# Selling Seeds, Selling Communities: Re-Seeing Agronomy and Conventional Agricultural Seed Development and Exchange in Rural Kansas and Missouri

By



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# Abstract

This qualitative research explores agri-food issues in contemporary, conventional hybrid seed production and exchange, particularly the sales of high-earning corn and soy hybrids ubiquitous on the farms practicing conventional growing techniques in Northeast Kansas and Northwest Missouri. Data for this project is drawn from on-site interviews conducted with sales agronomists working in the NE Kansas and NW Missouri agricultural region. The project asks about the materiality of the hybrid seeds and how sales agronomists see, interact with, and describe seeds, chemicals, and other services to farmer clients. The research reveals a hybrid seed package that bears multiple meanings across different networks of individuals alongside agronomists, a population of non-farming rural community members who feel the losses in population and community resiliency associated with large-farm agriculture but who also feel committed and responsible to the individual wellbeing of their farmer clients. The research also reveals a growing prevalence of precision agriculture services offered by sales agronomists. Drawing from the work of Bennet's vital materialism (2010) and contemporary revisions of the Deleuze-Guattarian assemblage (DeLanda 2016), this research suggests that automated precision agriculture methods reveal a food regime which *distributes* agency between many participants, conversely delimiting individual autonomy of the farmer-owner. I suggest that the problems preventing higher numbers of farmers from adopting ecologically sustainable practices may not be individually ideological or economic, but rather problems of agentic capacity, of *who/what makes a difference* in contemporary agricultural assemblages.

# Acknowledgments

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My grandfather,
dusty haymaker, leans on the scythe,
its sharp crescent in the grass
like an ear to the rail,
like an animal on its back
in a dry creek bed.
...
Under the half-light of the tool shed
my father's lost beneath the tractor
the white-knuckled lover
of broken machines.
He packs the new bearings,
dark fingers smooth the grease bead.
I hold the light and hand down the tools.
The afternoon holds its dust by the collar
against the shed. Having the right tools,
he tells me, is having angels-of-fucking-mercy.
I hold the light and hand down the tools,
my father's blind hands lifting to meet them.

**Seeing The Context: How hybrid corn invented 'conventional' agriculture**

Until the early twentieth century, agricultural maize (henceforth corn) production was a technique involving a human farmer who bred, or received a bred variety of, corn that produced *true-to-type*. Broadly speaking, this means a corn plant that produces similar corn plants in the future. A farmer might save a percentage of such corn to replant the following year, or to exchange for a new varietal with a willing neighbor or seed seller. Not long after the turn of the twentieth century, Dr. Shull discovered that by crossing two different true-to-type breeds of corn, the resultant *hybrid* produced larger more consistently productive ears of corn in the first generation, but in the second generation the genetic lineage produced frail, unproductive crops (Kloppenburg 1988). Dr. Shull called these hybrid seeds *economically sterile*, and Kloppenburg argues that this material and conceptual shift in corn from a reproduced living organism to a high-producing and high-consuming annual input cost was the catalyst for the transition into large-acreage, monocultural, agriculture techniques proliferating today.

This story is not a story of corn alone without other actors, throughout the 1930's and 1940's America's growing network of land-grant-universities (LGUs) and their extension offices prioritized research on these hybrid corn varieties and provided resources focused on integrating these techniques into the many farms around the US (Gilbert 2015).Hybrid corn quickly moved from a fringe research project to a dominant model that required vast resources. The resources needed include not only large acreage farms with rich nutrient deposits to grow high-yielding hybrids (Goldschmidt 1978) but also the vast productive seed-farms to produce new hybrids each years as hybrid seeds could not be viably saved. The scope quickly grew beyond what LGUs were, perhaps, intending and research and production on hybrid seeds was passed to private companies (Kloppenburg 1988, Gilbert 2015). Breeders, most often trained at LGUs, were now researching and breeding at private companies. Though legal protections were not offered to

patent or certificate new hybrids, because hybrid seed could not be viably saved by farmers the lineage of such hybrids became occluded: they were trade secrets, proprietary (Kloppenburg 1988).

While functionally property, hybrid seed varieties were not legally protected as kinds of intellectual property until the 1970's. Throughout the end of the twentieth century, key changes to the law, such as the re-codification of the Plant Protection Act (PPA) as the certificate-granting Plant Variety Protection Act (PVPA) or key court case such Diamond v. Chakrabarty (1980) and J. E. M. Ag Supply, Inc. v. Pioneer Hi-Bred International, Inc (2001) extended patent-like protection and utility patent-protection to these hybrid seeds on the idea that such seed-varieties were *genetically unique* (Aoki 2009, Schneider 2016). Perhaps, from here, the story may read more familiarly, Monsanto trans-genetically alter a productive corn hybrid to resist a chemical herbicide they also sell, Roundup™ (glyphosate), and begin to emphasize analogous practices in soy and cotton as well (Wield et al 2010). The synergy between chemical and seed genetics was codified and legally protect as property, the profitability of this model for large corporations became a catalyst for consolidation between agrochemical and seed production companies around the globe.

The story of corn in the United States and its impact around the globe is a story of agriculture that emphasizes a host of non-farming actors (notably human and nonhuman) which are vital participants in fundamental shifts in agricultural practice. It is also a story that emphasizes how the conceptions and meanings of the seed reinforce some attributes and promote change in others: a prime example being the shift in legal status for seeds from a public good to a proprietary input (Aoki 2009). The current moment of this recent collaborative shift in agriculture, in terms of its effects on farmland, agrobiodiversity, and the larger environment is, to say the least, gravely concerning. However, this project arrises from a fundamental presupposition to the research common amongst many ethnographers: that it would be beneficial to look from the grass-roots instead of the top-down. I do not mean to undervalue overarching,

critical approaches to agricultural corporations, but rather to posit that looking more carefully at communities of individuals who have any kind of advisory or decision-making stake in praxis across a number of farms may yield useful data about the current agricultural regime and potential ways-forward. Because of this, I look at the non-farmers living in rural spaces who consult with farmers and/or sell seed under contract with top-ten agro-chemical and seed production companies as a way of better understanding the relational flows of hybrid seeds.

This qualitative research explores agri-food issues in contemporary, conventional seed production and exchange, particularly as such production and exchange occurs in NE Kansas and NW Missouri. The project works across two axes, divided here into the two subsequent chapters of this thesis. The first axis works along the relational connections between seeds, seed dealers, and farmers as the occur *processually* in a larger context of conventional agriculture both in the United States today, but also in relation to past techniques. We might think of this axis of research as a snapshot, placed on a larger map of time and space: it connects my empirical qualitative study with a history of seed production and exchange while also trying to see how NE Kansas and NW Missouri connect to a wider picture of American agriculture. The second axis emphasizes the processual aspect of technique in agriculture by looking to new modes of practice in conventional agriculture and theorizing what these material changes mean relationally. Specifically, I look at how precision agriculture techniques (which, broadly, refers to automated forms of tilling, planting seed, or applying chemicals) change decision-making power for farmers and other participants in the agricultural assemblage. Together, the research represents an inquiry into seed meanings and exchange in the conventional US mode with an eye toward a better understanding of the changing decision-making apparatus in precision agriculture.

**Thinking With Seeds and Seed Dealers: Exploring the Techno-Political Relations of Big-Ag Seed Sales in Rural Kansas & Missouri**

I had driven out to Oak County, KS for my first interview on the project. I parked by a large concrete grain elevator on the edge of what is one of the more vibrant small towns in Kansas, still housing a few restaurants, a theater, a coffeeshop. I was surprised, I am now embarrassed to say, to find out that I actually liked the seed dealer I was interviewing. After all, the co-op here contracted with Monsanto, and Stine: inventors and sellers of round-up ready genetically-engineered (GE) seed. The actions of these companies were causally linked to losses in global agro-biodiversity, small farms, and United States (US) small towns. The actuality that large-scale, industrial agriculture has been damaging to the community experience of the American rural town and its participants, in addition to the local and global environment, is incontrovertible. Popularizing the ills of conventional agriculture has become a perennial and profitable occupation for anyone from documentarians (the various *Food Inc* style exposés) to fast food executives (the successful marketing campaign for *ethical meat* by Chipotle™ ). In these narratives, the crisis-inducing plans masterminded by wealthy, jet-setting, transnational executives of the big-ag and big-pharma companies are carried out by a simplistic population of ideologues who have been duped or brainwashed into selling (or buying) GE hybrid seed and the chemicals to which they have designed resistances (Pollan 2001). These often-overlooked populations of farmers and agronomists, we are left to assume, unflinchingly participate in the diminishment of their own hometowns in the unsustainable march toward more productive, efficient agriculture. Everyone in rural America becomes a villain, or at the least, the villain's unwitting lackey. Plans for a more sustainable future for rural farms and small towns often then become exclusive from the people who actually continue to live and work in these rural spaces.

Many of the seed sales reps and agronomists interviewed for this research are part of multigenerational agricultural families, are involved community members, and report a commitment to helping their farmer-clients scrape a living. Many report witnessing the declining population and livelihood of their small towns and the many small farmers who once lived there. They describe this as a real, experienced loss. When they do describe these changes they sometimes chock it up to a poor economy and chance, but they often cite the current material and techno-political conditions of agriculture: *You have to plant bigger and more precisely because the machinery, the seed, the chemicals, and their associated production and sale costs make it so*. This research takes this as its starting place: the relational assemblage of assemblages that surround two material actors: seeds and seed dealers. It also contributes to an opening discursive space where collaborative, democratic thinking about immediate steps towards more sustainable agri-ecological practices may be possible.

Human participants in agri-food systems select, save, plant, grow, and reproduce seeds in a variety of environs (Helicke 2015, Phillips 2013). Through human and non-human inputs, an ecosystem-embedded agriculture is (re)produced (Bennet 2010, Dwiartama et al 2016, Muller 2015). This is necessarily a collaborative social effort, relationships between organisms and matter are continuously negotiated and produced, forming agri-food assemblages (Carolan 2008, 2010, Delanda 2016). Agri-food assemblages involving seed-sowing are (re)constructed as seed saving/producing networks and processes develop and change across time (Phillips 2013). Conventional agricultural praxis in the US has mechanized and technologized the seed producing and exchanging networks in unprecedented ways, re-forming material relations in the agri-food system. Industrial agriculture is often ideologically caught between a nostalgia-driven pastoralism and the technologized drive for higher productivity through larger yields (Stock et al 2016) and more efficient planting (Carolan 2017). In the last century and particularly in the last fifty years, the social and ecological organization of agriculture in the US has radically changed while agro-technological development accelerated (Kloppenburg 1988). This qualitative research

with seed sales reps and agronomists seeks neither to romanticize conventional US agriculture (now roughly three generations old) nor to apologize for the sometimes-destructive results of the big-ag farm movement. Rather, the goal is to *think with* seeds and seed sales reps and agronomists to better understand the material, social, and technological relations active between seed production and farmer-planters.

Approaching conventional agriculture with a culprit in mind risks scape-goating in a sustainability and agro-biodiversity problem that is diffuse and systemic: it simplifies complex material relations to linear narratives that describe discrete corrupting entities. To put it another way, it is of course large corporations who have activated agricultural practices which devastate whole ecosystems, but to begin and end here is unproductive and misses whole other participants who affect changes in the assemblage. Secondarily, such approaches are often critical of farmers who do not cite big and mysterious social forces of planned corporations as animating agents for change, but instead cite the material instances of big-machinery, precision-style agriculture, and the demands of the larger economic buyers (Gibson and Gray 2014). While big-ag corporations do have a significant hand in planning and organizing the techno-political reality of rural small towns in the US, research may benefit from a closer examination of agricultural participants, particularly those directly contracting with these larger, often technocratic, entities. One goal of this research is to mobilize an inclusive-democratic approach which *thinks with* the material relations seed-dealers experience and to which they attest. A rhizomatic, assemblage-thinking approach (Deleuze & Guattari 1988, Bennet 2010) to these problems recognizes the diversity of meanings for seeds and the complex networks which inform and construct our ideas about what a seed *is* and *can be*. Understanding the changing conception of seed in conventional agriculture is part of understanding the hybrid and GE seed's changing materiality.

To understand the seed as technology, my research goes neither to farmers nor to top ten seed production companies, rather I speak with seed dealers and sales agronomists working in the Northeast (NE) Kansas and Northwest (NW) Missouri agricultural region. During the

summer and fall of 2017 I conducted 12 on-site interviews in the offices, homes, and working-farms in which participants work. These interviews were conducted in an open and emergent format utilizing a theme-based interview schedule which emphasized questions about material and social relations in their profession. Questions include many seemingly basic queries: "How would you describe a new corn hybrid previously unknown to a farmer-client?" or "if a farmer asks for your advice about what to plant in a given field, what kinds of information do you collect in order to make that decision?" or "do you treat the seed you supply, if so what treatments do you offer?" This research explores questions about how seed dealers conceptualize their relations with other actors in the agricultural assemblage. The immediate goal is to better understand techno-political relations in conventional US agriculture by looking at the specific case of NE Kansas and NW Missouri seed sales reps and the seeds they sell. Seed dealers have been understudied in social science research (see *Table 1)* by comparison to research on farmers themselves as well as on market-end buyers and their contexts. While only cursory and illustrative, the table demonstrates that discrete corporate entities, say *Monsanto* receive more research attention than a broad professional group of actors, seed dealers. Filling this gap, in its own right, is an important facet of the research. Secondarily, this project's assemblage-thinking approach, particularly as it applies to issues of environmental care, may help to open a space for more democratic and inclusive thought about agricultural systems and relations in the US and how to build a more environmentally just and inclusive future for the declining rural spaces here in Kansas, Missouri, and elsewhere in the world.

**Table 1: A Subject Keyword Comparison drawn from Sociological Abstracts***

| **Search Term** | Farmer's Markets | Organic Farmers | Conventional Farmers | Seed Dealers | Monsanto |
|---|---|---|---|---|---|
| **Instances of Peer Reviewed Publications Found** | 1228 | 327 | 257 | 3 | 64 |

*Terms delimited to peer-reviewed instances, may not reflect total number of relevant sources

**Growth and Concentration of Global Seed-Production Corporations**

To understand a seed dealer, it is important to address the larger corporation with whom a seed dealer contracts either directly or via one of many subsidiary companies. The corporate growth and concentration of the seed industry and the agri-foods marketplace in the age of trans-genetics and most particularly, patentable trans-genetic germplasm and resultant plant material, is unprecedented (Aoki 2009). While this growth has its roots in hybrid breeding techniques, and the first economically sterile crops (Kloppenburg 1988), the concentration begins in earnest in 1970, a year in which the Plant Protection Act (PPA) was re-codified as the certificate-granting Plant Varieties Protection Act (PVPA) (Schneider 2016). Consolidation magnifies in the nineties with the development of corporate synergy between trans-genetic seed research and development and agro-chemical holdings (Wield et al 2010). These trends encourage lateral production development coupled with increasingly concentrated corporate structures that ultimately form larger networks of linked chemical and genetic holdings resulting in an increasingly globalized seed and chemical field. The effects on agri-ecologic diversity caused by these changes are wide ranging. For this section, I will begin with what is most recent, an outline of the major corporate players and their immediate mergers and work backwards along a developmental narrative to the PVPA re-codification court case in 1970.

As of 2011, many of the absolute agro-seed and agro-chemical corporations remain distinct from each other. However five of the largest agro-seed and agro-chemical corporations have recently agreed upon mergers in 2016, which are currently (or have been) at various stages of approval by trade regulators. Dupont and Dow have agreed to a merger which is under some scrutiny concerning their re-organization by EU regulators (Pop in WSJ, 2016). Syngenta has agreed to a buyout by state-owned ChemChina for what would be China's largest national acquisition to date (Fioretti in Reuters 2016). Here, EU antitrust regulators have concerns of overlapping portfolio holdings, particularly ChemChina's subsidiary, Adama Agricultural Solutions, whose herbicides, insecticides, and fertilizers compete with Syngenta's product-line. Finally, and

perhaps most notably, Monsanto, the world's largest seed producer has agreed to a sixty-six billion dollar buyout by Bayer, the largest agrochemical producer (Gregston 2016). As with Dow(USA)-Dupont(Germany) and ChemChina(China)-Syngenta(Switzerland) mergers, the Monsanto(USA)-Bayer(Germany) merger as yet awaits trade regulation approval. However, this reflects a continuing trend towards larger concentrations of seed production-lines on an increasingly transnational and even global scale in which the six largest agrochemical *or* seed companies potentially become the three largest agrochemical *and* seed producing companies.

Until 1990, agrochemical research and development were conducted by separate corporations. In this time, the prevailing market strategy was for larger agrochemical companies to divest from less profitable, and perceived-as-unrelated seed-genetic companies (Wield et al 2010). During the 1990's, Monsanto successfully pioneered a synergistic market strategy for trans-genetic research and agri-chemical development (Wield et al 2010). Here, Monsanto's relatively modest agrochemical holdings consisted almost entirely of glyphosate herbicide Roundup™ (Wield et al 2010). To synergize profitability between seed stock and agrochemical holdings, Monsanto bred Bt (Bacillus thuringiensis, i.e. insect-resistant) corn to have greater resilience to glyphosate chemicals (Wield et al 2010). Monsanto is the first to imagine and produced a modified seed stock to create benefits which are tailored specifically to their particular, owned, patent-protected agro-chemical. To insure profitability over the long-term, Monsanto legal departments apply for and receive utility patents or PVPA certificates for these new genetic variations of (at first corn) but quickly soy and cotton among others.

This technique was so successful at the market-end, that throughout the 1990's, large agrochemical companies reversed earlier corporate strategies to divest from seed holdings and instead began what is currently the trend towards agro-chemical capital concentration in addition to a synergistic concentration of agro-chemical and seed holdings. This market-place technique further consolidates agro-chemical and biological technologies in the agricultural marketplace, and further delimiting the kind of production and exchange networks from a which a farmer is

constrained to purchase, or a seed-dealer to buy from. While local or smaller seed genetic companies (Midland, Taylor, etc) do exist and compete with these larger companies, their competition is limited to small regions and usually niche problems. Additionally, they usually mimic seed breeding and agronomic techniques of these larger corporations. They have not been the focus for this study because top five agrochemical companies, and particularly Dupont-Dow, Syngenta, and Monsanto-Bayer; hold such a dominant majority of the seed and chemical production and sales throughout the US. When seeking to understand a dominant agri-food regime, looking primarily to these participants gives us a clear picture of the relational flows between conventional farmers and agro-chemical and seed producers.

**Mobilizing Assemblage-Thinking Approaches in Agri-Food Research**

Political economic theorizations for environmental problems have often struggled to adequately describe or recognize the complexity, and particularly a level of scientific unknowability, of ecological and environmental relations. Many such theorizations, such as Beck's risk and risk society (Beck 1996), do come close. Beck allows for an encapsulation of environmental degradation and its unknowability by containing it within a risk factor that is necessarily unknowable. This is something of an antidote to the oversimplified metabolic critique of environmental degradation in the treadmill of increasing productive capacity (Buttel 2004). There is, we know, some metabolic rift (over-extraction, seperation of urban and rural spaces), but because at what point the rift becomes intolerable and because such a point would be so disastrous, the intellectual gesture becomes too speculativ, generative approaches, then, are difficult to develop from these critiques. Other political-economically inclined theorists have addressed the complexities of biological and transnational economies by describing a commodification and exchange that is decentralized and networked in nature: Hardt and Negri's *Empire* (2000) does synthesize elements of the Deleuze-Guattarian approach with post-marxist political economic critique. Empire, or similar explanations for the social interchange of

transnational corporations (neoliberalism), is explained through networked, human systems of exchange and valuation.

Liminal and complex technologies, such as biotechnology and seed production, resist stabilization at the genetic and phenotypic level. They also, then, resist stabilizing formations of labor-value (Marx & Engels, 1967) as congealed social realities. How do you measure the labor involved in hybridizing two historic lineages of seed stock? Particularly when taking into account the many non-human participants involved in the *improvements* or *changes* made across generations. Carolan, in his environmental sociological scholarship, calls for ecologic research and theory which addresses complexity, interrelating epistemic and ontological boundaries of *knowledge*, *what is*, and *what should be* in environmental and agri-food research (Carolan 2008). His comparative case-study between the seed bank at CSU and the Seed Savers Exchange in Iowa (2007) reveals two organizations engaged in preserving seeds. However, the way seed-material is understood varies and therefore the materialities saved also vary. The seed bank concerns itself with static genetic *code* which is frozen in cold storage while the Seed Savers see seeds as dynamic *lineages* which are saved but also reproduced at intervals (ten percent of the stock is replanted and re-saved annually) (2007). Here, as in Phillips' (2013) research on grassroots exchanges and seed-libraries in Canada's Saskatchewan Provence, the meanings of seeds are necessarily at the interstices of culture, economies, politics. In both cases, affects and effects in a variety of social spaces are seen as tightly interconnected and constitutive, not sorted out of the research as externalities. Legun's extended project on the political economy of apples and apple-growing meaningfully addresses the complexities of an agro-ecologically embedded system and the extensive material-relations of humans and non-humans in the system (Legun 2015, 2016). Apples, what they mean, their phenotypic presentation, their taste, individual and community desire for specific apples are seen and described as relational flows that together determine the present and future for the apple-growing agricultural system. I draw from Legun's approach to complexity and materiality in addressing conventional agriculture, while

emphasizing a generative, grounded approach in assemblage-thinking to explore technological, relational, material relations, as well as political-economic conditions in a specific seed-marketplace.

Dwiartama's assemblage-thinking study of rice in Indonesia reveals that there are "multiple meanings attached to rice, acquired through the assemblages formed with other actors… lines, relationships and assembling 'make' the worlds of rice" (Dwiartama et al 2016:85). For their team, rice was studied a cultural artifact as well as both a political and economic commodity. To study its variety is to study its relations between others. Similarly, seeds, as material objects, oscillate between corporate, laboratory, agricultural, and other traditional and emerging exchange networks. Therefore, a theoretical framework which is mobile and able to address a range of social relations between humans and non-humans in a variety of assemblages is necessary. My particular theoretical approach develops from new materialist scholarship (Bennet 2010, Muller 2015, Delanda 2016, Latour 1999), considering social issues in terms of human/non-human assemblages. This approach is emerging in agri-food studies, because of its ability to "destabilize the orthodox categories, techniques, and methodologies with which [social scientists] work" (Lewis et al ,2016). Additionally, as Legun notes, materialist approaches "can aid an understanding of new agri-food trends and illuminate points of system departure by explicating how different components of food economies practically come together in networks of coordinated action" (2015:315). To transpose, an emphasis on materiality addresses complexities of material meaning and relations more directly than political-economic approaches.

When describing relations (by which meanings and identities are formed) in assemblages, I utilize Manuel DeLanda's (2016) coherent revisions of Deleuze and Guattari's notion of the assemblage (and the assemblage of assemblages) which are mutable, various, and inter-related (Dewsberry 2011). Assemblages are fluid and processual: always in a state of becoming (DeLanda 2006). Assemblages are *relational*, *productive*, *heterogeneous*, *deterritorializing* /

*reterritorializing*, and *desired* (Muller 2015:28-9). To put it another way, assemblages are active, networked formations of power, that are imaginary as well as embodied, where the power, agency, and identity exist in the (re)productive flows (relations) between actors. It is not constant, but rather fluxing and becoming. As seeds are produced, exchanged, grown, and sold the energetic relations continuously remake the agri-ecologic assemblage. New materialist and actor network (ANT) research would be more accurately described as an ontology (Latour 1999) instead of a theory: a way of thinking about being and about social relations that flattens hierarchies between humans and non-humans (Latour 1996).

A new-materialist approach to environmental social problems imagines a "radical asymmetry in the relationship between humans and nature, the active existence and incessant becoming of the latter (from bacteria to geological processes, to humans' own bodily existence) being depicted as independent of, indifferent to, or overarching human appraisal and action" (Pelizzoni 2014). This way of thinking approaches social problems with humans decentered, other non-human participants are included in the study of social relations. These *things* (as Bennet prefers to term them) and systems of *things* are seen as vital assemblages (or assemblages of assemblages) with distributive agency (Bennet 2010). To be more specific to the project at hand, seeds are not fixed identities, but are rather mobile materialities defined, insofar as is possible, by a network of relations through which a seed affects and is affected by other participants. Recalling Dwiartama's study, we might approach this research by saying, *hybrid, GE seeds have multiple meanings acquired through the assemblages formed with other actors, lines and assemblings which make the world of GE seeds*. This research contributes to agri-food scholarship by qualitatively exploring and uncovering an often mis-apprehended and unobserved independent population involved in the connections between agrochemical/seed-production corporations and farmers. It contributes substantively to rural and environmental discourse by continuing a trend towards more flexible ontological (instead of theoretical) approach to complex environmental-social research.

Additionally, this research addresses a dearth of scholarship focusing on the independent contractors, seed dealers, who operate as relators as well as agentic actors in the material transfers of seed from producer to grower. Sociological and agri-food scholarship has tended to focus on the market-end of food, or on the farmers themselves. When research deviates towards conventional agro-chemical and seed production techniques and exchange the focus of the research tends towards descriptions of either the large farmers or the large corporations as though these vast networks of powers were discrete actors. To illustrate this gap in the scholarship, see table 1 (reproduced below) which compares instances of peer-reviewed scholarship found through

**Symmetry, Slowness, and Gathering: Methods**

Law's *After Methods* proposes that nonconventional or emergent forms of research are important for exploring the many relations of the world which have been made-invisible (o*thered)*, ignored, or whose categorical delineations have prevented the exploration of their relational multiplicities (Law 2004). These emergent (non-conventional) approaches are not without their lineage, Callon in his "Sociology of Translations" writes,

> Instead of imposing a pre-established grid of analysis upon… [the entities and their relationships mobilized by actors in discussion], the observer follows the actors in order to identify the manner in which these define and associate the different elements by which they build and explain their world (Callon 1986, 201).

My research method is broadly informed by the discipline of Science and Technology Studies (STS), whose focus on the laboratory (Latour and Woolgar 1986, Moll 2002, Law 2002) has great application when (re)imagining social relations in the bio-tech (seed/chemical) sales markets. I draw on how Law criticizes normative methods for categorization and calls for the addition of research which engages in "gathering," or "build[ing] up" instead of applying coherence (Law 2004:100). As he discusses, "method assemblages" do not need to be described

as good or bad, but rather decisions about method need "to be made in ways that are specific and local" (Law 2004:103). In this light, and in the light of gathering instead of criticizing, this project utilizes an emergent on-site interview schedule and eschews conventional coding practice to gather and think with the translations and relations of the assemblages in which seed dealers and seeds act. My approach looks for and reports "the apprehension of non-coherent multiplicity" (2004:97), and by tolerating non-coherence, my research is meant to be generative and inclusive of the people and materials I study.

The data collection for this project occurred across three months (August 2017-October 2017) and included twelve onsite interviews conducted using a thematically-driven, open and emergent interview schedule. Participants were selected using a semi-random, snowball sampling method in which individuals contracting with top five agrochemical and seed production companies were contacted via phone and selected for in-person interviews. Participants were asked to refer colleagues for the project, in most cases participants chose to refer individuals with perceived differences in expertise, geographic area, or business model (farmer-dealer, coop dealer, independent dealer, district sales manager, etc). These conversations were audio recorded and transcribed, information about the material spaces these participants occupied and with whom they interacted throughout the interview were included in the transcription as heading notes. Specific names, locations, and professional affiliation (name of seed dealing organization under which the dealer sold i.e. Smith & Sons Ag Services llc.) were redacted and replaced with pseudonyms and fictionalized counties, respectively. To maintain some sense of space, dealers operating in the same actual counties operate in the same fictionalized counties. While professional employing affiliations are not revealed, information revealed about specific contracted seed corporations remains in-tact. Interview sites were usually in an office space. These office spaces were often small, independent structures attached to or near infrastructure owned by the seed dealer or seed dealer cooperative, such as seed bins, grain elevators, warehouse style storage, seed treater, application machinery, and so forth. At times I

would meet in alternative spaces, including the sales representative's home. This allowed the collection of limited observational data about the immediate material spaces and rural environments these participants occupy. Questions in the interviews were wide-ranging and response-driven. The first two interviews were somewhat wider-ranging and were utilized to *check* the validity of a materially-oriented approach. Material-thematic responses from these (and subsequent) participants reinforced my initial approach and intention to ask questions specifically targeting a better understanding of these individual's material relations.

**Exploring Seeds and Seed Dealers**

These conversations explore the overlapping and sometimes contradicting meanings and assemblings of seeds and seed sales in NE Kansas and NW Missouri. In analyzing their responses, three broad *meanings* emerged. The seed and the dealer operate in many arenas, but particularly the seed and seed sales industry emerged as a powerful cultural (and agricultural) assemblage. The transgenic seed connects and enables specific ways of living. Additionally, the seed, but particularly transgenic genetic packages emerge as a distilled and protected, economic commodity. Finally, the seed as a branded material emerges into both political and cultural realms. I address these three meanings followed by a fourth discussion about the larger ecologic meaning-makings of seeds. The focus in each is to understand the agentic capacity, specifically the material ways of being which constrain and enable the being of other actants in the assemblage and the assemblage itself.

***Seeds and seed selling as (agri)culture: "I grew up on farm"***

Seeds are complex living things. These complex living things have the ability to grow and reproduce life that is both like and in many ways unlike itself in subsequent generations. This has already been discussed, but it bears repeating that hybridizing seed is effective as a social technology for economically constraining farmer buyers to repurchase instead of save

precisely because hybrid seed is unpredictable in its second generation of growth. During many of my interviews I would ask about how dealers began selling seeds, they would discuss communities in which they grew up, mentors who led them here, and so forth. When asked about seeds, many would refer to, or open, a seed guide, prepared by a production companies regional technical agronomist, which ranks a seed's "performance" in a number of categories on a scale of 1 to 10. Though the information is distilled to a number, which represents an attribute of the seed, a critical look at these guides reveals that a variety of ecological assemblage actors are involved in determining the importance and actuality of whether a corn seed will be resistant to corn-borer, or a seven on dry-down. The seed stock's age, and treatment options are determined by a range of human decisions and social technologies. In the case of the dealer and the seed, living things interacting with whole communities contribute to the meaning(s) of seeds and seed dealers, the (agri)culture of seed and seed dealing.

Almost all participants report that they grew up on a small(er) family farm. For many this is intimately connected to their current work through a direct-lived material connection (still residing on said farm or in said community) or an indirect relationship (a way to continue involvement in agriculture or rural living). Many younger seed dealers make the transition from family agriculture to seed dealing through the professionalized agronomy industry. John from Oak County Kansas reports that his interest in agronomy developed while involved in Future Farmers of America (FFA). Darla from Maple County, attended Kansas State University in the early 2000's at the suggestion of a mentor figure in her 4-H club reporting: *"Well there's really no before, I grew up on a farm in North-central Kansas and that wasn't going to be sustainable much longer so I went to K-State and got a bachelors in agronomy."* This story is not unusual, and many farmer/sales-reps analogously begin seed-selling because of the difficulty of maintaining an ever-expanding farm. These farmer-dealers operations are common, though decreasing in number around the NE Kansas & NW Missouri agricultural region. Farmer dealers

I spoke with, such as Rick of Maple County and Ron of Cedar County both described seed selling as an integral part of maintaining *sustainable* (read consistent) profitability.

This raises two questions of interest to my research: do seed dealers live in the communities in which they grew up (read have long-term, material-relational connection to these places)? What do seed dealers mean if/when the describe operations as (un)sustainable? Many seed-dealers do live in the county in which they grew up, Jerry who sells seed for a large Kansas seed co-op is a multi-generational, long-term resident of Maple County in his late 60's looking to retire before too long. Derek of Hedge County is also later in his career and operates a farmer-seller operation, he too is a long-term resident, still living on the land his parents had farmed. However, Darla and John, both students of K-State have moved around several times, taking agronomy positions around and often outside of the state before finding the position they now work within. For many years, even while the current large corporations dominated the agricultural marketplace, local dealers would be the primary source of seed. Over time, and with the professionalization and technologization of agri-business operations and seed/chemical sales and application, and increasing demand for technically trained (usually at land grand institutions) agronomists to fill the role of seed dealer. This professionalization increases competition for a job field which is unusually diffuse, with only a handful of dealers operating in each county. Young agronomists do not often have the luxury of moving back home, unless there is a farmer-dealer operation to inherit. Otherwise, young seed dealer/agronomists must go where there are available contracts for seed dealers.

In other words, the economic conditions of conventional seed-selling in connection with the politics of competition (and non-competition) create the conditions for a professionalized mobility that is not unlike the professionalized mobility of academics or lawyers, who professionally benefit from an ability to move to the best location. Unlike academics or lawyers, who are concentrated in urban areas and county seats, where courtrooms and universities abound, seed dealers disperse to the available spaces in agricultural, rural counties. Other

dealers, usually older dealers, are those which had turned to sales as a local supplement or replacement for the increasingly unsustainable farm. These people tend to see themselves as problem solvers, creating a way for themselves and their friends to continue living and interacting in the same relational networks in which they and their families have lived. To simplify, if you want to live in Oak County Kansas, there are only so many jobs you might have. One of those is farming, another is seed dealing, there might not be much else left to do. If your 1800 acre farm is becoming economically unsustainable, you might lease your neighbor's land to expand your operation, or you might contract with Pioneer to sell seed in exchange for a commission on your seed sales.

In both cases, the material culture of the reconstructed and often decaying small town and agriculture industry in NE Kansas and NW Missouri encourages two kinds of consolidation: the consolidation of land ownership in fewer, larger hands with ever-growing equipment; and a centralized hierarchritization of seed production and dealing. To begin with the latter, in order for the young seed dealer to occupy a space similar to the space of their youth, they are faced with two options, to either rethink their parent's farm (to expand it, or I suppose, to find an alternative market space to occupy, a much more radical rethinking), or they must attend a University to receive professionalized education which allows them to integrate into a changing agricultural assemblage through other means. To say it simply, most dealers must learn to *be an agronomist* to succeed as a dealer. This mimics the flow of hybrid seeds, which do not occupy a variety of agricultural spaces before entering the specific farm in which the farmer-buyer eventually grows the seed. Each actant, including the farmer and the dealers, are faced with material relations that co-constitute their own sense of self in a way not dissimilar to the farmer's in Bell's research (2004). For Bell, he witnessed farmer-decisions on management decisions such as weed-control, which were not rooted in a productive bottom line, but in a negotiation of input costs with farmer-control with weed intervention with the perceived-other who judges whether the appearance of a field represents a good farmer or not (2004:111). Farmers he spoke to would pay

more for increased herbicide application to eradicate weeds which would not significantly detract from yields. Bell theorizes that this is because the farmer is farming themselves as much as they are a crop (2004:97). While oversimplified, this notion carries over to this research meaningfully, that seed dealers, farmers, and seeds are negotiating *themselves* through their relationships with other actants in a farming assemblage throughout Kansas.

The seed is produced in large, controlled, distinctly ecologically unique seed farms, often far from the eventual planting. These seeds  by the seed company then transported to the dealer who purchases the seed (or agrees to store it on commission). Some seed, particularly Soy, may be treated at this stage by the dealer. The seed, now in Kansas and Missouri for possibly the first time, is then transported to the farm either by a delivering dealer, or on pick up by a larger farmer. The farmer loads a combine with this seed and plants it across large swaths (totaling to thousands of acres) and it begins growing. The culture of the seed, its breeding and trans-genetic program, the social relations which allowed it to be materially produced, transported, and placed in the ground are now interacting with a new culture. Seed dealers often see themselves as participating in helping their friends and clients maintain sustainable farming operations. However, that sustainability is often measured through the slim profitability of an agricultural operation, whether they can help their client stay solvent through the next few years.  To do this, a closer cultural match is required between the origin of the seed and the growing of the seed, I posit that the precision agricultural services encouraged by larger corporations and emphasized at many agronomy programs offered by Land Grant Universities are ways of laboratory-izing the land, to make whole agri-ecological cultures more stable, predictable, inert (Buttel 1985). The worlds of seeds are distilled into two, oft-oversimplified meanings, the economics of the agricultural and seed markets, and the political meanings of brand loyalty and use. To recall Bell, the self we are discussing is not only the farmer's self (*the good farmer*), or the seed's self (*the right hybrid for every acre)*. Incidentally, both these *selfs* are amenable to an assemblage-thinking approach, hybrid corns and farmers are optimized and identified by how they operate,

control, affect, and live in wider sets of relations. To put it another way, we know farmer and the seed by the relational flow.

***Seeds and seed selling as genetic commodity market***

Not all dealers describe seed in precisely the same way, but every seed dealer interviewed for this project, when asked about how they describe the seeds they sold, or when asked what seeds they sold, or how'd they describe a new seed/hybrid to a client they begin by mentioning the brands (Mycogen, Pioneer, Asgrow, etc) or more specifically a more specific trademark (Extend™ ), and a response-category kind of attribute (*it's an eight on dry-down,* or *good on tough soil)*. For all but one of my participants, these response type attributes were at first, if not consistently generalized into a "genetic package" or more specifically a "trait." For many seed dealers, the genetic offerings are categorical specificities generic (not specific to) the brands who offer the seed. Pioneer salespeople often told me that *nowadays everyone sells everything so a lot of it is personal*. However, several contractors with multiple seed corporations mentioned this multiplicity results from a need to gather *genetic traits* from a variety of sources. Interestingly, members of the same organization contradict one another, one saying they would leave Stine if their customers were not more loyal to the brand, and another saying that Stine is an important addition to a strictly Asgrow-Dekalb sales-operation because Stine carries LibertyLink™ corn. LibertyLink is a brand name and it, like many transgenetics, is an owned trait, in this case Bayer (the large pharmaceutical and agro-chemical conglomerate) owns a large production portfolio of Liberty™ herbicides (glufosinate) LibertyLink™ is their glufosinate-resistant *genetic package*. This particular trait and traits like it are important enough for dealers to opt out of some incentive building rebates by offering a broader range of seed companies:

> For most of the years, probably since 2001, it was strictly Asgrow-Dekalb (Monsanto) but that has changed with technology as you've reverted to getting the certain traits and

> certain chemical packages needed for that seed, because they own their own rights to that and to get what's needed we have to run with the three companies. (Jerry, Maple County)

Additionally, seed dealers also often describe a large part of their job as finding the right genetic package for a problem, and finding said package which fits the cost-expectations of a farmer. Farmers, too, according to dealers, think this way about a seed. Dave from Oak county narrativized the selling/buying exchange in a way common to many of my interviews, saying a farmer is often going to ask about what genetic package's are available and what traits benefit their farm, but it will often come down to a price-point-problem: "Well, how much does that trait cost me?"

What is a genetic trait? In these conversations the genetic package of a seed is described in two ways, one relates to the branding of a seed. These, usually transgenetic traits, represent specific resistances to chemical compounds utilized in conventional agriculture to address weed or pest problems (eg Liberty Link™ corn is resistant to Gluphosinate). This genetic trait is set a price-point based on its perceived desirability for higher yields, its new-ness to the market, and its company exclusivity. This genetic trait is most marketable because it represents a response to an ecosystem which is selected by human participants (the laboratory, the test plot) instead of co-related to the human participant (the field). Genetic traits which respond to co-related ecological participants in an agri-ecological assemblage are more difficult to both market and describe (e.g. rate of nutrient uptake). These are simplified to rated responses to stimuli and "performance" generalizations. Taken together, these phenotypic response-attributes are described as a *genetic package*, these *genetic packages* are seen as the bought-and-sold commodity. The material, living, reproducing seed, is re-seen as a fixed code. This fixed code is bought and sold by the principles of other intellectual property markets, but because it is subject to the unique demands of cheap available food in the US, results in slim dispersed profits amongst its farming and dealing participants instead of the high pay of software developers concentrated in silicon valley

and the urban areas of the world, where the high-compensated biological scientists employed in the laboratories of these seed and agro-chemical companies often also work.

***Branding: Seeds and seed selling as a political action.***

The assemblings of a seed contribute to, determine, and (re)invent the material seed. Branding, in the neoliberal era, is a relational (Bennet 2010) as well as ideological (Ricoeur 1986) act. It contributes a distinct political meaning to the seed in a way which is more apparent than genetic manipulation. Brand loyalty, like loyalty to other causes, beliefs, and nations informs decisions and divides populations. During my conversations with participants, I would often ask whether farmers felt more loyal to the seed-company or the dealer from whom they purchased seeds. Dealers almost always told me that their farmer-clients were loyal to the expertise, friendship, and person of the dealer. I'm sure that that is generally true. However, when asked if companies had ever switched seed suppliers, few had in recent years, and several reported stories analogous to Dave's:

> "We were contemplating switching out of one of our seed brands [several year ago] just because our business models didn't align. They sell direct to farmer as well as through us. So they were competing with us in our same area and we had a problem with that. So what I did is I called every one of our farmers that I sold that brand to and every single one of them said that they would stick with that brand.'

These kinds of contradictory statements about loyalty abound. Pioneer dealers, in particular, reported that every seed company "has something good to offer" and as such the relationship with the individual seed dealer or the brand are determining factors for customer satisfaction, but these same dealers would make a claim that Pioneer offered "the best" or near it, often citing that Pioneer's seed production is located in the United States (despite foreign ownership by DuPont). Brand homogeneity and loyalty is often encouraged by small discounts or rebates offered by the

corporations should they decide to make one seed corporation an exclusive provider to that farm. However, brand homogeneity is often not common practice amongst farmer-buyers. Seed dealers report that many farmers will split their fields between two or more companies because of perceived risks in planting to similar seeds, and the perceived benefit of company diversification often outweighs perceived benefits of small rebates.

Unlike many branded plastic objects, a hybrid seed's vitality exists right on the surface. And yet, the branding of hybrid seed-stock has been very effective. Seed dealers liken brand loyalty for seeds to brand loyalty for vehicle manufacturers. John says, "It's like, some people just love Chevrolet." Darla reports that: "In my last county everyone drove a Chevy truck, and one county over they're all Ford people. Seeds are like that." Automobiles are complex industrial machines which require consistent industrial (petroleum-based) inputs in order to function. Vehicles cannot self-reproduce, collaboration between a variety of ecosystem actants (solar radiation, rain, heat, cold, wind, etc) result in co-entropic tendencies, what is often termed, regular *wear and tear,* or exhaust. This is perhaps overly-simplistic to point out, but seeds, at least with the correct agri-ecologic actors, respond co-constructively with other members of an assemblage. Seed dealers and agronomists are, of course aware of this, on soil with good water retention and high nitrogen (N) phosphorous (P) and Potassium (K) content would recommend what is called a "race-horse" corn variety. A high-yielding hybrid that is also a higher consumer of nutrients and moisture from the soil. Seed catalogs trumpet "the latest innovations," "crop management solutions," and "seed applied technologies" alongside local expertise to maximize efficiency (Dekalb-Asgrow 2018 Seed Guide 2017). Seed dealers I spoke with consistently described their role as helping get the correct seed in the correct context to maximize productivity on their client's farms. This was particularly true of seed dealers who say their role as an agronomist first. Darla likened attitudes toward seed brands to attitudes toward automobile makes. Just Chevrolet's ad-campaigns for their 2017/2018 line of vehicles: "No other brand has

more J.D. Power Initial Quality awards than Chevrolet" so do seed companies and the dealers they contract promise *the right hybrid for every acre*.

***Bigger farms, precision agriculture***

The future of farming in activist scholarship is often discussed as though industrial formations of agriculture will go one particular way, towards higher rates of automation extraction and laboratory-ization unless a group of concerned citizens intervene and that this looks like a certain kind of homogenous wasteland. This is not untrue, seed dealers and agronomists contracting with top-five agrochemical corporations clearly see the material impetus to automate, expand, and control through larger tracts of monoculture farms. However, it is risky to oversimplify the many ways agricultural praxis is already being processually re-invented, and while the future food regime appears technocratic, there remain a variety of ways even these dominant large companies may proceed. The importance of engagement with the global and local food-system as distinctly *processual* is an especially important approach for American rural sociological scholarship in the few institutions where it remains prominent. The introduction of smart-technology (Climate™) and variable rate application techniques is a growing trend in agriculture. Many of the younger agronomists I've spoken to receive particular training in their agronomy MS degrees in this area and are hired particularly for this expertise. These techniques, which rely on large data-sets and significant input from technically-trained agronomy experts further highlight the distributed agentic capacity of actants besides the land owning farmer in the farming assemblage.

Seed dealers, by and large, are reflective individuals interested in the long-term health of the social communities they occupy, the farmer dealers and co-ops, and the ag-services businesses are underappreciated in their political and economic power as well as their cultural clout as advisors and community participants. They are self-consciously interested in rurality,

rural spaces, and rural living. They are also self-consciously interested in economically (and sometimes environmentally) sustainable agricultural praxis. Rethinking agriculture, I have argued throughout this paper, begins by re-seeing the agentic capacity of other agricultural actants including sales-people, agronomic consultants, and the in-the-field technologies (herbicides, pesticides, fertilizers, seeds, applicators, and so forth). A more inclusive and holistic approach to the dominant food regime sees agriculture and seed production and sales as distinctly distributed (Bennet 2010) processes carried out by whole communities of actants and in which, we must be careful to remember, the "I" is often not the most important actor.

In the early 1940's technical agriculture became pre-eminent largely through the intervention of land-grant universities (Gilbert 2015). Moving forward with research in the dominant US food regime in either exploratory or actionary directions predicates moving forward with exploring the many involved institutions, materialities, and individuals often seen as only *influencers* instead of participants in the agricultural assemblage. Both understanding and, at times(where possible), rethinking the engagements of productive, educational, ecological, and research assemblages in the decision making capacities of farmers and agronomists living in rural spaces is a rethinking of *who is farming* and *how they are farming*. Particularly in the growing field of precision agriculture, I argue that a farmer who is *distributed* across a community instead of embodied as an individual becomes increasingly evident (Author N.D.). Additionally, further research in alternative ways of organizing currently held material organizations which are more sustainable, is a vital step towards more ecologically just futures. While seed-dealers are fairly mobile by comparison to farmers, both, particularly the independently owned ag-retailers, are low-mobility individuals with high investments in land and communities with significant debt burden taken to own the complex and expensive agricultural equipment required of the dominant agri-food regime. Re-seeing other ways to organize the relationships of these materialities is an obvious step for a more inclusive future which is

accessible by those who live and practice agricultural professions in rural spaces throughout the Midwest and particularly in NE Kansas and NW Missouri.

**The Distributed Farmer:(Re)Thinking Ownership, Autonomy, and Decision-Making in the Precision Agriculture mSTA**

Out in Wellsville, there's a barbecue place, Smokey's, where my wife and I like to eat burnt ends; sometimes we get takeout and drive two miles north to White Tail Run Winery. On the short drive we pass field after field of the precisely tilled, planted and harvested farms that have become indicative of what we might think of as the new seed regime, the post-green revolution industrial farmer (Kloppenburg 1988, Stock 2016). These fields are now in at least their second generation of petroleum-derived machine farming and are currently entering their first generation in which this carbon-economy is being synthesized with an info-economy (Carolan 2017). Through installed, invented, third-party, or brand name "smart" equipment, field data is collected, aggregated, and utilized in a way that even a few years ago was unimaginable (Climate Field Guide 2017). In the last ten years a rising trend of *precision agriculture* enrolls big data sets to increase efficiency on the farm by varying plant density and application rates of expensive chemicals in the field. But the use and value of yield, fertility, and nutrient data has far broader implications when examining the techno-economic relations between actants within the agricultural assemblage.

This project arises from a literature on software freedom (Deibel 2013), farmer-autonomy (Ashwood et al 2013, Nelson and Stock 2016, Stock and Forney 2014) and assemblage techniques in social scholarship (Callon 2015, Carolan 2010, Dwiartama and Rosin 2014, Muller 2013). However it also arises out of this particular drive, north of Wellsville, on which I wondered about some basic questions: Who owns the land these fields are on? Who owns information about the land? Who makes decisions about the land? Who carries out those decisions? And then wondering a secondary question: if the participants who answer these questions are different actants then might we benefit from thinking about farmers not as

individuals but as distributed networks? And if so, would not a more equitable governance consider ownership along these same distributed flows? To put it another way, if whole communities participate in the decision making on a farm, then perhaps the inequities in the conventional agricultural farm, between say GM and non-GM farmers (Callon 2015) or conventional or diversified farmers, begin at an abuse of the governing body's misapprehension about who makes decisions in the field.

This paper draws on the material and theoretical research of rural and environmental social scientists, but also draws from experiences and data collected in the field over the last six months for a previous project, targeting a better understanding of the socio-material and techno-political flows between humans and non-humans in the seed-selling networks. I engaged in a weak theory (Gibson-Graham 2014) and gathered qualitative data drawn from 12 on-site interviews conducted between August '17 and December '17. Participants identified as either seed-dealers or agronomists, most often both, and worked in the Northwest Missouri, Northeast Kansas Agricultural region. The goal of this project was to think with seeds and seed dealers in order to better see the relations between agricultural suppliers and the farmers who grow their food. While conducting this research, I began to realize that a problematic had appeared in agri-food and environmental literature today: a lack of interest in *how* the conventional farmer could access a more eco-sustainable future for themselves and their communities (addressed somewhat by Nelson and Stock's "Repeasantization" 2016). This project is an attempt to begin in the space carved out by that project, to imagine a more utopic direction for agriculture that is accessible to the conventional farmer. This paper begins with an explanation of my approach towards agri-ecologic systems. This is followed by an exploration of my initial questions about which actors control (own) other actors and what those flows mean. Then, in the spirit of a more hopeful (Anderson 2008) actionary research, I engage more directly with what can be: a more equitable and diverse range of bio-economies oriented towards sustainable and co-relational agricultural projects.

***Mobilizing an Assemblage Approach to Agriculture: Seeing Market Socio-Technical Agencements***

Agriculture, like the plows, tractors, combines, draft-horses, scythes, and other equipment participating in agriculture across history, is a technology long oriented directly towards a specific problem: eating, and indirectly towards all sorts of other problems: urbanity, rurality, fuel, carbon-economies, and so forth. Agriculture and its tools together, in the contemporary era, form market socio-technical agencements [henceforth mSTA] (Caliskan and Callon 2010). Seeing mSTAs confront neo-liberal and Bourdieusian conceptions of markets and others sets of relations as applied structures and fields of hegemonic control as important sites of study (Flanigan and Sutherland 2015) but also somewhat reductive in their delineations of mileaus for exchange of social capital(Callon 2015). Assemblage participants establish and reify *structures* through relational flows (Bennet 2010, Delanda 2016). What Caliskan and Callon offer in the seemingly over-technical term, mSTA, is a way to discursively locate the specific set of assemblage relations active in what we think of as the sphere of the economic, in this case *agronomic,* marketplace. As with other assemblages, and again, in sharp contrast to many post-marxist and cultural scholars, these relations form a non-reducible mess of economic, political, cultural, and interstitial meanings; to put it another way, there are no separate "spheres" or fields of meaning (Callon 324:2015).

Sorting, translating, and (re)imagining the in-the-field mSTAs (interpreting and understanding the relationships that play into agriculture) has long been the work of the farmer, but as the big-farm ideology, praxis, and materiality have converged and expanded, so have new technologies been employed to continue the (re)interpretation of the complexities of an agri-ecologic assemblage (Carolan 2010). Much in the vein of Dwiartama and Rosin's (2016) work on synthesizing ANT approaches and Resiliency scholarship, so does this research employ mSTA

in an effort to see non-humans as agentic without decontextualizing or devaluing human intentionality. This is particularly important as we imagine utopic responses to precision agriculture techniques. Precision agriculture is driven by the collecting and knowing of field data (Carolan 2017). This is a shared enterprise and as in the days for which one waxes nostalgic, where a farmer relied on whole communities to farm, so today do farmers rely on whole, albeit very different communities. An mSTA approach begins here:

> Knowledge and materialities participate in the design, elaboration, experimentation, change, maintenance, extension and operation of agencements. Inquiring into the role of knowledge and materialities in the elaboration of markets enables us to articulate a connection between the study of marketization and the performativity programme. More precisely, we can draw a link between marketization and the co-performation of mSTAs by economies… Hence, the analysis of the mechanisms of this co-performation process is one of the priorities of this new programme. (Caliskan & Callon 2010:23)

The network (Latour) (or agencement (Callon), or assemblage (Deleuze & Guattari), as you have it) engages and distributes agency among many actors and actants (Latour 2004). But who are these actors and actants and what socio-historical occurrences inform the particular mSTA dominant in conventional agriculture (and it's possibilities)? Answering this question is a way of answering questions about what the market is, does, and means and who has power in the productive market of agriculture.

Conventional agriculture, and how it came to be, can be extrapolated back millennia, but I posit that a useful comprehension for what conventional agriculture has become begins with (and a few decades before) the New Deal policies that encouraged the integration of land-grant universities (LGUs), hybrid seed breeding, and the everyday farmer in the 1940's (Aoki 2008, Gilbert 2015, Kloppenburg 1988). These programs began promoting the role of technical approaches to agriculture that fueled the green revolution (Kloppenburg 1988) and the technical knowledge of professional agronomists. LGU's were active in propagating new, more productive hybrid seed stock, and through extension offices, encouraging the use of these hybrid seeds by everyday farmer-individuals. As of the 1950's, we might think of the major players as farmer-

owners, banks, LGUs, agronomists, hybrid seed stock, fertilizers, and farmer co-ops. This is an incomplete list, but it represents the expanding network of stakeholders whose decisions affect the potential formation of specific agro-ecologies in the field. In the 1950's LGUs reduce hybrid breeding programs in favor of privatized research by for-profit companies (Gilbert 2015). This is quickly followed by important legislative decisions to revise the Plant Protection Act as the Plant Varieties Protection Act, allowing patent like protection on sexually-reproduced plant material and genetic code (Schneider 2016). These are followed by important court cases throughout the end of the twentieth century (Diamond v. Chakrabarty 1980, J. E. M. Ag Supply, Inc. v. Pioneer Hi-Bred International, Inc 2001) which solidify and reify the offering of patents over genetic material contained in living beings. Throughout the last fifteen years, proliferation of expensive mechanical and digital farm technology and such proprietary software as Climate™ MyJohnDeer™ further solidifies the increasing size of the conventional farm (Carolan 2017, Comi ND). We might then add to the earlier list of important actors/actants: trans-genetic seed stock, legal apparatuses, corporate hierarchies, transnational-political apparatuses, contract seed-dealers, and private research laboratories.

Together these actors/actants perform with another the mSTA, that is, by sharing translating and relating through flows they co-create an agri-ecologic system.

This co-creation has profound effects on the meanings and material effects of individual participants and whole ecosystems, an area of study that has yielded exciting results in a variety of studies (Dwiartama et al 2016, Legun 2015). What becomes clear is that while it is true that whole communities have always participated in agriculture. The technicalization of the convention agricultural assemblage which *denaturalizes* agriculture does not empower the individual farmer (for good or bad) but radically expands the assemblage participants. The introduction of big data radically reifies this actuality. "To eat chips" Bennet reminds us "is to enter into an assemblage in which the I is not necessarily the most decisive operator" (2010:40). Similarly, the farmer as the owner and operator of a field, becomes distributed amongst many

participants who engage in ownership, management, and labor in the field. This is particularly evident in the increasing practice of precision agriculture techniques of variable rate planting, application, and fertility treatments.

In cases where a conventional farm is utilizing all three of these techniques a number of actants engage in the practices. A consultant trained as an agronomist (many of whom are sales agronomists, meaning they'll also sell seeds, fertilizer, pesticides, and herbicides) take acre-by-acre core samples which are tested for nutrient and content. The data from this is mapped onto GIS data taken from the farmer's field to chart the fertility of a field. This data is synthesized with yield data collected from a yield data service, the most complete of which would be software such as Climate, but in some cases it may be less complete data taken from readings on myJohnDeere or PrecisionEquipment measurements (similar to Climate). These are also (usually automatically) mapped onto GIS data of the farm. It charts precisely which regions produce the highest productivity in the field in tandem with fertility data. While complete measurement services like Climate promise future development which may push the field agronomist out of their current role, this data is most often utilized by the field agronomist sometimes in conversation with the farmer to create a precision planting and treatment plan. This plan can be loaded onto contemporary farm equipment where the operator (depending on the sophistication of that farmer's machinery) may simply load the data while the precision-equipped planters, applicators, and tractors work, or in less automated precision farms, the machinery-operator may manually adjust rates according to the planting guide which would be updated digitally based upon GPS location according their GIS-mapped datasets.

In both cases, agentic capacity is expressed by the data, machinery, and in-the-field agronomy techniques in the Latourian sense: "anything that does modify a state of affairs by making a difference" (Latour 2005:71). In looking at this state of affairs with an eye towards power, farmer-autonomy, and a more utopic future where individuals in the assemblage are more free to establish, alter and effect relations and share meanings, we might begin by seeing power

and agency as distinctly *distributed* wherein collections of bodies relating to one another assert power in the network. Bigger networks distribute more power, and participants which are able to strengthen, reify, and determine relations most effectively have greater capacity to enroll actants (Callon and Law 1982). Big Data works along clearly along this principle: the more data points the more powerful your information. David, who worked as a regional technical agronomist for a top-five agrochemical company, ran a battery of test plots in his local region. But by voluntary data-sharing agreements, most climate-farmers share their yield data with local sales agronomists and their technical agronomists. So David could synthesize that data with data shared across climate and other platforms by farmers in that region. Additionally, because of his organization affiliation, David had access to collected data from other TA's in other regions across the US. David's primary job in this respect, is to interpret that data and make regional recommendations about the most productive "package" for a "systematic approach" to growing corn and soy in a given season. David, because of the large amount of data he has access to, is able to see yield variation across ecologies in the nation and can also measure latitudinally for the efficiency (in terms of yield) for specific pesticide, herbicide, and fertilizer uses. On the surface, this immediately benefits the farmer who is often willing to share data with the organization who develops and supplies their seed. However, because *Big Data* is powerful precisely because if its *big-ness*, any individual farmer's yield data is limited in its scope. The Technical and Managing Agronomists who have access to data shared by farmers most yield data and proprietary data produced by top-five agrochemical companies about their own stock and their competitor's stock, have enrolled a larger network of distributed relational power. To put it simply, because data is proprietary, and therefore occluded until shared, those with the ability to gather the most data *see* the most in the precision agriculture mSTA and are able to most effectively *recommend* productive futures for themselves.

Most agronomists working for top-five agrochemical companies in the NE Kansas and NW Agricultural region describe their goal as helping the farmer maximize their yield at a cost

that is affordable. We might say yield, and economic-financial sustainability, is king. Climate, which systematizes and collects precise yield data, along with precision planting which seeks to maximally increase yield across large acreage through expensive automated machinery reify this concept. By interpreting a specific kinds of information, farmers and agronomists can cooperatively produce the most efficient large-acreage farm. However, in the many polls, surveys, and quantitative data of all kinds in the social science, we are aware that questionnaires reflect biases intentional or otherwise reflective of enrolling actants. Surveys collect only certain measurements and those measurements illuminate or occlude specific actants, relations, and potentialities in the mSTA. Besides recognizing the power of gathering data, we must also remember that data, while real and agentic is, as other actants, determined by its relational flows. In other words, climate is organizationally owned by Monsanto, and like the many agronomists who make money selling these products, we should remember that human actants in these networks have power to help determine what kind of data is collected, saved, and interpreted.

A utopic future in the sense Levitas (2013) and Anderson (2008) use the word, requires a more accurate account of *who* is farming. To put it another way, to imagine what could be, we must understand the processual right-now: how decisions are made about the field, *who* has the power to make that decision and how participants in the precision agriculture mSTA resist or enable agri-ecological futures. To put it another away, much of the research on agriculture that is concerned about more sustainable and just futures has focused, rightly, on farmer autonomy (Stock and Forney 2014). An autonomous farmer, they find is more free, often deemed as a social good in itself, and therefore can make better decisions about whole communities on the farm, including more ecologically sustainable practices. A later study by Nelson and Stock (2016) suggests an avenue of repeasantization as a way forward. Peasant agriculture is distinctly about knowing the land, and using that knowledge as a mode of sustainable community and personal reification and stabilization.

However, precision agriculture social organization confounds the first step. The debt burden to agricultural banks in order to lease large amounts of land and sophisticated equipment is enormous (Carolan 2017), adding a participant to the commercial plan agreed upon the lender and the farmer, another actant in the in-the field decision making. Farmer-owners find it difficult to know all parts of a large acreage farm, and so require significant, organized data to see yields, productivity, disease, fertility and so forth. To interpret that data and to effectively utilize it, many farmer-owners turn to agronomists, seed dealers, crop consultants and precision machinery that can adjust to this data. Together these all become actants in the farming assemblage. When remembering that bodies are, themselves, networks of relations, assemblings (Delanda 2016) whose cohesion is interrupt-able (the threat of violence,the everyday actualities of decay, defecation) then we could begin by terming the farmer as the cohesive assemblage responsible for decision making and intervention with in-the-field ecologies in order to grow food. When looking at conventional precision-agricultural, it becomes clear that the farmer-as-assemblage is not one body, but many bodies, things and ideas acting with converging and diverging relations, agencies (Latour 2004), and intentionalities (Dwiartama and Rosin 2015): a *distributed farmer.*

***The Distributed Farmer***

I'll begin this section with two diagrams, one as the farmer is conceptualized as individual and one where the farmer is conceptualized as a locus of decision-making and actionary power in the field, and a second depicting the distribution of agencies in the farming assemblage.

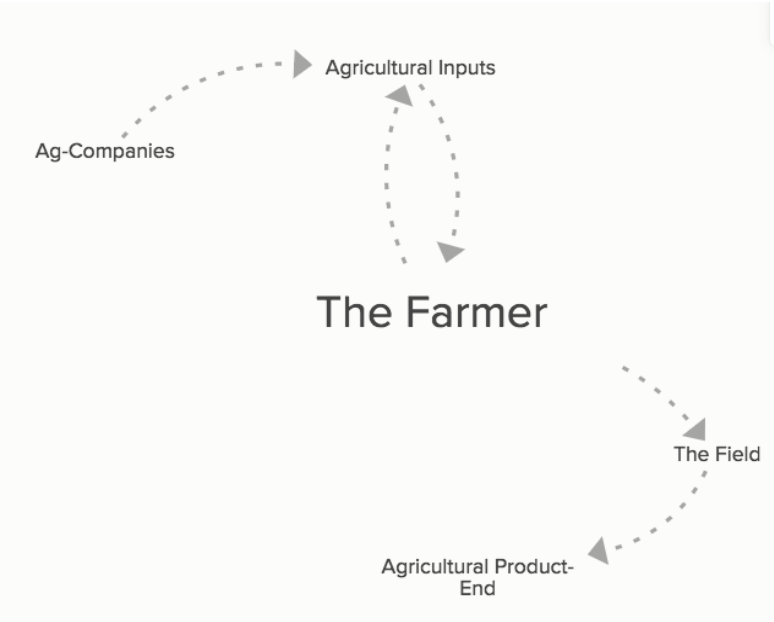


*Figure 1: The Farmer As Discreet Individual*

In this first example, the farmer is seen as the locus for decision making. They are constrained by input materials (seeds and chemicals) which they may sometimes save but often purchase from agricultural companies. The farmer is responsible for understanding and interpreting these inputs in relation to the field in which they plant these inputs. The field, for the good farmer, produces high yields of desirable agricultural production. This diagram is oversimplified, but it is representative of a traditional political economic conception of the land-owning laborer (Marx 1967) who works to extract market-goods from the land. The owning-laborer is seen as qualitatively different from the factory worker, this individual operates freely and makes decisions independently. This farmer engage with coercive structures but they are free to engage as an individual as they please. While a neat theorization, it fails to reflect the messiness of convention agriculture relations.

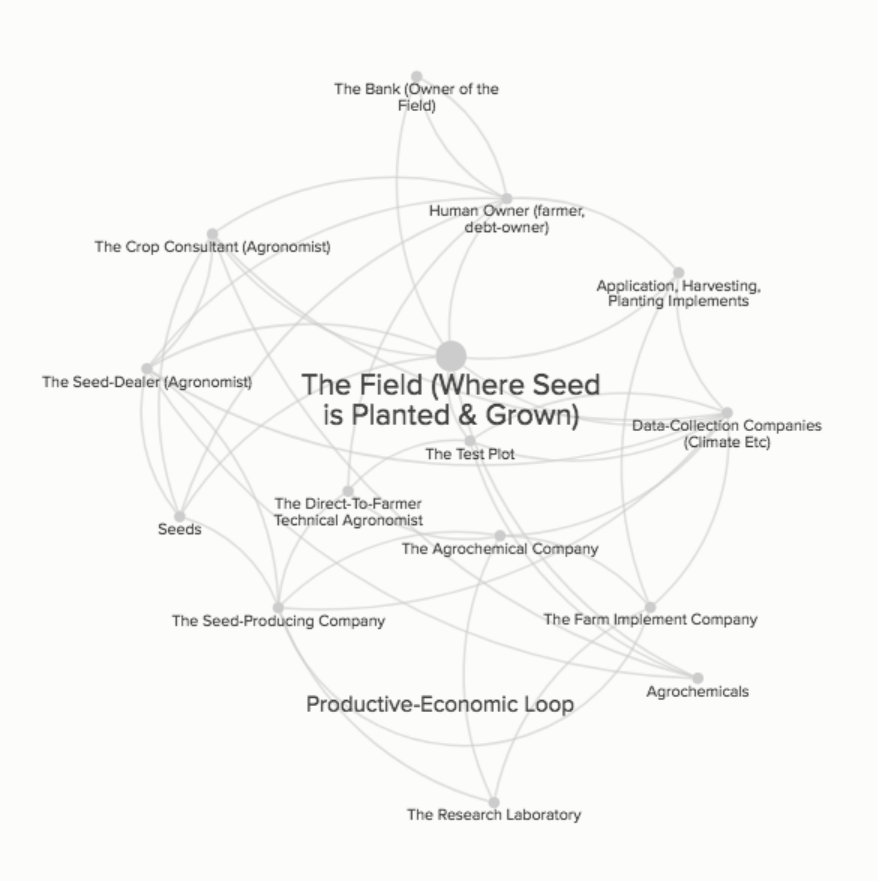


*Figure 2: The Farmer as Distributed*

When examining the relational flows more holistically, as in figure 2, we see that the agentic capacity of the farmer as the individual who happens to own the land and often operates machinery, is surprisingly limited. The productive-economic loop of interconnected companies has as much if not more socio-relational connectivity than the embodied *farmer-owner* in an agricultural assemblage.

To put this another way, when talking about the farmer in the contemporary precision-agriculture sense, we are not talking about the individual, usually a man (Gray and Gibson 2014), living on the land possessing enormous financial debt burden (Carolan 2017), but rather the distributed agentic assemblage of actants which together know and makes decisions about planting. These actants (again) include the proprietary data-gathering hardware, the data saving

and analyzing software, the agronomist/consultant who engages in decision making discourse with the farmer-owner. Additionally consider the agronomist who interprets that data and makes recommendations, the companies that own and produce both the data software and hardware along with chemicals and seeds which are recommended and sold to farmer owners to be planted in fields, all according to a farm-plan approved by agricultural banks scattered throughout the US. To put it another way, no one actor *knows* the land, or the seed, or the farm as a whole system and therefore *no one* makes decisions as a discreet actor. The ultimate decisions made about the land, in a precision agriculture model, is translated through software that directs application rates for chemicals, by planters and harvesters which are directed by GPS systems and utilizing GIS data.

The moments of cognizance, decision-making, and acting, all instances in which we might consider agentic capacity being observable are spaces of distribution (Bennet 2010). Questions of power become less about spaces occupied in a hierarchy or a supply chain but the ability of actors and actants and networks of actors and actants to enroll (Callon and Law 1982) relations and flows of relations into systems which privilege or enable agencies of some groups at the cost of agentic capacity of others. To put it another way, a utopic gesture in governing farm management begins by seeing the distributed farmer as who they are, a distributed assemblage within a larger agri-ecological mSTA. Coercion of members of this assemblage most often begins by taking advantage of miss-apprehensions about the relations within the mSTA. The human farmer-owner of the large-acreage, conventional precision agriculture farm can be coerced into continued unsustainable praxis not by obtuse structures but by relational exchanges which can be leveraged and controlled by specific interactions. To bring this into specifics, networks of agricultural product producers are able to leverage ownership rights of data at all levels: by enrolling legal apparatuses to protect ownership rights for seed-genetic material (Carolan 2012) and by buying and/or starting proprietary products which gather, store, and manage particular kinds of data, seed companies are producing an assemblage and enrolling

particular actants in the form of data. Additionally, through informal and formal data gathering and sharing techniques, participants from the productive economic loop have greater power in the form of relational connectivity between a larger amount of data. More sustainable, just, *utopic* futures begin with rethinking information ownership. Freedom of information may not insure just futures but it could allow for more just, sustainable agri-ecologic formations in the future precisely because information's flows participate in decision making, action, and cognizance of the farmer (Comi, in progress 2017).

A productive economic loop is sub-headed in the diagram I've illustrated in figure 2. In the current precision agriculture mSTA the productive economic structures including seed production companies, farm-implement producers, and data gathering techniques and equipment have coalesced into economically re-enrolling networks of owned entities. This loop has strong relational capacity to effect, strengthen, or alter identifying principles of many other in-the-field actants, such as contracted sales agronomists or certified implement technicians. These actants rely on sanctioning from participants in a productive economic loop to monetize their relational praxis. Additionally, when assessing big-data's agentic role and more utopic futures for governance of the distributed farmer, we should keep in mind that it is assemblage actants within this productive economic loop which have decision making stakes in what data is collected and how that data is collected and interpreted. In other words, as it stands, the data enrolled in the assemblage is primarily enrolled by actants directly relating to these companies.

To put it another way, what we often see as a large super-structure occupying sphere's of power which structurally control citizens of a regime. The actuality of an assemblage approach which keeps human intentionality in mind (Dwiartama and Rosin 2016) reveals that agentic capacity within the mSTA feels removed from some participants not because of harsh governance but because it's co-participants (actants) have grown in networked power. We might say that the productive economic loop has greater in-the-field decision making capacity, after-all, it is the technical agronomists who *see* comparative agronomic data, who interprets that data for

farmers and alongside line-breeders and lab-breeders. Who together make decisions about which specific groups of hybrids are regionally appropriate. It is not because these large corporations exist above the in-the-field technologies and bodies and ecologies, but rather because these large corporations are more intimately connected to the in-the-field technologies, ecologies, and bodies. The relational intersections more tightly connected, more durable (Law and Moll 1995). New futures involve imagining which relational assemblages are most beneficial, durable and practical, for encouraging material changes the organize actants in more equitable, sustainable fashions..

**Utopic Futures for Precision Agriculture and The Distributed Farmer**

What is utopia and how does it relate to the sociological *seeing* of distribution in the precision agriculture mSTA? Methodologically, by creating a space for social dreaming (Levitas 2013) the confrontation of what is (as is reified as ideology) by what can be (which is imagined as utopia) (Ricoeur 1986) has the potential to both clarify historiographic conceptions of the now, as well as co-produce ways forward. This is what Anderson refers to when he imagines a "transcending without transcendence", a scholarship of "hope" whereby stagnation is not assumed, and rather the demonstrably processual becoming of the social is recognized by leaving an eye toward an imagined future (Anderson 2006:691-3, Stock 2016). In this section, I imagine a more free mSTA arrangement inclusive of already invented materialities (though not necessarily inclusive of the continued development cycle) that I argue would be both accessible to the conventional precision-agriculture farmer in the Central US and which may open the door for more community and ecologically sustainable decision making in the distributed farming assemblage.

Seed stock and arable land, for better or worse, have long been seen as a public good (Aoki 2009, Gilbert 2015). Unclaimed plots of land were homesteaded, and *public land* was settled. The detritus of this praxis in the United States cannot be overstated: the vast, national

campaign of manifest destiny saw thousands if not millions of indigenous groups and other non-citizens violently removed from their land, exterminated, or otherwise disabused of their rights as humans sharing a geography. As perceived available land grew smaller (arable land previously occupied by indigenous groups), the method of distributing this *public good* (homesteading, land grants, and the like) became untenable. I argue that this, in tandem with a number of other facters instigated a re-conceptualization of arable land not as a public good distributable to willing workers, but as the private commodity resource it had become, available to those able to pay up front or by loan through financial institutions. In the 1950's through the 1980's as trans-genetic modification became possible, we saw a similar erosion of a public good. A half-century of hybrid breeding had led to many functionally proprietary lineages produced only by specific plant breeders. This was reified by patent protection on such hybrid or trans-genetically modified seed stock. In short, seed stock as a kind of information, and arable land as a kind of resource, moved easily into the private sector. To somewhat abruptly move to a divergent social sector, we might consider the contested space of the internet, which may see as a public good, at least since being transitioned from its original militarized application into the civilian sector. However, with the rise of proprietary operating system frameworks (Windows, OS X) and browsers (Safari, Internet Explorer, Microsoft Edge) and increasingly developed regulation and enforcement of Intellectual property in the digital era, we continue to see the erosion of this public good. This is perhaps most visible in the recent net-neutrality debates arising from recent governance in the US which effectively cedes control over internet access to private internet-providing services (Kang 2017).

Data collection and sharing, particularly across the increasing use of the Climate platform, exists at the intersection of these thoughts. It engages with networked communicative structures to rapidly share and store data collected in-the-field about arable land and is used to both develop new, and suggest current proprietary seed stock for those in-the-field applications. Approaching this ideology and a utopic future from an mSTA perspective keeps in mind that

these meanings and spheres are actually tightly interconnected, durable networks of being. Parsing and separating those networks, selecting what to engage with and how is part of the mobile actants decision making capacity. But that capacity is limited by the strength of enrolling structures, not least of which are state-sanctions reflective of publicly held ideologies, notably here, of property and what is or isn't a public good.

Dewey's formative theorization of a distinctly American pragmatism sees education as formational for the development of a democratic society (Dewey 1999). While Dewey is speaking in a distinctly ideological human space, we can extrapolate that same principle, that to interact flexibly but also durably with other actants in the assemblage, a seeing of connectivity between relational members is vital. In Dewey's ontology, democratic being and just futures hinges on self-conscious individualization which can be achieved only through shared education: a knowing of oneself in relation to others. In this new materialist (ANT-minded) revision, the range of participants is broadened, including human and non-humans, and education is thought of more basically as accessing *relations*. Seeing participants enables agentic lines of relating, *enrolling*, and/or being *enrolled* within the mSTA. Occluding participants disables actants from accessing or responding with agentic capacity along relational lines: while conversely enabling those who do *see* to enroll others more effectively. In the case of data, networks of intentional human actants in a vibrant assemblage of agentic actants have organized information access in a way which encourages a landscape of participation in which everyday farmer-owners and even many agronomists are unable to see the many data points (participants) which together enable specific lines of research, development, and planning at the agro-chemical and seed production level. In short, such farmers have less decision-making power precisely because they *see* less.

When seeing a utopic future for precision agriculture, it might be helpful to synthesize this view of inclusive futures for free participants in the agri-ecologic assemblage with the utopic gesture of the dotCommunist movement. Eben Moglen, founding member of the Software Freedom Law Center authors the "dotCommunist Manifesto" in 2003 as a way of codifying a

more just shared future for software and information freedom and to clarify how integral information freedom is to radically democratic societies. Though outdated and, in many ways, a reductive (re)seeing of Marx's communist manifesto (1843), his seven goals at the close of the manifesto clarify some of the overlap in utopic futures in both precision agriculture and data-sharing more generally in the internet era:

> 1. Abolition of all forms of private property in ideas.
> 2. Withdrawal of all exclusive licenses, privileges and rights to use of electromagnetic spectrum. Nullification of all conveyances of permanent title to electromagnetic frequencies.
> 3. Development of electromagnetic spectrum infrastructure that implements every person's equal right to communicate.
> 4. *Common social development of computer programs and all other forms of software, including genetic information, as public goods.*
> 5. Full respect for freedom of speech, including all forms of technical speech.
> 6. Protection for the integrity of creative works.
> 7. Free and equal access to all publicly-produced information and all educational material used in all branches of the public education system.
>
> (Moglen 2003, my emphasis)

The dotCommunist movement sees social solidarity in the Marxist sense as foundational to democratic, inclusive and just futures. To this group, the legal sanction of intellectual property is analogous to the bourgeoisie of nineteenth century England's control over the worker's means of production (Marx 1967). What's different between the dotCommunists and early Marxists is not simply temporal, but also ideological. The goals of radically shared information, education, and communication is not simply means of production, but an aforementioned seeing of, and between, participants. The freedom proposed in the dotCommunist manifesto, intentional or otherwise, is actually a freedom to co-participate and relate in the network without governance sanctioning, limiting, or expanding the communicative capacity of some actants before others.

To synthesize a way forward with the worlds of agronomic and agri-ecologic production in the precision agriculture mSTA begins by freeing the particular formations of information

currently owned by farmers, LGUs, and owned corporations. This includes genetic information held currently under patent or kept in occluded spaces. This is, in its own right, a way to free participants in an agri-ecological assemblage, and a further discussion about rethinking genetic rights can be found in Deibel's recent scholarship (2015) Kloppenburg's work on seed regimes (1988) and my own past work all address this issue at some level and offering varying conceptions of what a more free commons for seed-genetic technology and bio-informatic sharing. When oriented specifically toward the precision agricultural mSTA, seed-information should be kept in mind but information about the fields, yield data, core samples, and other information relevant to seeing the large-acreage mechanized agricultural space. The relational space these data points occupy and that, particularly, they occupy as an assemblaged aggregate unto themselves.

Recognizing the agentic interplay between members in the distributed farmer reminds us that decision-making for sustainable agri-food futures is not limited to farmer-owners or shadowy corporate hierarchies or moneyed agricultural lenders or networks of seed and chemical salespeople. Rather, decision making occurs along relational flows between these actants, agency is distributed in the assemblage. Recognizing this has implications for our observations of the farmer: that the farmer is community instead of individual, many human actants engaged alongside non-human actants (data, machinery, data-gathering hardware and software) which are co-participating in relational exchanges that (re)imagine what is and will be on the farm. But recognizing this shifts where we must look to effect immediate change in agricultural praxis. Precision agriculture has been discussed as a discursively fixed, structural shift to what farming is and how it will be. It certainly represents an extractive but durable organization of agricultural relations enrolled and stabilized through actants participating in productive-economic spaces in the global economy. However, to simplify that engagement as a stable, stagnant structure is both to miss the complexities of the many actors as well as to fail to see the inherent instability in any

social organization. Energetic relational inputs are constantly required in order to stabilize and continue producing these heterogenous systems of relations. The systems self-stabilize (Dewsbury 2011) but only insofar as actants engage, enable, and constrain relations, only insofar as powerful assemblages of individuals continues to circulate enrolling actions effectively.

To put it another way, re-seeing one member, or one group has vast implications for the entire assemblage of assemblages. Re-see what data is collected and the participants themselves change: how data is collected, shared, and governed is constantly in flux, being renegotiated and self-stabilized across time. This is not to overstate the importance of a single relational flow, but rather to see that utopic futures are present in a vibrant catalogue of participants, and that with an eye towards specific goals (Dwiartama and Rosin 2016) co-participation to re-imagine the possible in distinctly more just, free, and sustainable ways-of-being could be possible. Placing yield and nutrient data from the fields of farmers alongside genetic data from the seed-producing corporations into the public domain may seem invasive at first glance, but it actually represents a freeing of data-actants in the precision agriculture assemblage and enables a more free engagement of the distributed farmer with food-producing agro-ecologies which could provide maker-solutions to some of the many abuses beginning with occluded actants enrolled into assemblages as proprietary goods. Seeing this data in the public domain does not change the some core form of things, but re-sees the relational flow and therefore alters the agentic capacity of each thing with which it co-participates. By recognizing the precision agriculture farmer as distinctly distributed, itself a community, one counter-intuitively frees actants in that community, or at least de-stabilizes the current enrolling mSTA, and allows new ways of seeing the field by seeing data. I argue seeing the distributed farmer lends greater autonomy to precision agriculture practitioners to refigure themselves and their relations within the agri-food assemblage of assemblages. To put it another way, as it stands, the various “ways out” or ways of refiguring what kinds of agriculture can occur once a field enters into a precision agriculture technique are

occluded, perhaps re-seeing the relations in such an assemblage would make new collaborative ways forward visible to its participants. This project is not a project for an answer, but maybe it is a project for a door propped open. A project in the spirit of Levitas's utopic method (2013), an imaginary, intellectual gesture toward what can be conventional agriculture instead of what is conventional agriculture.

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