout the first part of the book, in fact, Fullilove shows how “a materialization of complex systems of labor and knowledge” took accumulated experience from public efforts and placed it in the hands of private benefactors (68). The third chapter, focusing on the possibilities of tea cultivation in the United States, provides a case study of the same mixture of government backing and private beneficiaries.

The tea example provides a nice point that resonates well with technology transfer narratives of the twentieth century. Boosters assumed tea-as-a-crop was a technical artifact and not a complex knowledge system, so that when they sought to transfer it they saw only the technical aspect. That faulty assumption, as with its deployment in the next century of technology transfer (Borlaug’s dwarf strains included), led them to miss their mark due to their ignorance of the complexities that made it effective in its prior home. And even in that prior home, as Fullilove will show in later chapters, the so-called local knowledge that some presumed was based on stationary and multi-generational understandings of place had itself resulted from nomadic and variable cultural conditions, of wanderers, of the dispossessed, of the immigrant.<sup>4</sup> Things don’t stay still. Assuming the story of those things, like seeds, is a story of stationary development is thus problematic.

After one of the Field Note interludes commenting on the author’s own experience tracing this story, the second part of the book again stitches together different global locales into one analysis. Here, in one particularly effective passage, Fullilove uses Chapter 4 to draw up the context of railroad expansion to substantiate her point that complex multi-variable political economy offers a more faithful explanation of seed development than that of individual improvers. As we know from rail history but not the History Channel, it isn’t railroad magnates and their indomitable spirits that explain growth and success, but railroads in league with federal bureaucracy, land development patterns, demographic encouragement to settle the prairie, and commitments to dispossession and regrowth of new seeds, crops, and people. And it wasn’t just immigrants who settled the new wheat seeds of the plains states, but Mennonites who themselves had travelled half the world in exile and resettlement to pursue their livelihoods—from Prussia to Russia to New York to Kansas.

For Fullilove, pointing this out is in keeping with an aim to explain what it means to credit larger forces, not superficially (i.e., it was “capitalism,” it was “politics,” “society” did it), but through complex legal-political-diplomatic activities. This is connectivity, entanglement, tension, flux, and complexity, not ease. Chapter 4 explains that global networks of trade that made such things possible, that “the rise of New Russia as a grain exporter was a geopolitical achievement as much as an agronomic one” (113). Legal-political-diplomatic actions allowed for new seed distribution, not heroic individuals alone. This is getting heavy. As a locus of analysis,

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<sup>4</sup> This is a point from one of the field notes. The farmer “didn’t have knowledge because he was indigenous or traditional. He had knowledge because he was a traveler” (93).

Turkey Wheat, the seed of note here, brings together local varieties in the steppes of the Crimea, Mennonites' disembarking from trains in Kansas, and the not-yet amber waves of grain on the plains of North America.

Chapter 5 carries forward the Mennonite story in a chapter I found compelling. It explains the shift away from communal values to an ideology of individualism. It's a shift away from values embodied in cultural organization and political commitments to shared models of land governance (right down to the seed and its free sharing) to modes of larger scale operation and agrarian development. In prior tellings this shift was explained as what Fullilove shows is a myth of Mennonite success. They worked hard, knew a lot, and did the job through the will of noble immigration. The breadbasket of the world the plains became, the amber waves of grain the song refers to, followed from their introduction of Turkey Red Wheat in the nineteenth century. But it wasn't so.

While Mennonites in such stories earn credit for working Turkey Red Wheat into the Plains agrarian regime, Fullilove articulates the necessary conditions that made it possible with the same you-didn't-built-it-alone framework. They were colonizers who were members of an imperial expansion plan; beneficiaries of rail networks, new farm equipment, and communication networks; workers operating on top of the groundwork already done by the patent office and other forms of publicly funded research, like that of the USDA; models of living that moved beyond earlier communal villages in an effort to accommodate new scalar demands. I didn't read this as critiquing the Mennonites so much as placing their accomplishment into that wider world. Although their communal village model had been quite efficient outside the rail, communication, and harvesting technology systems of the time, the demands of scale beyond their communities influenced new technological choices, the seeds included. The problem was scale. And scale was encouraged, as it still is, by demands of global marketplace consumption.

This chapter, at the end of Part II, gets at what feels like the whole thing: where did we moderns get the idea that seeds are innovations? There's a Page 99 test for fiction that, Wikipedia tells me, was concocted by the author Ford Madox Ford. Read page 99 and you'll know if you want to read the whole thing. For Fullilove, I would recommend the Page 135 test. There we learn that we got the idea of seeds-as-innovations because "private property and state grants and privileges provided the engine of agricultural development in the United States. Myths of national bounty, heritage, and innovation mask these political economic arrangements, in part by refiguring the seed as an object of natural advantage, cultural property, or research and development, rather than a product of labor shared across space and time" (135). It wasn't from national bounty alone, which rather than being pre-ordained had to be made. It wasn't just from the unfettered zeal for innovation that, in the same you-alone didn't build that way, was neither pre-ordained nor linear.

If the points about national bounty and innovation are more familiar to readers in environmental history and science studies, the one about heritage adds extra depth.

The heritage counter-argument comes by revealing the ways nomadic and indigent peoples—made so either by choice or by political force, but let's be real, usually political force—were also the result of more complicated heritages, not singular or stationary ones. Mennonites who had been forced out of Prussia a century earlier were then forced out of Russia to North America. Their heritage and the heritage of the seeds were never static or thin. They were a dynamic accumulation of knowledge that would seem hard to reduce to a commodity for free enterprise but was nonetheless made so.

My reading of *The Profit of the Earth* had the first five chapters striking me as most consequential, followed by two additional cases in Part III before the book's substantive concluding chapter. Chapter 6's attention to pharmacy-related issues with seeds and medical cultivation—about collectors, dealers, importers, analysts, agents, merchants—made a historical point that is always useful: things did not have to turn out the way they did. It was not inevitable that western systems would adopt the botanic medical approach common in the twentieth century. Rather, the details explored in prior chapters of seed cultivation, property rights, and over-singularity led to them. Chapter 7 reveals the compelling story of John Uri Lloyd, who Fullilove describes as “a sensitive soul with an ecological sensibility, and an optimist who wrote a jeremiad under the cover of science fiction.” His novel, *Etidorhpa*, proposed “a redemptive vision of scientific practice oriented toward humility and self-awareness rather than progress and gain” that would be lovely to see more of today (191). And, in the end, Fullilove's analyses of Lloyd, pharmacopeia, agrarians, imperialists, capitalists, agronomists, patents, and diplomats might bring a sense of humility to readers who now see the seed within a much thicker framework.

*The Profit of the Earth* does not traffic in simplifications. Let's be clear about that. Fullilove argues against singular reductive argumentation, instead helpfully insisting on reconfigurations, cyclical patterns, entanglements, flux, and more. Those are what you find on the margins of history, though through her analysis you might say those so-called margins are really more deserving of narrative prominence, dare I say centrality. Nor does she accept simplifications from historical actors who claimed it. The stories people have told about seeds are more politically complex than boosters want us to know; improvement is more complicated economically than those peddling simple models of public beneficence would have us believe; seeds may be artifacts of marketplaces, built and developed as deep-time technologies, but they are also always socio-technical systems of culture, ideology, power, and control. Seeds are a physical, material component of agricultural environments yet they “are not merely [material] agricultural inputs, but symbols of prosperity and bounty masking the political-economic requirements of cultivation” (124).

Nor is Fullilove one for stasis. This too plays out as a double move. It is true of the actors in her account as well as her own travels while conducting research for the book. Field Note interludes in *The Profit of the Earth* find her crossing from the

Tigris and Euphrates to St. Petersburg to the Caucasus and Armenia and Tajikistan and Aleppo to the plains of midcontinent North America and back to Washington, DC, like Mennonites and Russians and turkey wheat before her. The book's research perambulations model the kind of migration the seeds followed. It makes you think there's likely a future meta-study to be done of the travel budget for global histories.

These approaches carry with them risks: an unmooring in time, an imbalance in the reader, unsure where we are, when we are, whom we are following. When nothing stays still it can be hard to hold on. The timelines are sometimes tightly controlled, as with discussions of railroad magnates and Mennonite settlement patterns. Sometimes they are looser, as with discussions of nineteenth century pharmacopeia and twentieth century science fiction. They're all intriguing, but presented at different rates of time and scale. Roller coasters can be fun for the thrill of it, but they can also be dizzying.

Those issues relate to another risk, that of the import of the argument. This is the 'Where to now?' question. Conclusions and epilogues give authors the smallest space to suggest implications, consequences, and legacies to the content of a book.<sup>5</sup> There was a captivating five-page passage in Chapter 8 that hinted at this (196-201). But the format of the Roundtable Review allows for further explication and gives space to add beyond the conclusion and epilogue. I hope to hear more.

One aspect in particular is about seed saving, heritage seeds, seed banks and the like. Given Fullilove's point about the "myths of national bounty, heritage, and innovation," I wanted to hear more about the payout in particular for undoing the myth of heritage. How far does this go, in practical, political terms? Do some peoples have less connection and rights to certain seeds than others? If some seeds are worth saving more than others, what does *The Profit of the Earth* suggest as a course of action for deciding which ones are worthier? Are these unanswerable questions? In one direction, I'm thinking of work on food traditions, terroir, and cultural cuisines. And, in another, I'm wondering what this study says for projects like the Svalbard seed vault and other seed banking attempts.

And then I wanted to hear more about what work this book does for debates about GMOs. This may be the more straightforward and anticipated kind of thing to ask, but it was surprising that Monsanto only got passing reference one time, in a Field Note, and genetic modification had but a short nod in the introduction. But if Nick Cullather's (2010) ostensible history of the Green Revolution, *The Hungry World*, provides deep background that provides the context from which genetic modification technology took political root, then similarly *The Profit of the Earth* provides deep background that provides the context from which the Green

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<sup>5</sup> Though, admittedly and understandably, historians avoid what could be construed as teleological claims in such matters of contemporary relevance. In a job interview some years back a faculty member challenged my use of the phrase "lessons learned," because historians speak for the era they study, not the one they live in. I disagreed. I didn't get the job. (Hi, Don.)

Revolution took root.

Fullilove takes to task “the shibboleth of unilateral progress” and the “grammars of improvement” we write with/on the seed. I share the resistance to unilateral progress narratives. But that doesn’t mean things can’t get better. I don’t read Fullilove as suggesting they can’t, but I am also unsure of where this book leaves us or where it wants to go from here. It’s after a more durable sense of progress than the static and simplified ones almost always written post facto. But what replaces it, for seeds? What is better? Where to?

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**Comments by Jenny Leigh Smith, Hong Kong Univ. of Science & Technology**

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There is a lot to learn from Courtney Fullilove's ambitious first book, and also much to consider. Broadly speaking, this is an agro-ecological history of the late 19<sup>th</sup> century United States. Underneath this rather broad description is a book organized as a series of mini-biographies, institutional and commodity histories and first-person memoirs of seed-collecting missions. For the most part, the unusual motley nature of Fullilove's narrative is a strength, although I found some parts of the book more interesting than others. I imagine this would be a common experience, given the range of topics she explores. For example, while I have an almost inexhaustible enthusiasm for historical details about the rise and fall of the U.S.D.A.'s federal seed distribution system, the allegorical and thematic links between American pharmacist John Uri Lloyd's science fiction and 19<sup>th</sup> century patent standards was, for me at least, a less toothsome topic.

One of the more ambitious goals of Fullilove's book is to link contemporary concerns about agricultural biodiversity and food security with 19<sup>th</sup> century practices that held these same goals. While these issues may seem like recent ones, they actually have deep historical roots. Although the political, commercial, technological and environmental contexts of agricultural production have evolved dramatically in the past 150 years, the cultural resonance of seeds as technological artifacts endures. Fullilove links her sundry chapters to the single intriguing concept that seeds are deep-time repositories of human culture. This provides a strong link for all her stories, although at times the author's flair for glib writing undercuts her most crucial message: seeds matter, they have for a long time, and they will continue to do so in the future.

Fullilove's book provides fodder for several potentially lively lines of inquiry; one is the narrative device of switching between the third and first person. In three different mini-chapters—labeled as *Field Notes*—Fullilove replaces the standard omniscient historical narrator with personal contemporary recollections of the author's work as a seed collector for the Syrian seed bank ICARDA in the former Soviet Republic of Armenia. These interstitial breaks are not wholly unique; Kate Brown employs something similar in *Plutopia*. This narrative switch raised several questions: first, should more historians do this? It seems an excellent way to break up a historical monograph. Second, in spite of the appeal of the first person genre, I worry it might come with some baked-in problems. While participant-observation is the norm for anthropology, historians have traditionally privileged written primary sources over potentially messy contemporary human encounters. Contemporary human encounters in Syria have been especially messy recently. By the end of the book, I had grown quite worried about Fullilove's Syrian collaborators. Are they still at work? Are they still alive? Is their seed bank still intact? A quick Google search turns up an article Fullilove wrote for an online journal in early 2016 that seems to answer all three questions in the affirmative, but it is now 24 months deeper in to the Syrian civil war. I am also curious if Fullilove has continued collaborating with

this group and other seed saving teams and how these collaborations, if they continue, have influenced her approach to future research projects.

A second topic for discussion originates in a more standard historical observation: this story is profoundly informed by the US institution of slavery and its aftermath. This is to Fullilove's credit: it would have been be easy, and perhaps for some, more obvious, to write a story about educated white men improving agriculture and imposing scientific order on unruly nature (largely outside the American South) in a way that did not engage with the violence of slavery or its enduring and problematic legacy. Fullilove does an excellent job explaining to readers how slaveholding and Jim Crow attitudes inspired and guided plans for agricultural expansion during the late 19<sup>th</sup> century. In this roundtable, I push Fullilove to examine links between this 19<sup>th</sup> century agro-biological American situation, informed as it was by vast racially-based social and economic injustice, and the more recent state of the field of agro-biodiversity, seed collecting and seed commodification. Bringing this analysis into the 21<sup>st</sup> century, are these impacts still visible, and if so, where are they seen most readily?

A contrarian note on language: in the introduction, Fullilove identifies this book as an international and global history, yet the vast majority of the book's sources are written in English (a few are in German). In spite of this limitation, the action of the story takes place variously in Armenia, Crimea, Japan, Russia, Syria and several Western European capitals. This is anathema to the way global histories are usually written. Traditionally, historians who tackle international subjects are expected to be well versed in the languages their subjects spoke or wrote in. Fullilove's research, largely in English, is a non-traditional approach. Let me be clear; I think this is great. However, as a fellow scholar who creates international histories with only a handful of languages in my toolbox, I would like to know more. I am curious about the workarounds Fullilove employed to gain this global perspective; were language translation apps an essential tool for doing this work (and if so, how could or should these new tools be credited in these new kinds of histories?). Given the language barriers inherent in this project, how did the author circumvent or rise above linguistic challenges to produce a work that does convincingly argue for the global origins of not only American agriculture, but farming worldwide?

Finally, I quite liked this book, but I have one, fairly mild criticism. The way I read the book, it seemed clear *The Profit of the Earth* owes a significant and largely unacknowledged debt to both Donald Worster's work on agro-ecology (especially his original case study—*Dust Bowl*— which also addresses wheat farming in Kansas) and David Moon's wonderful book on steppe (prairie) grain farming and the development of scientific agriculture in the Russian Empire, *The Plough that Broke the Steppes*. Moon appears frequently in the footnotes, Worster does not. Like Fullilove, these two books highlight the impermanence and vulnerability of food security, especially for grains, at the mercy of environmental changes. Delightfully, they are in conversation with each other as well and are a pleasure to read side by side. *The Profit of the Earth* is a strong new book with a fresh take on these subjects,

and while Fullilove focuses on many topics that are not of concern to either Worster or Moon, many of her concerns run parallel to theirs. I invite Fullilove to expand on how these two books influenced her own work, especially since they both fall more solidly within the category of environmental history. Additionally, how has the historical agroecological perspective evolved since Worster first coined the phrase nearly 40 years ago?



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**Comments by Jeremy Vetter, University of Arizona**

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In this book's acknowledgments, Courtney Fullilove begins by frankly and commendably acknowledging that writing it "has been a study in detours" (p. 223). Quite so: her book provides an episodic and unpredictable romp through a series of often surprising chapters. It begins in its first three chapters—which I found the most satisfying part of the book—quite tightly focused on what is in her title, with a focus on the antebellum period. It then gradually unfurls in various, often unexpected, directions as it moves chronologically into the later nineteenth century, and then snaps back to the core subject in the final chapter, which analyzes seeds as a "deep time technology" (p. 196) from prehistory to the present. In reading her book, I couldn't help but simultaneously be impressed with the sharpness of her analysis of the individual case studies and wanting more direction from the author about how it all fits together argumentatively and more discussion of how it intersects with scholarly debates about the fascinating issues which her book raises for historians of environment, capitalism, science, agriculture, and the U.S. in the world.

This book is consistently enjoyable to read, rendering engaging stories and tracing lively connections. However, its overall subject matter and argumentation can sometimes be elusive. The book puts forward many generalizations and historical assertions with which I am in broad sympathy—about the relevance of political economy for understanding agricultural science, the importance of looking beyond expert science to incorporate the contributions of lay people to the production of knowledge, and the necessity of analyzing all of these American developments in their global context—yet its fundamental impulse also remains somewhat deconstructive. By this, I mean that many of the chapters revolve around taking standard narratives and assumptions about seeds (or other related topics, such as botanical medicine) and then subjecting them to critical historical scrutiny, in order to reveal their complexity, contingency, and incompleteness. But what to make of all this? Below I will raise a series of issues and questions for the author by taking pairs of keywords, from the title, and then asking how the author might articulate more fully how it engages with scholarly debates related to these keywords.

First, *Profit and American*. "Political economy" is frequently invoked in this book—something which this reviewer heartily approves—but I'm not sure that there is a clear statement or systematic analysis of what argument the book is making about political economy in the United States, whether about change or continuity over time. To some extent, this is a characteristic shared by many works in the recent history of capitalism that are heavily inflected by cultural history, in which political economy is highly contextualized and culturally embedded in particular times and places. But there are enough hints in this book—an interest in history over the *longue durée*, as well as frequent references to labor systems, wealth inequality, and property ownership regimes—to indicate something more. In chapter 5, for example, when discussing the reasons for Mennonite success in midwestern wheat

farming, Fullilove identifies “wealth and large-scale ownership” as the “primary factors,” characterizing seeds as “not merely agricultural inputs, but symbols of prosperity and bounty masking the political-economic requirements of cultivation” (p. 124). Such an explanatory framework, in which cultural narratives are deconstructed, but then revealed to be obscuring more fundamental political economic realities, recurs throughout the book.

Thinking about political economy, whether in a regional, national, or even global context, also makes me wish to have more engagement with the secondary literature, in order to show both differences in scholarly approach with other previous works and also to highlight significant changes over time that would highlight instructive contrasts with the nineteenth-century period that Fullilove refreshingly emphasizes. Two secondary works hover throughout the book and often show up in the notes: Jack Kloppenburg’s *First the Seed* (1988); and Philip Pauly’s *Fruits and Plains* (2007).<sup>6</sup> Of the two, Kloppenburg has the more explicitly developed political economic framework, especially during and after the age of genetic science, while Pauly is focused more on the nineteenth century and is less explicit about political economy. For both of them, I would be interested to know more about how Fullilove is building on, extending, agreeing or disagreeing with, or otherwise engaging with their arguments. There is a tendency in *Profit of the Earth*—perhaps stemming from a desire to attract a wider public rather than just a scholarly audience—to avoid too much explicit framing of the book within scholarly debates. This can lead to some interesting, unremarked juxtapositions, such as a key endnote in the introduction (n. 9 on p. 8) that synthesizes the history of public-private relations in U.S. agricultural research in a single paragraph, then references not only Kloppenburg and Pauly, but also books by William Cronon, Margaret Rossiter, Deborah Fitzgerald, Alan Olmstead and Paul Rhode, and Donald Worster—an impressive group of well-known historians, but with an extraordinarily diverse range of approaches and ideas. That they could all be synthesized into a single brief paragraph is itself remarkable, but where Fullilove’s book fits in relation to their work is an even more intriguing question to answer.

In narrating the long-term political economy of U.S. agricultural knowledge, the long twentieth century is usually cast as a fundamentally different world from what came before. Fullilove’s book challenges us to think about how some important shifts—such as the erasure of agrarian knowledge outside of official institutions, the appropriation of that knowledge, and the tensions between the public and private sectors—could be traced all the way back to the early nineteenth century. But in order to make this case more clearly, it might be useful to situate the book in relation to some other works on the history of late nineteenth-century and twentieth-century U.S. (and global) agricultural science. The twentieth century, as Kloppenburg and others have shown, was an era of dramatically expanding

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<sup>6</sup> Philip J. Pauly, *Fruits and Plains: The Horticultural Transformation of America* (Cambridge, Mass.: Harvard University Press, 2007); Jack Ralph Kloppenburg, *First the Seed: The Political Economy of Plant Biotechnology, 1492-2000* (Cambridge: Cambridge University Press, 1988).

privatization and commodification through plant variety protection, hybrid seed development, and eventually genetic engineering. In her earlier book, *The Business of Breeding* (1990), Fitzgerald examines the development of hybrid corn in Illinois through both the public and private sectors. “As hybrid corn was transformed from a common research program into a popular and profitable commodity around 1936,” she writes, “the cooperation that had obtained between the university and the seed companies began to disintegrate as their interests and goals diverged.”<sup>7</sup> How did the trajectory of public-private relations for hybrid seed both compare to and emerge from the earlier tensions between public and private in the Patent Office seed program analyzed by Fullilove?

A potential clue to the shifting political economy of agricultural science, although focused more on the national level rather than the state experiment stations emphasized by Fitzgerald, comes from the political scientist Daniel P. Carpenter, who attempts to explain the rise of bureaucratic autonomy for the U.S. Department of Agriculture. In doing so, he not only chronicled the dominance of “pork-style distribution of common seeds” from the 1860s through the 1890s in the USDA’s activities, followed by a dramatic rise in scientific research from the 1890s into the early twentieth century, but also found a striking statistical association between support for the Populist presidential candidate in 1892 and requests for seeds rather than information. These findings, in conjunction with what we know from studies by Fitzgerald and other historians of agricultural science, suggest a potentially fertile field for connecting and comparing with Fullilove’s observations on the early to mid nineteenth century political economy of seeds and knowledge.<sup>8</sup> This is probably clearest in the first two chapters, which are the most comprehensive and satisfying accounts we have yet of the circulation of seeds and knowledge during the era prior to the founding of the U.S. Department of Agriculture. But in the remaining chapters, our attention is often drawn not to more general patterns but to the intriguing questions raised by particular case studies. For example, in chapter 3, if neglect of political economy is the key reason for the failure of the American tea project—and, in particular, the lack of emphasis on smallholder alternatives to plantation slavery—then we are we to make of the similar reliance on coercive labor in Asian tea cultivation and the explicit efforts by American promoters to argue that tea would fit in well with slavery in the American South?

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<sup>7</sup> Deborah Fitzgerald, *The Business of Breeding: Hybrid Corn in Illinois, 1890-1940* (Ithaca: Cornell University Press, 1990), 7. For an important comparison case in Germany for the political economy of plant breeding, especially in relation to agrarian political economy, see Jonathan Harwood, *Europe’s Green Revolution and Others Since: The Rise and Fall of Peasant-Friendly Plant Breeding* (London: Routledge, 2012).

<sup>8</sup> Daniel P. Carpenter, *The Forging of Bureaucratic Autonomy: Reputations, Networks, and Policy Innovation in Executive Agencies, 1862-1928* (Princeton: Princeton University Press, 2001), 179, 184. Chapters 6 and 7 are perhaps most relevant to this book review and are titled “Science in the Service of Seeds: The USDA, 1862-1900,” and “From Seeds to Science: The USDA as University, 1897-1971.” Chapters 8 and 9 are also about the USDA.

Next, consider *Earth and Agriculture*. I am predisposed to accept Fullilove's gestures toward not only political economy, but also changes in land use, for explaining historical outcomes. Yet I would have enjoyed seeing more presentation and analysis of evidence, perhaps from census records or other aggregate data sets, about land ownership patterns, labor systems, wealth and income distribution, agricultural land use changes over time, and the like. For instance, chapter 6 makes the plausible claim that botanical medicine's marginalization by the late nineteenth century was "as much a result of changes in land use and political economy as of medical knowledge" (p. 154). But how do we know this? Mainly through a few letters or reports from farmers that are obliquely referenced in the text (about which more below), which suggested that having more land under cultivation and changes in agricultural work practices was making it more difficult to secure supplies of *Echinacea* and other wild plants (p. 168). To complement these anecdotes, perhaps it would be helpful to situate them in the larger data about land use patterns and agricultural practices in Kansas and nearby states, in order to see how well the timing fits with the causal explanation being offered by Fullilove.<sup>9</sup> Or perhaps there are sound methodological reasons for eschewing such evidence, when it might not be fine grained enough to capture the particular aspects of land and labor that are most relevant.

As another concrete example, consider once again chapter 3, where Fullilove argues that a neglect of political economy led to the failure of tea cultivation in the United States. I wondered about the environmental and material factors: weren't they at least as crucial to the outcome? How were the environmental conditions in the U.S. similar to or different from the Asian places where the tea came from? If the climate, soil, and topography played no role, or only minimal role, in the failure to develop a U.S. tea industry, is there more evidence showing why this was the case? Likewise, similar questions about global environmental comparison are suggested by the fascinating back story of Mennonite land use history in Russia prior to their emigration to the U.S., tracing seed explorer Mark Carleton's "trail to the Black Sea port of Odessa, down into the Crimean Peninsula, back up the Molochna River colony from which Bernard Warkentin originated, and again to the port of Berdiansk on the Sea of Azov" (pp. 102-103). What more might we learn by comparatively examining the environmental conditions in Russia and the U.S. Great Plains, as well as the climatic cycles they experienced?<sup>10</sup>

Finally, consider *Global and Seeds*. Sticking with chapter 3, we are also aptly confronted with the materiality and global context of seeds. The tea plants and their

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<sup>9</sup> For an especially impressive study from the same region that combines qualitative local examples with broader quantitative evidence, even if I don't entirely agree with all of its conclusions, see Geoff Cunfer, *On the Great Plains: Agriculture and Environment* (College Station: Texas A&M University Press, 2005).

<sup>10</sup> Some suggestive evidence can be found in a book that Fullilove does cite several times: David Moon, *The Plough That Broke the Steppes: Agriculture and Environment on Russia's Grasslands, 1700-1914* (Oxford: Oxford University Press, 2013), which of course has a title that deliberately echoes the American experience.

seeds varied, as Fullilove points out when discussing Robert Fortune's travels in Asia, and the Americans apparently often received inferior seeds, or at least so one of them claimed (p. 78). How much, then, might the material properties of the seeds themselves be considered an important part of the story of failure? Was this just a marketing ploy by his rival Francis Bonyngne, or was this a significant factor in the explanation? The global context of U.S. seeds and knowledge about them continue to be central in chapter 4 and 5 on Mennonite settlers in Kansas, but these issues seem to become less prominent, especially in chapters 6 and 7 on botanic medicine. At the same time, "seeds" themselves also disappear from the narrative, with the shift to *Echinacea* and pharmaceutical plants more generally.

As a book at the intersection of environmental history and the history of science, it is also quite appropriate that Fullilove emphasizes the relationships and tensions between different forms of knowledge, including the agrarian knowledge of farmers alongside formal scientific knowledge. Yet, as we have learned from other histories of agricultural science, the involvement of lay people and "agrarian knowledge" didn't stop with the rise of agricultural experiment stations in the late nineteenth century. Indeed, the end of the nineteenth century seems a strange place to stop for a book on the "global seeds of American agriculture" (even if the author does take the side story of botanical medicine, instead, into the early twentieth century and the final chapter, on seeds more generally, up to the present). Most famously, in the late 1890s, an Office of Seed and Plant Introduction, was set up in the U.S. Department of Agriculture, led by the famed global plant explorer David Fairchild, whom Pauly calls the early twentieth century's "central figure in systematic plant introduction."<sup>11</sup> Although "Seed" was removed from the agency's name in the mid 1920s, a few years after this the agency's historian nevertheless described the Office as one that "obtains new and promising seeds and plants through exploration and correspondence and tests them at field stations or through coöperation with other agencies, public and private."<sup>12</sup> Further name changes would occur in subsequent decades, but the opening decades of the twentieth century would long stand as a

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<sup>11</sup> Pauly, *Fruits and Plains*, 126. The most thorough secondary account of this agency, that I am aware of, is Jeffrey Jacob Jones, "The World Was Our Garden: United States Plant Introduction, Empire, and Industrial Agriculture, 1898-1948," (Ph.D. dissertation, Purdue University, 2004), which compares the U.S. plant exploration efforts with those of European empires and identifies this agency as an underappreciated contributor to twentieth-century U.S. agriculture. It might be interesting to know how Fullilove situates her own work, focused mainly on an earlier period, in relation to Jones's work. Are there instructive points of contrast with the political economy or knowledge production practices discussed by Jones? For example, Jones argues that Fairchild and his Seed and Plant Introduction (SPI) colleagues "consciously dedicated the SPI to furthering the scientific/industrial/agribusiness model of agriculture," mainly "in response to their understanding of the 'rural crisis' of the 1880s and 1890s, an era when farm incomes fell drastically as a result of overproduction in basic grain and fiber commodities" (p. 31). How, if at all, did these increasingly global agricultural boom and bust cycles affect the trajectory of government involvement in seeds and knowledge about them throughout the nineteenth century? Or was the end of the nineteenth century a turning point in this regard?

<sup>12</sup> Fred Wilbur Powell, *The Bureau of Plant Industry: Its History, Activities and Organization* (Baltimore: Johns Hopkins Press, 1927), 38.

pivotal era in the global search for seeds and plants by American travelers. Looking back in the mid-1930s, another USDA historian credited this “plant-introduction work,” which “developed into a system of world-wide agricultural exploration,” for bringing some 34,000 varieties and species of plants into the U.S., with careful records kept of all this work.<sup>13</sup>

Its most prominent leader of plant and seed exploration, Fairchild grew up as the child of an agricultural college president in Manhattan, Kansas in the late nineteenth century—a state that is also a recurring setting in Fullilove’s book—and recounted his life and global travel experiences in *The World Was My Garden* (1938), which has become a major source for historical narratives. Exemplifying the narrative that Fullilove repeatedly, and rightly, criticizes as too narrowly drawn, Fairchild opined that his schoolmate Mark Carleton “would go down in history as the man who explored the ‘Black Lands of Russia’ and sent home the Durum wheats.”<sup>14</sup> Fullilove, however, is concerned less with the official plant explorations of Carleton, Fairchild, and their colleagues, and more with deconstructing the narratives they told about earlier seed and plant introductions, especially turkey wheat by the Mennonite settlers a few decades earlier. But what if the travels of official USDA agricultural scientists were included in the narrative more fully? How would it change the story, by incorporating a different model of the relationship between political economy and knowledge production?<sup>15</sup>

Before concluding my review, I would like to raise two other issues, one related to my own pickiness about references (but something perhaps worth discussing) and the other a tantalizing idea in the Epilogue that I would love to know more about. First, about the citations: In several of the chapters, including chapters 4, 6, and 7, I noticed that key archival sources were often referenced only once for the collection as a whole when it was first used—albeit with some extended description of the materials (e.g., n. 17 on p. 248, no. 40 on pp. 258-259)—then relied upon extensively throughout a chapter without any further citations to any specific items. I presume this was done with the aim of revising for a wider public audience, which is perhaps less concerned about the detailed references. As a result, the reader must depend on clues within the narrative itself—names, dates, topics—to infer the exact source materials, such as specific letters in those collections. This places an unusual burden on the author to convey this information in the text, and I wondered, as I was reading, what were the considerations for and against this strategy. It does

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<sup>13</sup> Alfred Charles True, *A History of Agricultural Experimentation and Research in the United States* (Washington: Government Printing Office, 1937), 197.

<sup>14</sup> David Fairchild, *The World Was My Garden: Travels of a Plant Explorer* (New York: Scribner’s, 1938), 12.

<sup>15</sup> According to Pauly, in *Fruits and Plains*, “Fairchild organized and maintained a national circuit of horticultural congregations, consisting of propagating gardens with local patrons, and of dispersed ‘cooperators’ who included land grant college professors, commercial orchardists and nurserymen, and serious amateur gardeners. Cooperators received new plants and returned testimony about their qualities; all were kept abreast of new introductions through published inventories and a mimeographed bulletin aptly titled *Plant Immigrants*” (p. 129).

seem to work in many cases, when it is convenient to give names and dates within the flow of the text, and often the clues are complete enough that one could imagine finding the item without much difficulty. However, in other cases, a reader might be frustrated not only by the extra work to locate a specific item but also by not knowing all the basic facts about the source while reading. For example, in chapter 6 on the late-nineteenth-century *Echinacea* collecting efforts of Ohio pharmacist John Uri Lloyd, the text itself merely refers to responses from “Jacksonville dealers” and “North Carolina dealers” (p. 162) without referring to the names or specific dates, although we learn from the endnote that the only files available were from 1903, and this is also implied later in the chapter when the author refers to “1902, the year before Lloyd sought supplies” (p. 164). In the end, this does not take away from the many good things about the book, but it might be interesting to know more about the thinking behind this choice.

Finally, the more exciting, but thus far unrealized, idea: In the Epilogue, Fullilove mentions “a desire to write a better history of American wheat varieties using genetic records,” something in which she was “still engaged” at the time of finishing the book (p. 213). This suggests an even greater motivation behind all the travels described in the various “field notes” interludes between sections of the book, which offer brief vignettes of travels with plant genetics collectors. How might our narratives about the history of seeds and plants be changed through the use of genetic evidence? That is something I wondered about myself in my own past, as I transitioned from a master’s degree in science that involved some genetics, and into history, hoping to integrate genetic evidence in my later research, which is something that for me has remained completely unrealized (except for speculative comments at the odd conference roundtable or panel) after I shifted to a research program where such evidence was not really useful.<sup>16</sup> Upon seeing Fullilove’s comment in her Epilogue, however, and thinking again about her book as a whole—and especially her ruminations about seeds as deep time technologies—it struck me that she is now well situated to integrate genetic evidence into her work, in a critical yet productive manner, to deepen and enrich her historical account. What is the fruit that such integrative work might promise? How might this transform the history of American seeds in global context? In such future work by Fullilove, even more fascinating and well-told histories undoubtedly remain to be revealed.

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<sup>16</sup> For an example of someone who has made use of genetic evidence productively in environmental history, in the history of human health and disease, see James L. A. Webb, *Humanity's Burden: A Global History of Malaria* (Cambridge: Cambridge University Press, 2009).

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**Response by Courtney Fullilove, Wesleyan University**

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It's really a pleasure to have colleagues reflect on this work and suggest questions to pursue. I wrote in the acknowledgments that the book was a study in detours. This was partly an allusion to the seven summers I spent collecting seeds in the Caucasus and Central Asia when I probably ought to have been writing. But it also referred to the trajectory of my archival research, which mirrored my sharpening focus on the plants in the field. What began as a dissertation on the US Patent Office in the 19<sup>th</sup> century turned gradually to a fascination with the records of seeds and cuttings packed in its halls. I never lost the surprise I felt as a graduate student in the archives upon finding the spoils of scientific expeditions overflowing the galleries of the Patent Office Building. And I was struck by the scale of the office's effort to import seeds and cuttings for the benefit of American farmers. At first I focused narrowly on the question of why an institution dedicated to issuing property rights in invention funded public agricultural research and provided the basis of an autonomous U.S. Department of Agriculture. Then I became interested in the broader transplantation of plant genetic material to the United States, both as an aspect of its history as a settler colony producing commodity crops for international consumption, and as a program of research and development that shaped the trajectory of global agricultural development in the 19<sup>th</sup> and 20<sup>th</sup> centuries. My fieldwork with international agricultural research organizations collecting seeds for international gene banks, which so slowed my writing progress, also gave me insight into the ways history lives in contemporary science and policy.

For me, the key to the book is in the title, over which I labored, and which is taken from Ecclesiastes 5:8-9. "If you see in a province the oppression of the poor and the violation of justice and righteousness, do not be amazed at the matter, for the high official is watched by a higher, and there are yet higher ones over them." (ESV) "Moreover," (switching to the King James Version here for the sake of poetry), "the profit of the earth is for all. The king himself is served by the field." The obscurity of this passage has always appealed to me. What does it even mean? That there is a functioning system of oversight, mitigating injustice, or that we all subsist because of the ruthless exploitation of natural and human resources? Or both? As this passage suggests, and as my book aims to demonstrate, world food systems are constituted of not simply of material inputs but of human labor, property rights, commerce, and financial instruments. As Ben Cohen notes, the book I've written is not so much an account of these components—seed saving, plant breeding, or property and commerce in seeds—as an analysis of the logics that support those practices. This requires, as Deborah Fitzgerald generously summarizes, thinking about "contemporary agricultural practices in the context of ancient and global patterns of farming." As she observes, this perspectival shift requires us to reconsider many of our cherished tropes of American history: the power of innovation, the hard-working immigrant, and even the notion of discrete cultural heritage.



This what I think history is best for: not simply to provide chronicles or limited critiques of political and economic developments or environmental exploitation, but to understand the practices and assumptions that bring these categories into being. Here this means demonstrating that seeds are not just material inputs, but symbols of prosperity made to do the bidding of those who lay claim to them. Further, and I appreciate Ben zeroing in on this bit: “Private property and state grants and privileges provided the engine of agricultural development in the United States. Myths of national bounty, heritage, and innovation mask these political economic arrangements, in part by refiguring the seed as an object of natural advantage, cultural property, or research and development, rather than a product of labor shared across space and time” (135).

As Ben observes, however, all this myth-busting this leaves us in an uncertain place. In so many ways, the idea of cultural heritage seems to provide a defense against the progressive commodification of culture. Why mess with that? My intent isn't destructive. I think there is legitimate confusion about the styles and politics of agrobiodiversity preservation, partly owing to our cozy recourse to so many contradictory myths: of innovation, heritage, tradition, and technological solutionism. No wonder when confronted with a project like the Svalbard seed vault, which aims to preserve world biodiversity under permafrost, people never get past the charisma of a trapezoidal hatch marking Noah's Ark at the North Pole. But there are important questions to ask. Can community seed saving support these projects of scale, and vice versa? Are they compatible or inconsistent with capitalized breeding practices, including but not limited to varied styles of genetic modification that have proved so controversial in recent years? The intention of the book is not to answer these questions but to place them in people's minds by exploring, as Deborah Fitzgerald summarizes, the “basic tension between seeds as commodities and seeds as sustenance and community cohesion.” Here and in all my research, I want to provide an empirical basis for more aware political and legal interventions, and to value knowledge and labor obscured by dominant imperatives of production and use.

Although reviewers have noted the wide geographic scope of the project, the book doesn't make a claim to be an international or global history. It is first and foremost a book about American agriculture, and the ways in which historians must locate national histories within a broader frame. In field jargon, one might better classify this as a history of the “U.S. in the world.” That said, as a professional consideration, I question what purpose would be served, as Jenny Smith suggests is often done, by qualifying or disqualifying a history as international or global according to the number of multilingual or multinational archives and sources it employs. Among other things, such an approach neglects diasporic archives and records, as in the case of the Mennonites from Southern Russia (whose archives in Kansas and Ukraine/Canada are all primarily in German). One of the concerns of the book is the simultaneous migration of people and knowledge, which rigid definitions of international or global history may obscure. I am particularly looking forward to David Moon's new work on Russian-American crop/knowledge exchange, which

promises to employ a broad range of Russian-language sources inaccessible to me at the time of research.

On the whole, I welcome the discipline's orientation away from national histories toward transnational and global concerns. As I argue in the introduction, these views are essential to understanding environmental and economic history writ large—and this is the kind of history I want to see written in the future, rather than the history I have written here. The interstitial “field notes” on my collecting work with plant genetic resource specialists are meant to open vistas to these approaches. As Amy Greenberg pointed out in a forum I participated in the *Journal of American History*, however, the obstacles to multilingual and international research are formidable.<sup>17</sup> To support it as a profession, we need to think about ways to reward collaboration in the tenure process, rather than insisting on itineraries or levels of linguistic preparation that exclude many scholars. My new work on the history of biodiversity preservation is more international in orientation; and I agree that working in third and fourth languages in multi-sited archives alters perspective. It also slows progress dramatically, and I wouldn't have pursued it without tenure given limits on resources and time. (Ben asks in passing about the travel budgets projects like mine require: I'll reply only that you'd be amazed how cheaply you can fly from Almaty to Raleigh in July, as long as you're willing to be uncomfortable.)

Taking up the book's Part I on “Collection,” Jeremy asks what I mean when I say political economy, and more specifically how I regard Jack Kloppenburg's work. In this book I treat politics as the exercise of power, and political economy as the study of how politics and governance shape the control of material and intellectual resources—and ultimately the choices of individuals and communities. Kloppenburg's account remains an essential history of how public research in the United States ultimately supported private industry, most persuasively demonstrated with respect to hybrid corn. Generally, I think my research supports his thesis, and it is part of a much broader legacy of histories examining the simultaneous development of nation state and market. My specific interest is in the extent to which political and economic development at the national level require the reconfiguration and renaming of local knowledge and resources, explored most systematically in Parts II and III of the book on “Migration” and “Preservation.”

Jenny Smith, also focusing on the book's Part I, characterizes the book's analysis as agroecological rather than political economic and regrets the absence of more extensive discussion of Donald Worster's work. She identifies the term “agroecology” as coined by Worster in the 1990s; but as he would be the first to observe, the approach was already decades old at the time he introduced it to historians. In this respect my instincts are similar to his: although my book was informed by historical works on 19<sup>th</sup> and early 20<sup>th</sup> century agriculture, including those Jeremy lists, its

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<sup>17</sup> “Interchange: Globalization and Its Limits between the American Revolution and the Civil War,” *Journal of American History* 103, no. 2 (September 1, 2016): 400–433, <https://doi.org/10.1093/jahist/jaw182>.

primary inspirations came from outside of it, both in the longer range history of European natural science, and in my practice of botany and nature collection in the field. In particular, I wanted to explore the continuities I identified between those practices, both at the level of techniques of collection and documentation, and in the political and scientific institutions they supported. These interests are reflected in my field notes on biodiversity collection, which are interleaved with the historical chapters on the transplantation of seeds and cuttings to North America.

Although the literature on agroecology was not a primary influence for me, the interpretation interests me, especially as more and more approaches—ecosystems, agronomy, political economy, population ecology—have been gathered into its fold. Truthfully, this capaciousness strikes me as a critical weakness. Ecological frameworks are useful to historians because they allow us to see interdependencies and interactions without resort to simplified models of power or linear causation. But they lose force when they fail to specify their relation to the diverse approaches to human social and economic relations named above. Additionally, these approaches differ from mine in their materialism. I appreciate Philip Pauly's insistence that we put the "culture" back in agriculture, understanding the complex values and meanings people attached to the plants they exploited. My focus is thus less on the material components of agro-ecosystems than their epistemological foundations, amplified in the chapters on the attenuation of botanic medicine (6-7) and seeds as deep-time technologies (8). Readers who choose to focus only on the book's Part I to the exclusion of these discussions will misconstrue its analysis of agricultural systems as primarily materialist, rather than considering the ways in which economies are fabrications of knowledge and imagination.

I was happy to see Jeremy take up a remark I make in the epilogue, which is that while I went to a genebank in Syria with a view to using genetic records to write better history, I returned wanting to use history to think more critically about genetic records. Provocatively, he returns to the first question, pressing the question of how genetic records can be used to write better history. A final argument of the book is that we cannot use genetic records as evidence without understanding their particular histories as modes of analysis. Nevertheless, I agree with Jeremy that the judicious use of genetic analysis as historical evidence warrants investigation, and indeed is inescapable given the authority attributed to genetics as a discipline in the early 21<sup>st</sup> century.

I have learned an enormous amount even since the publication of the book from emerging studies of plant genomics and domestication. As testament to this, the wheat genome was only sequenced after the book went to press. One write-up described wheat genome as the "Mount Everest" for geneticists because of its size and complexity: five times that of a human, hexaploid rather than diploid, 80% non-coding DNA, and consisting of extremely long repetitive sequences. One

commentator described these sequences as a “jigsaw puzzle of blue sky.”<sup>18</sup> The existing sequencing software simply collapsed these sections, preventing a complete sequence from being compiled. Ultimately the “super reads” and “mega reads” of the next generation software took a total of 470K CPU hours, which is to say 53.7 years, running on a grid of 1K jobs in parallel, to 3320 max, such that the entire project took about five months.<sup>19</sup> And there is so much we can learn from the results. The annotation of the genome itself is a herculean endeavor.

In my epilogue, I make a sort of missionary call for more contextual, human scale histories in which the insights of genetics can be embedded. But what I also want to say is that there are people doing this. Phylogenetic analysis has limits: it can only see relationships between categories or things as they have been defined. It can't identify geologic events, or climate, or geography: it has no ecological perspective, except through interdisciplinary analysis. The most recent students of plant domestication weigh up phylogenetic analysis against archaeobotanical evidence, searching for the missing pieces and the unstudied assumptions about evolution, human choices, and natural constraints. Some conclusions: domestication was not so much an event or innovation as a series of push-pull factors, with post-Pleistocene climate changes chief among them. Sea level rise, forestation, new areas of foraging and settlement created new trade networks. As Andrew Sherratt characterized it, farming was a minority response to the ecological conditions of the early Holocene. He took it further: our histories shouldn't be clouded by Victorian suppositions of its moral and technical superiority, or prioritize cereal domestication over crop packages, larger plant assemblages, and the long history of plant resource management that preceded domestication. Domestication in Southwest Asia was a recurrent global process, part of a broad human knowledge of landscape management that simply didn't leave the same material records as domestication. And anyway, even if one prioritized material records, arguably food processing technologies like cooking vessels were more important than farming in determining the trajectory of world food systems.<sup>20</sup>

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<sup>18</sup> Ewen Callaway, “Small Group Scoops International Effort to Sequence Huge Wheat Genome,” *Nature News*, accessed July 16, 2018, <https://doi.org/10.1038/nature.2017.22924>.

<sup>19</sup> Aleksey V. Zimin et al., “The First Near-Complete Assembly of the Hexaploid Bread Wheat Genome, *Triticum Aestivum*,” *GigaScience* 6, no. 11 (November 1, 2017): 1–7, <https://doi.org/10.1093/gigascience/gix097>.

<sup>20</sup> Dorian Q Fuller, George Willcox, and Robin G Allaby, “Cultivation and Domestication Had Multiple Origins: Arguments against the Core Area Hypothesis for the Origins of Agriculture in the Near East,” *World Archaeology*. 43, no. 4 (2011): 628–52; Andrew Sherratt, “Diverse origins: regional contributions to the genesis of farming,” in Colledge et al., *The Origins and Spread of Domestic Plants in Southwest Asia and Europe*, 1-20; Zeder, “The Origins of Agriculture in the Near East”; Manon Savard, Mark Nesbitt, and Martin K Jones, “The Role of Wild Grasses in Subsistence and Sedentism: New Evidence from the Northern Fertile Crescent,” *World Archaeology* 38 (2006): 179–96. One recent synthesis of domestication literature is provided by James C. Scott, *Against the Grain: Plants, Animals, Microbes, Captives, Barbarians, and a New Story of Civilization* (New Haven, CT: Yale University Press, 2017).

This brings me back to the focus of the book on seeds as “deep-time technologies.” When we start to use these broader time scales and ranges of actors to talk about the history of technology, narratives such as innovation look fairly flimsy. And this is where the deep past is a key to the “radically different agricultural future” toward which Deborah Fitzgerald sees me driving. In general discussion, as Ben notes, we have only the constrained vocabularies of Green Revolutions and GMOs to guide us. The book explores more the fundamental and longstanding questions about the relationship of rural life to capital and governance that have produced these vocabularies. This is consistent with Jenny Smith’s note that legacies of racism and social and economic injustice persist into the 21<sup>st</sup> century. The book’s historical chapters explain the ways in which these inequities root in colonialism and associated practice of European natural science. The book’s field notes, excerpting travels in Central Asia and the Caucasus, are meant precisely to explore the persistence of these inequities in 21<sup>st</sup> century scientific practice. One example: Article 15 of the Convention on Biodiversity addresses equity by recognizing the sovereignty of states over their national resources; but as I narrate through the case of ethnic minorities in the Caucasus and Central Asia, nation states are not reliable representatives of all people who reside in their boundaries, especially when resources enable the accumulation of wealth. The limits of contemporary policy with respect to biodiversity collection, research and development, and commodification of seeds are discussed in the final chapter and epilogue. These are also topics I explore in my new research on the history and politics of biodiversity preservation.

Finally, as Deborah Fitzgerald notes, the book means to explore the relationship of people to the complex plants on which they rely for sustenance. We’ve been led to think people made themselves masters of plants, but in many respects plants have always had the upper hand. If we respected them more, we might devise more and better ways of living with them, and each other.

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### About the Contributors

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