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Steven Rosenzweig
General Mills

Meagan E. Schipanski
Colorado State University

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A Dryland Cropping Revolution? Linking an Emerging Soil Health Paradigm with Shifting Social Fields among Wheat Growers of the High Plains*

Steven T. Rosenzweig
Department of Soil and Crop Sciences
Colorado State University

General Mills

Michael S. Carolan
Department of Sociology
Colorado State University

Meagan E. Schipanski
Department of Soil and Crop Sciences
Colorado State University

Abstract Once reliant on year-long periods of unvegetated fallow, dryland farmers are reaping environmental and economic benefits by replacing fallow with a crop, a practice called cropping system intensification. However, in the U.S. High Plains, transitions to intensified cropping systems have been slow relative to other regions, and cropping systems have stratified into varying degrees of intensity. Prior attempts to explain the wave of cropping system intensification have largely focused on simple economic rationales, and thus we lack a critical understanding of the social dynamics underlying the revolution in semi-arid cropping systems. We examined the motivations, perceptions, and social interactions of dryland farmers that practice different levels of cropping system intensity in Colorado and Nebraska. Building on Carolan's application of Bourdieusian social fields to agriculture, we identify overlapping fields expressed among interviewees. While these fields are reflected in farms' different degrees of intensification, they can be used to help identify and locate farmers associated with the emerging soil health (or regenerative agriculture) movement. The paper concludes by identifying strategies for change, some which would serve to reshape social fields, and others which leverage existing social positions and relationships to enable farmers to overcome the barriers constraining cropping system intensification.

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Introduction

Agriculture in the High Plains—a subregion of the Great Plains that includes eastern parts of Colorado, Wyoming, and New Mexico, and also western parts of the Midwest states of Nebraska, Kansas, and South Dakota—is undergoing a transformation. For almost 90 years since the Dust Bowl, a period of prolonged drought, crop failure, and rampant soil erosion, dryland (nonirrigated) farmers in this region have largely relied on one type of cropping system to stay viable in a climate characterized by water scarcity and unpredictability. The wheat–fallow system involves growing winter wheat for 10 months, followed by a 14-month period without a crop called summer fallow. Wheat–fallow was universally adopted by dryland farmers throughout the High Plains after the Dust Bowl in part because high-power tractors and improved weed control implements facilitated the maintenance of unvegetated summer fallow periods, and also in response to recommendations from the Soil Conservation Service (now the Natural Resources Conservation Service, NRCS) to alternate strips of wheat and fallow to impede rampant soil erosion (Greb 1979; Helms 1990). Precipitation accumulates in the soil during the year-long fallow period, which enables farmers to mitigate some of the risks of wheat failure due to drought (Peterson et al. 1996). However, while wheat–fallow provides some degree of yield and income stability, it can reduce the productivity and profitability of dryland farmers because it requires two years to grow a single crop (Kaan 2002; Peterson and Westfall 2004).

Low levels of crop productivity and low diversity combined with over a century of tillage have left soils degraded, further exacerbating the risks of a profession already fraught with uncertainty. Tillage leads to a degraded soil structure and less organic matter in the surface soil relative to no-till systems, with implications for water infiltration and retention (Frey, Elliott, and Paustian 1999). Additionally, low crop diversity and frequent fallow periods support less microbial biomass and return fewer carbon inputs to soil relative to intensified and diversified systems, which also constrains soil health and function (Peterson and Westfall 2004; Rosenzweig, Fonte, and Schipanski 2018; Rosenzweig, Stromberger, and Schipanski 2018). While wheat–fallow remains a ubiquitous practice in the High Plains, and nearly every dryland farmer in the region still relies on wheat as the dominant crop, farmers are transitioning toward more economically and environmentally beneficial cropping systems (Hansen et al. 2012; Rosenzweig, Stromberger, et al. 2018).

Exponential growth in the adoption of no-till over the last two decades has enabled dryland farmers to transition to more intensified cropping systems, which are crop rotations that have reduced the frequency of summer fallow (i.e., mid-intensity), to the point in some cases of eliminating it entirely (i.e., continuous cropping; Hansen et al. 2012). Transitions to intensified systems were rapid in Canada and the Northern Great Plains following the advent of no-till, but the High Plains have been slower to follow suit due to the drier climate (Cochran et al. 2006; Hansen et al. 2012; Smith and Young 2000). Recent research suggests that the rate of soil carbon sequestration associated with continuous cropping in the High Plains has the potential to offset all of the greenhouse gas emissions associated with the life cycle of dryland no-till grain production (Rosenzweig, Fonte, et al. 2018). Continuous cropping also improves soil structure via a doubling of soil aggregate stability and improves nutrient cycling via a tripling of beneficial soil fungi relative to wheat–fallow (Rosenzweig, Fonte, et al. 2018; Rosenzweig, Stromberger, et al. 2018). Mid-intensity rotations also elevate these properties of soil health relative to wheat–fallow, though to a lesser degree than continuous rotations. In addition to improving soil health, farmers using continuous and mid-intensity rotations in the High Plains were found to have 80 percent and 70 percent higher net operating incomes compared to wheat–fallow, respectively (Rosenzweig, Stromberger, et al. 2018). Due to the potential for cropping system intensification to reverse century-old trends in soil degradation and revitalize the profitability of dryland agriculture in this region, there is a need to understand the factors driving or inhibiting transitions to intensified cropping systems in the High Plains.

There is a wide range of factors internal and external to the individual that influence farmers' willingness and ability to change agricultural practices. Such factors include structural conditions such as farm size, farmer age, and land tenure (Carolan 2018; Rogers 2003), personal characteristics including moral reasoning and identity (Quinn and Burbach 2008; Roesch-McNally, Arbuckle, and Tyndall 2018), social and cultural factors like norms and social capital (Burton 2004; Sobels, Curtis, and Lockie 2001), and macro-scale forces like policies, markets, and climate (Stuart and Gillon 2013). These complex and interacting forces form the context in which management decisions are made and influence farmers' perceptions and beliefs. In order to better understand farmer decision-making related to cropping system intensification, we analyze this "landscape" of different beliefs and understandings—what Bourdieu (1977) calls "fields"—that manifest in the practice of different levels of cropping system intensity.

The paper draws upon an analytic and conceptual framework earlier articulated in this journal by Carolan (2005) that draws upon Bourdieu's (1977, 1990) concept of field and applies it to the realm of production agriculture. This approach is helpful as we seek to generate a greater understanding of the drivers, constraints, motivations, and attitudes governing cropping system intensification in the High Plains as it enables an assessment of the socio-structural context in which farmers construct their own values, beliefs, and understandings. The argument is informed by in-depth interviews with dryland, no-till farmers throughout the High Plains representing three levels of cropping system intensity from wheat–fallow to continuous. The empirics reveal fields that are semi-competing and semi-overlapping. Understanding a farmer's location within a respective field can help inform strategies for social change, particularly when the aim is the facilitation of farm transitions to intensified cropping systems. As noted below, soil health practitioners figure prominently in one social field. Our analysis, therefore, also adds to the nascent social science literature on the soil health (or more recently, regenerative agriculture) movement (Carlisle 2016; Roesch-McNally et al. 2018).

In the next section, we briefly review the literature concerning transitions to diversified and intensified cropping systems, particularly among farms situated within the High Plains. This is followed by an outline of the conceptual approach, drawing from Carolan's (2005) earlier article and the work of Bourdieu (1977, 1990). A description of the methodological approach follows. The remainder of the paper covers themes, locates farmers in their respective dryland agriculture (Bourdieusian) fields, and concludes by identifying the strategies for change to aid policymakers and researchers in enabling innovation in cropping system management.

Contextualizing Transitions on the High Plains

Scholars are only beginning to examine the farm-level social dynamics of the transformation to intensified and diversified cropping systems (Basche and Roesch-McNally 2017; Blesh and Wolf 2014; Carlisle 2016; Roesch-McNally et al. 2018), which, in referring to this transition in dryland systems in particular, some have called the "semi-arid cropping revolution" (Smith and Young 2000). For example, Blesh and Wolf (2014) found that transitions to diversified cropping systems were enabled through a mixture of cognitive resources like ecological or systems thinking and resources external to the individual like strong relationships with other farmers and progressive farming organizations. Such progressive institutions are emerging in greater numbers and influence as the result of an emerging soil health paradigm, which is largely farmer-led and originally championed by the NRCS (2013; Roesch-McNally et al. 2018). The formal adoption of the soil health paradigm by the

NRCS, especially given the agency's historical role in shaping cropping systems in the High Plains, may have implications for the social landscape of dryland agriculture in the region as they seek to legitimize the soil health paradigm.

Another body of literature seeks to understand this revolution through an analysis of macro-scale structural forces like policies, markets, and technological advancement. Maaz et al. (2018) largely attribute greater crop diversity in Canada and Australia to policy and market changes and research advancements, though Smith and Young (2000) found that market prices and policy had little relationship to summer fallow frequency in Canada and the Northern Great Plains. In the High Plains in particular, a number of factors have been identified as likely factors enabling transitions to intensified systems. These range from advancements in no-till technology and practice leading to greater precipitation storage efficiency (Lyon et al. 2004), to the development of drought-resistant corn varieties with improved yield and survival, and access to markets for alternative (non-wheat) crops like peas (Strepanovic et al. 2016). Additionally, agricultural policies like crop insurance regulation have been shown to influence the economics of dryland crop rotations (Nail, Young, and Schillinger 2007) and may serve to discourage cropping system innovation by decoupling risk and crop biodiversity (Bowman and Zilberman 2013; Di Falco and Perrings 2005), though it is unclear how such policies influence cropping system intensification. Structural forces like crop insurance policy set the "rules of the game," by which farmers play and impose real or perceived constraints on viable agricultural practice. However, these rules and the ideology that produced them can be contested as new beliefs emerge about what the rules ought to be.

There is a sizable body of scholarship that attributes the growing wave of cropping system intensification to simple economic or agronomic rationales, assuming that most producers transition mainly to increase profitability (Hansen et al. 2012; Kaan 2002). While perceived profitability has been found to correlate with the adoption of intensified cropping systems (Saltiel, Bauder, and Palakovich 1994) and agricultural practices generally (Knowler and Bradshaw 2007), such perceptions are highly dependent on social interactions and information networks (Carlisle 2016). Additionally, while it is generally accepted that a mid-intensity rotation (e.g., wheat–corn–fallow) increases net economic returns relative to wheat–fallow, the economics of continuous cropping are much less straightforward because of different input requirements and increased risk of crop failure (Aiken et al. 2013; Dhuyvetter et al. 1996; Kaan 2002). To our knowledge, there has been no attempt to explain the *sociological* drivers and constraints contributing to cropping system intensification trends in the High Plains.

While economic risks can increase with continuous cropping, these systems tend to provide the greatest soil health and environmental benefit (Rosenzweig, Stromberger, et al. 2018; Shaver, Peterson, and Sherrod 2003; Sherrod et al. 2003), and farmers may be willing to risk profit to engage in environmental stewardship (Chouinard et al. 2008). Additionally, as intensification is most often achieved by increasing the diversity of crops in rotation, a wide range of benefits from risk mitigation to better weed control and reduced pesticide inputs typically accompany greater cropping intensity (Derksen et al. 2002). These complex trade-offs and interactions between risk, profitability, and soil health suggest that the decision about whether and how much to intensify is more complicated than the prevailing narratives around profitability acknowledge. An understanding of the social dynamics influencing the degrees of cropping system intensity on the landscape could help identify strategies to overcome the barriers constraining intensification.

Outlining the Conceptual Approach

In contrast to individualistic and rationalist approaches to behavior and perception, a focus on Bourdieusian fields decenters the individual as an analytic unit, looking instead toward the social and embodied nature of action as a source of knowledge, understanding, and affect (Bourdieu 1977). Central to this literature is the idea that social activity, much of it mundane, not only reproduces worlds but also creates them. This tradition seeks to apprehend from whence deeply held understandings—or "spirit" (Weber 1993), "field" (Bourdieu 1977), "ethic" (Appadurai 2013), "imaginary" (Anderson 1983; Taylor 2004)—arise, noting that while "understanding makes the practice possible, it is also true that the practice largely carries the understanding" (Strauss 2006:330).

Practices are guided by what Bourdieu (1990:66) has called the "practical sense," which refers to patterns rooted within the respective communities of an individual. Practices should not, however, be reduced to merely learned rules of "appropriate" behavior. Practices can also engender a "feel for the game" (Bourdieu 1990:66) that is notably disruptive to the status quo, leading to imaginaries that have the potential to provoke resistance and change. Behavioral change, then, when viewed through this lens, emphasizes *acts* and *social networks of trust and knowledge* for understanding why agents do and think as they do.

Such approaches have been applied widely in the critical agrifood literature, from the "good farmer" literature (e.g., Burton 2004; Sutherland and Burton 2011) to more specifically Carolan's (2005) application of the Bourdieusian field concept to understand contesting fields in agriculture. In Carolan (2005), a heuristic was developed to help think through the social processes at work that cause, for example, some farmers to look at an agro-ecological space and see a poorly managed field, while other farmers can look at the exact same space and see a highly valuable management practice—e.g., where someone's "weeds" is for another person evidence of "biodiversity."

These sensibilities about what is and ought to be, according to Bourdieu, are to some degree field specific, and no field exists without actors who embody and carry out its logics, understandings, and practices. Using fields to study the social world allows us to talk about social life as being highly differentiated, thereby providing an alternative to (grand) narratives that paint a black and white world (e.g., the neoliberalization of everything, Capital versus Alternative). Fields are associated with their own taken-for-granted understanding of the world (though there can be overlap between fields), explicit rules of behavior and implicit social norms, and evaluations that assign value to capitals. Capitals are resources of different types—social, cultural, natural, built, financial, human, and political—that can be invested to create new resources (Flora 2018). The relative value of any one type of capital is field specific, and therefore identifying the types of capital one prioritizes can help locate them within a particular field. The field concept also allows us to transcend traditional distinctions between the individual (e.g., perceptions) and the structural (e.g., policies and broader inequities) by giving us a means to talk about their interrelationship.

A field, according to Bourdieu (1977), resembling the neoinstitutional concepts of field (e.g., Naidoo 2004), is a space where competing interests fight for domination and legitimization by the way of mechanisms of inclusion and exclusion. Some fields, as Bourdieu also explains, are more established than others. He wrote of, for example, how the business field tends to be more established and powerful (in terms of conveying status upon "legitimate" participants) than the artistic field. As fields coalesce, markers of distinction become clearer and more difficult to resist and challenge, giving legitimacy to those willing to abide by the rules of the game.

We see this playing out in Carolan's (2005) piece, where conventional producers were shown to deem anyone adopting more sustainable methods as somehow less of a "real" (i.e., legitimate) farmer. Meanwhile, those embedded within what he identified as the sustainable agriculture field were operating according to competing understandings about the "right" and "wrong" ways to farm and about what "successful" operations looked like (403–4). Carolan argues for situating growers in their everyday lived experiences; a move that shows tensions within as well as across fields, as evidenced by, say, competing understandings of what it means to be a "real" farmer, to say nothing about what it means to be a "good" one. Carolan was especially interested in those spaces of overlap, where the fields of "conventional" and "sustainable" interpenetrate and thus cocreate each other (405).

Those spaces of overlap might offer important insights for understanding the underlying mechanisms for social change in the countryside. Many located in the overlap of two fields ought to have been subsumed into the competing field, and yet they maintain a position in both. How does that happen? While still having a "foot" in the conventional field, these individuals should also have a good sense of its rules, logics, and understandings, making them well suited to be further agents of change, particularly if they possess cultural and social capitals that have a high exchange value in both the dominant and competing fields (i.e., they are well-respected and well-connected). Finally, better understanding this population could also prove useful to better understand *which* farmers and social networks ought to be targeted by policy interventions if the goal is further field interpenetration.

This overview of the conceptual approach will be elaborated upon as the paper moves to engage with the empirics of the study.

Methods

Interviews with 23 farmers were conducted in 2015 and 2016 following the precepts of grounded theory (Glaser and Strauss 1967), with a slight alteration. Though this method does not presuppose an understanding of the phenomenon at hand, but rather allows relevant themes to emerge throughout the interview process, the interviews were inspired by the semi-structured, open-ended interview questionnaire used by Blesh and Wolf (2014). Major themes included motivations and strategies for intensifying, barriers to intensification, resources or capitals, and information sources. Themes were coded into applicable categories, which were constantly compared throughout the course of data collection, enabling higher order themes to emerge. Each interview lasted between one and two hours. Sampling was concluded when new themes ceased to emerge. The lead author conducted the interviews, and the coding and analysis were conducted by the lead author and a research assistant using ATLAS.ti. Pseudonyms are used in this paper to protect the identities of farmers.

Each level of cropping system intensity—wheat–fallow (unvegetated fallow every other year), mid-intensity (unvegetated fallow every two or three years), and continuous (no unvegetated fallow)—was present in each of three climatic zones (north, middle, and south) located in eastern Colorado and western Nebraska (Table 1). The northern zone contained farmers in Nebraska, while the middle and southern zones contained farmers in northeastern and southeastern Colorado, respectively. These three zones reflect a gradient in potential evapotranspiration (PET) that increases in the High Plains from north to south. Higher PET levels in the south contribute to drier growing conditions and may impose limitations on cropping system intensification, which is more water-intensive than wheat–fallow (Hansen et al. 2012). Farmer selection was structured to include farmers practicing each level of cropping system intensity in each climatic zone. This strategy was selected in part to satisfy the experimental design for concurrent studies analyzing the soil health, input use, and profitability implications of cropping system intensity across PET zones (Rosenzweig, Fonte, et al. 2018; Roenzweig, Stromberger, et al. 2018). However, this approach also enabled us to examine the influence of climatic constraints and differences in crop insurance policy on decisions related to cropping system intensification,

Table 1. Characteristics of Farmers Interviewed.

Farmer ID	Cropping System Intensity	Acres Farmed
N1	Continuous	4,600
N2	Continuous	16,000
N3	WF, mid-intensity	9,000
N4	Continuous	3,500
N5	WF	2,000
N6	WF	2,000
N7	WF, mid-intensity	3,400
M1	Mid-intensity	12,000
M2	Mid-intensity	10,000
M3	Mid-intensity	20,000
M4	WF	9,000
M5	Continuous	4,000
M6	Continuous	5,500
M7	WF, mid-intensity	7,000
M8	Mid-intensity	3,600
M9	Continuous	1,600
M10	Continuous	1,980
S1	Mid-intensity	9,900
S2	Mid-intensity	21,000
S3	Continuous	4,000
S4	WF	47,500
S5	WF	10,000
S8	Continuous	2,400

N: Northern zone, encompassing western Nebraska; M: Middle zone, encompassing northeastern Colorado; S: Southern zone, encompassing southeastern Colorado; WF: Wheat–fallow.

as these conditions both vary across latitudes in the High Plains. Almost every farmer either grew up on a farm that practiced wheat–fallow or practiced it himself (all respondents were male) before transitioning to the present crop rotation. Interviewees were identified by snowball sampling, as each participant was asked to suggest at least one other farmer who fit the following criteria: practice dryland agriculture (no irrigation) with <500 mm annual precipitation and use no-till practices. By seeking out farmers across a wide geographical range along the full spectrum of cropping system intensity, we were able to access a variety of social networks, thereby overcoming a common shortfall in snowball sampling (Gilbert 1995). We captured a wide range of farm sizes (Table 1). The mean farm size for wheat–fallow, mid-intensity, and continuous farms across all regions was 11,200, 12,800, and 4,800 acres, respectively.

Results

Applications of Bourdieu's theory of practice in agriculture have evolved from a singular field of farming (e.g., Raedeke et al. 2003) to the distinct yet overlapping fields of conventional and sustainable agriculture (Carolan 2005). Carolan justified the construction of multiple fields by noting that arguments for a singular farming field "conceptually oversimplify the diverse array of attitudinal proclivities, cultural rules and resources, and objective network constraints that exist within the production realm of agriculture" (2005:395). In attempting to understand the factors that influence the occurrence of summer fallow in the High Plains, we build on this analysis and find a complex set of distinctions between social networks, information sources, perceptions, and practices, which necessitates further reconstruction of the social (sub-) fields in agriculture. In doing so, we identify numerous overlapping social fields within the broader fields of conventional and sustainable agriculture (Figure 1). Gleaning from the findings of the abovementioned interviews, we "map" the subfields of *no-till wheat–fallow*, *no-till mid-intensity*, and *soil health practitioners* against Carolan's (2005) more general fields of conventional and sustainable agriculture. This tentative analytic and conceptual exercise is explained and justified further in the following discussion. Three emergent themes from the research reveal the forces that shape and are shaped by the social landscape of dryland agriculture: (1) the emergence of a soil health paradigm, (2) perceptions of risk and profitability, and (3) crop insurance policy. Discussion of each theme is followed by strategies for facilitating transitions to intensified cropping systems, based on the insights that emerged from the interviews.

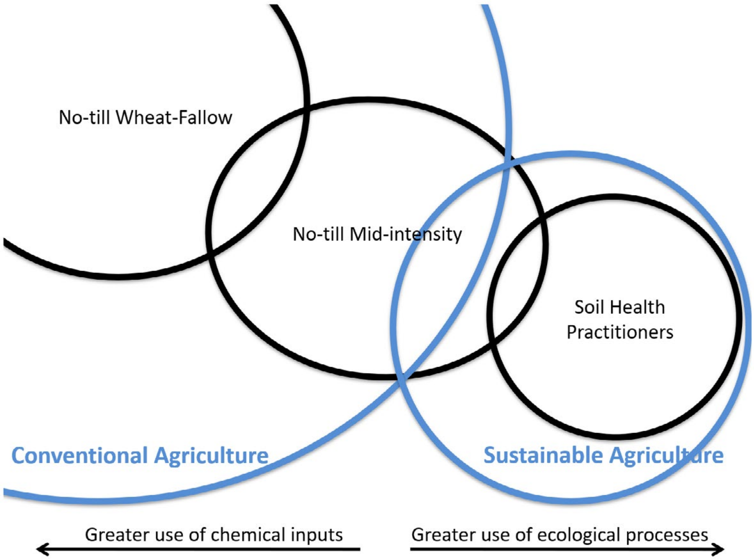

Figure 1. Heuristic Model Overlaying Carolan's (2005) Fields with Distinct Subfields of Practice among Dryland Farmers in the High Plains.

Theme #1: The Emerging Soil Health Paradigm

In 2013, NRCS launched the first soil health initiative in the United States. The "Unlock the Secrets of the Soil" campaign, as it was called, laid the foundation for the national conversation about soil health. Soil health is a management philosophy centered on four principles: (1) keep the soil covered as much as possible; (2) disturb the soil as little as possible; (3) keep plants growing throughout the year to feed the soil; and (4) diversify as much as possible using crop rotation, cover crops, and livestock (NRCS 2013). While many producers likely followed these principles for decades if not centuries prior to 2013, NRCS codified and formalized these few simple rules, and the movement that has since emerged established an infrastructure and platform for the dissemination of the soil health philosophy. Here we draw links between the tenets of soil health and the beliefs of a subfield of dryland farmers (i.e., soil health practitioners), which led them to practice continuous cropping and reduce the use of chemical fertilizers and herbicides. We then discuss how these beliefs were formed through trust in alternative sources of information emerging from the national soil health movement.

In the years since 2013, farmers and ranchers; food and agribusinesses; environmental organizations; and, to a lesser extent, universities, have joined the movement to spread the soil health ideology through farming conferences, articles, videos, films, and personal communication. We found evidence of an impact of this larger movement on the ideologies and practices of dryland farmers in the High Plains. Some farmers strongly identified with the soil health philosophy, which some have called a "soil stewardship ethic" (Roesch-McNally et al. 2018), and this new way of thinking manifested in transitions to continuous cropping systems and innovations beyond cropping system intensification like the integration of livestock and cover crops.

Several of the soil health tenets are relevant to decisions about summer fallowing. We found adherence to these principles, specifically the tenets related to maximizing diversity and time with a growing plant, to be a strong motivation underlying transitions to continuous crop rotations. When asked about his motivations for continuous cropping, Alex, a mid-zone continuous farmer (M9), mentioned, "My goals are just to diversify myself even more … and return more to my land." When asked the same, Tim, a mid-zone continuous farmer (M6), said, "We're going to try to have no fallow periods even between crops. We're trying to go to continuous root all the time. You know, our philosophy is … we want to keep a growing crop year-round." As we will discuss, whether or not farmers adhere to the soil health philosophy depends on *whose* knowledge they trust.

Trust in Alternative Information Leads to New Beliefs and Practices

A critical source of motivation for soil health practitioners in the High Plains lies in the stories of other farmers that have successfully transitioned to highly diverse continuous cropping systems. A number of high-profile dryland farmers have become important figures in the soil health movement, and several of them were mentioned by the soil health practitioners in this study as inspiration for transitioning to a continuous crop rotation. These high-profile farmers communicate their stories through the infrastructure of the soil health movement: conferences, videos, magazine articles, and farmer-to-farmer communication. The specific outcomes that soil health practitioners are inspired to achieve are often related to reductions in chemical inputs or improvements in soil health that they perceive leads to higher profitability. When discussing his goals as a farmer, Tim said, "I'd love to be the Gabe Brown of Eastern Colorado. I'd love to have his yields and no chemicals and no fertilizers. That would be perfect."

Rosenzweig, Stormberger, et al. (2018) found that soil health practitioners in the High Plains translated this belief into practice, as annualized fertilizer use between 2010 and 2014 was 40 percent lower in continuous rotations relative to mid-intensity. Continuous farmers also used about 50 percent of the glyphosate used by wheat–fallow farmers, and less than 20 percent and 40 percent of the amount of 2,4-D and dicamba, respectively, constituting substantial reductions in the three most prolific herbicides in grain production (Rosenzweig, Stormberger, et al. 2018).

While soil health practitioners largely believe that fallow is a detriment to profitability due to the high input requirements, most other farmers believe that summer fallow is a necessary component of a profitable dryland farming system in the High Plains. When asked if there were any distinct social groups in the agricultural community, Chris, a mid-zone mid-intensity farmer (M1) referred to the producers who eliminated fallow as "a group of cover crop-livestock-holistic-soil health-it doesn't matter we're going to prove this works no matter if it's economical or not," illustrating the common belief that summer fallow is an economic necessity, and certain soil health practices are economically detrimental.

The farmers who cited soil health rationales as motivation for eliminating summer fallow place their trust in different sources of information than the inhabitants of other social fields. The soil health practitioners identified nationally recognized leaders in the soil health movement as sources of information, including other farmers and several independent agricultural consultants and soil scientists. This differs from the information sources of other inhabitants in the field of sustainable agriculture, and also those practicing conventional agriculture, who tended to receive their information from neighboring farmers, sales agronomists working for agribusiness, and mainstream research institutions like local land grant universities and the USDA Agricultural Research Service. Soil health practitioners were more likely to distrust mainstream research, while less intensified producers used it to justify their use of summer fallow. When asked about his decision to stop growing grain sorghum and return to the wheat–fallow system, Arnold, a wheat–fallow farmer in the southern zone (S4), said,

> For years, I guess all the old-timers, my dad and all the older [farmers], they said that wheat–fallow is the most profitable system. And my dad read a study that I think K-State did that said they did the feasibility on different cropping systems and they came out with the same conclusion.

When asked to elaborate on a comment about agricultural research, Alan, a northern-zone continuous farmer (N4), said,

> [A researcher] did 5 years of research with wheat behind peas and wheat summer fallow and I saw his research because one day he gave me hell about it when I was giving a talk and said that I shouldn't be telling guys that yields would be pretty good. And I said, 'Well … that's been our experience and that's been the experience of guys that I've talked to that have raised peas is that their wheat yields are staying pretty consistent.' And he's like, 'My research showed that it costs you about 20 bushel wheat yield per acre … you're going to lose a lot of yield if you grow peas.' There's another 50 farmers around the room that will disagree with you … so I don't even pay any attention to researchers anymore really.

This is not to say that the mainstream scientific consensus stands in opposition to the merits of soil health practices, though mainstream researchers are less likely to make the broad claims of the potential impacts of these practices compared to the proponents of soil health. As such, soil health practitioners tend to trust each other's knowledge and that of independent scientists who are unified in their support of soil health claims. Carolan (2006b:326) noted that the rise of sustainable agriculture as a legitimate farm management system could be attributed to the fact that "more people now trust sustainable agriculture and the proponents of sustainable agriculture to be speaking the truth." The same can be said for the emergence of the soil health paradigm, though its legitimacy has yet to be fully realized within mainstream research institutions. In other words, by choosing to trust soil health proponents, soil health practitioners accept different knowledges and truths than those held by other farmers. In this case, soil health practitioners reject the long-standing "truth" that summer fallow is a necessity in a semi-arid climate, though this "choice" is also an artifact of their views toward risk and profitability.

Theme #2: Perceptions of Risk and Profitability

Challenges in adopting ecologically based systems are often framed as difficulties in overcoming the chasm between choosing to promote human and ecosystem well-being versus choosing to maximize profit (Morel and Léger 2016). However, cropping system intensification can simultaneously improve soil health (Rosenzweig, Fonte, et al. 2018; Sherrod et al. 2005), and increase net profitability by 25–80 percent compared to wheat–fallow (Kaan 2002; Rosenzweig, Stormberger, et al.

2018), therefore bridging the chasm of profit/environment. But we find that farmers inhabiting different social fields have different definitions and perceptions of "profitability," and thus the potential benefits of cropping system intensification can be interpreted in contrasting ways. This is less to suggest that farmers, or at least some farmers, are not interested in having profitable operations. The point, rather, is that profitably can mean wildly different things depending on the (sub-) field one is embedded in. This difference, for example, could be in defining profitability as short-term economic profit or yield *maximization* vs. long-term social, ecological, and economic profit *optimization* (Flora and Curtiss 2014).

These perceptions ultimately influence the chosen degree of cropping system intensification. Additionally, farmers do not make decisions concerning adoption of risky agricultural practices based on the intent of profit maximization alone (Shapiro, Brorsen, and Doster 1992), but instead integrate their perceptions of risk and profitability (Anderson and Dillon 1992). We identified three distinct strategies for navigating the interactions between profitability and risk: risk avoidance, yield maximization, and input reduction.

Risk Avoidance

Cropping system intensification in the semi-arid High Plains involves considerable risk and uncertainty. It is a region with greater day-to-day and year-to-year weather variability than almost any other region in the country (Nolan Doesken, personal communication). For dryland farmers, there is a considerable risk that each investment in the seeds, chemicals, and labor required to plant a crop will be lost to drought, hail, or fire. Wheat–fallow farmers avoid risk through infrequent crop plantings and reduce the risk of losses to drought by summer fallowing to increase the chances of a successful wheat crop. When asked how cropping system intensification affects profitability, Darrell, a southern-zone wheat–fallow farmer (S5), said,

> You could almost argue that wheat–fallow in some circumstances is more profitable than a more intensive cropping rotation. In this part of the state, where it's more arid and we have less moisture, the reality is that if you grow 2 crops out of 3 years, that's that much more moisture you're pulling out. So as long as the weather's providing enough moisture, it all works great. But if your shortfall is on moisture, just going out there and doing one wheat crop, that has really good genetics that can grow really good yield every other year, there is an argument to kinda stay towards that. My experience is summer crops tend to be more erratic on their success, because rainfall in the summer months can be erratic.… And so statistically, guys bet on their wheat

> crop year in and year out because it's kind of a known quantity and they know what to expect.

Many wheat–fallow farmers' perceptions of profitability are inseparable from the perceived risk of drought. While wheat–fallow minimizes yield risk, farmers who only rely on one type of crop are highly vulnerable to market risk. Low wheat prices leave wheat–fallow farmers with no other sources of profit, and while they may have consistent wheat yields, their profitability is highly influenced by volatile markets. Wheat–fallow often results in the smallest amount of total crop production on an annualized basis compared to the other cropping systems and provides the least benefit to soil health, which may, in fact, increase the susceptibility to yield risk in the long term as soil health declines. But as Bowman and Zilberman (2013:44) note, "A risk-averse farmer … may be less likely to adopt new technologies, even if they are likely to reduce … susceptibility to risk or increase productivity or income over the long run." A farmer's level of concern with an on-farm risk often relates positively to their likelihood of agricultural adaptation (Mase, Gramig, and Prokopy 2017), but it is clear that the timescale on which farmers perceive profitability determines the strategies they will employ. Heavily focused on short-term risks, wheat–fallow farmers choose yield consistency and risk avoidance over profitability or long-term risk mitigation through improvements in soil health.

Additionally, thinking about profitability beyond the myopic (neoliberal) understanding that reduces "it" to economic capital toward a stance recognizing *all* capitals—illuminates the relevance of social networks and communities of practice upon decision-making, as various types of capital have different exchange rates depending on the field that one inhabits. Wheat–fallow farmers are willing to trade in natural capital in the form of soil health in order to achieve consistent (at least in the short term) returns of economic and other forms of capital derived from a high-yielding crop. The symbolic and cultural capital embodied by a large wheat crop has a high value in the social fields of conventional agriculture, as many farmers and bankers confer the qualities of a "good farmer" on those with impressive yields (Burton 2004). Thus, yield risk embodies other risks that extend beyond the threat of economic losses to those influencing social and cultural status.

Yield Maximization

Mid-intensity producers capitalize on yield gains associated with cropping system intensity without substantially increasing the risk to wheat yields. We call this the yield maximization strategy, whereby farmers rotate different crops to reduce pest pressure and market/price risks while maintaining summer fallow periods, which combine to support higher wheat yields. They also add summer crops that have the potential to increase total grain yields by 75 percent relative to wheat–fallow (Peterson and Westfall 2004). A typical response from farmers when asked about their motivation for transitioning from wheat–fallow to a mid-intensity rotation was captured by Nick, a mid-zone mid-intensity farmer (M8): "Economics. Trying to get more crops—2 crops out of the 3 years instead of 1 crop every 2 years." Wheat yield drag, the penalty to wheat yield associated with moisture reductions from eliminating summer fallow, is the primary barrier impeding continuous cropping among yield maximizers. There is an obvious economic cost associated with lower wheat yields. When asked how he perceives continuous cropping to affect short-term profitability, Seth, a mid-zone mid-intensity farmer (M3), said,

> Well my last experience with [continuous cropping] is that it cost me about $200,000. Just because the peas weren't yielding that great and completely destroyed my wheat yields and it even lessened my corn yields 2 years later.

However, even among mid-intensity producers, there was a diversity of reasons for not tolerating wheat yield drag. While some farmers' concerns over low wheat yields are mainly economic, others rationalize the use of summer fallow from the standpoint of protecting natural capital, which indicates a division of mid-intensity farmers in both the conventional and sustainable agricultural fields (Figure 1). When asked what challenges he faced in finding a crop to replace summer fallow, Chris offered the following exchange:

> Chris:: We planted cover crops strips in a fallow field a couple of different years … and it was 18 bushels less [wheat] production where we had the cover crop vs. where we just no-tilled, summer fallowed it. And then the other issue that crept up in that situation was then the residue from that wheat crop, it was a lot poorer wheat crop, that residue—the hard wind broke that off. We actually ended up having to go apply manure to the cover crop strips to keep the topsoil from blowing away.
>
> Interviewer:: It's the opposite effect of what you wanted.
>
> Chris:: That scared us pretty bad. Our whole entire rotation depends on that dense, heavy wheat residue.… And the best way we've found to produce that is with summer fallow wheat.

While yield maximizers may strive for the simultaneous accrual of natural and economic capital, adherence to this productivist model is characterized by a high input and high output strategy (Burton 2004; Wilson 2001). The viability of high-input business models as a means of maximizing profitability is waning, as the cost of inputs like fertilizer, seeds, and herbicide has risen steadily since the 1960s while commodity prices have stagnated or decreased. These looming trends have placed a "double squeeze" on farmer profits (Van der Ploeg 2006).

Input Reduction

Farmers practicing continuous cropping, and especially soil health practitioners, have found a potential strategy to overcome the double squeeze. They utilize a low-input model to increase profitability, demonstrated by much lower fertilizer and herbicide use compared to the other cropping systems (Rosenzweig, Stromberger, et al. 2018). We previously discussed how the practice of continuous cropping helps achieve herbicide reductions and also noted that soil health practitioners were inspired by others who have managed to drastically reduce input use. Yet it is largely the way continuous farmers perceive the costs and risks of summer fallowing that motivate transitions to continuous cropping systems. When asked why he decided to start experimenting with alternative crops upon returning to the farm after college, Alex said,

> I went to University of Nebraska and had an economics degree and so you start penciling out this wheat-summer fallow system. You got all this money tied up in fertilizer and herbicides and all that, and then you spend the whole year killing things [weeds] so you have $50/acre tied up in your wheat crop before you even put it in the ground. So I was trying to eliminate that. And that's how I kinda found these cover crops and stuff because I was trying to eliminate that fallow period after millet or any of those periods where I had to spray or do something.

In stark contrast to wheat–fallow and mid-intensity producers, who utilize summer fallow to mitigate yield risk, continuous farmers view summer fallow as an even riskier strategy. Summer fallowing can be an expensive practice, especially for no-till farmers. It takes multiple herbicide spray operations with costly chemicals to prevent weeds from growing during fallow periods. Herbicide costs often represent 20–30 percent of a producer's input costs in the Great Plains (Derksen et al. 2002), and these spray operations are becoming even more expensive due to herbicide-resistant weeds, which force farmers to use more expensive or greater quantities of herbicides. Therefore, summer fallow is an economic investment that improves the likelihood, but does not guarantee the success, of the following wheat crop, as any number of natural or economic disasters can make a wheat crop unprofitable. When asked what he learned from the experience of transitioning to continuous cropping, Tim said, "I can't have a fallow period, I'm just throwing money into a black hole with no guarantees."

Still, farmers practicing continuous cropping assume enormous risks to wheat yield. Continuous cropping simultaneously exacerbates and mitigates yield risk relative to the wheat–fallow strategy (Dhuyvetter et al. 1996). The risk of a failed wheat crop due to drought is high because the reserves of soil moisture are consistently low (Aiken et al. 2013). However, by leveraging crop diversity, continuous farmers may be less susceptible overall to sweeping losses by drought, hail, or fire because different crops grow at different times of the year (Bowman and Zilberman 2013; Di Falco and Perrings 2005). Additionally, price/market risk is mitigated through diversification. As explained by Connor, a northern-zone continuous farmer (N2), "I don't have all my eggs in one basket. If the price of wheat is terrible at least you have some of the other crops to fall back on."

Continuous producers, and those practicing sustainable agriculture in general, have a long-term view of profitability as they consider the potential for enhanced resilience conferred by soil health benefits. Continuous rotations improve soil structure relative to less intensified rotations and have more soil organic carbon (Rosenzweig, Fonte, et al. 2018; Shaver et al. 2003), which can help the soil collect and store more water from precipitation. Practitioners of sustainable agriculture see losses of natural capital like degraded soil structure directly translating to economic losses. When asked about the importance of soil health, Alex explained,

> In that instance when we seen that lake form in that [neighbor's] field, that showed a water infiltration problem. It didn't rain an awful lot in that particular field, it just rained enough that that soil was so poor that it could not hold the rain that came.… And I think that's how important moisture is—you have to utilize it. It doesn't matter what falls from the sky, it matters what ultimately infiltrates your field and isn't stuck in a lagoon or ponded up in the middle of your field. I've been trying to build soil health … to try to accept rain events that come very rapidly. It's hard to tell what the future will bring but I think you can prepare yourself now for events down the road. So the moisture I am getting now I'm growing as many plants and as diverse plants as I can to build that soil so that if we do come to a very dry time hopefully I've built my soils enough and raised my

> organic matter and still have my soils covered that I can better make it through that dry period because my soils will be more resilient.

Such everyday observations about the weather and land, and the connections between them, can shape a farmer's values, perceptions, and choices about how to farm (Morton, McGuire, and Cast 2017). While the perception of risk from drought was universal among dryland farmers, the risk posed by poor soil health, namely the reduced ability to infiltrate and store water, was only articulated by soil health practitioners. Soil health is slow to change, and it requires long-term vision to assume greater risk in the short term in the hopes of acquiring natural capital that can protect future profits. As risk perceptions are a key bottleneck controlling agricultural adaptations (Grothmann and Patt 2005; Mase et al. 2017), a lack of risk assigned to poor soil health among the inhabitants of the more conventional social fields may be an important factor constraining cropping intensification.

Farm size may play an important role in the ability of farmers to recognize resource concerns such as a lack of water infiltration and to act on those concerns (Gould, Saupe, and Klemme 1989). Previous findings on the role of farm size on soil health practices have been mixed, with smaller scale farmers more likely to recognize the benefits of such practices, but larger scale farmers more able and likely to adopt them due to the ability to spread the cost across a larger acreage (Carlisle 2016). We found that the average size of continuous cropped farms was less than half that of wheat–fallow and mid-intensity (Table 1), and it did appear as if smaller farmers were more aware of resource concerns as illustrated in the previous quote. Time and labor constraints may be another factor contributing to the smaller continuous farm sizes. While wheat–fallow and continuous farms are similar in size if only cropped acreage is compared—as wheat–fallow farmers only manage crops on half of their acreage each year—cropping intensification often requires added time and labor, which may be more manageable for smaller farms. When asked about the economic impacts of intensification, Seth said,

> Do I see economic gain in [intensifying]? Yeah, but it is busier. The more crops you grow, the more you gotta do, the more you gotta handle, the more you gotta market, the more you gotta think about.

When asked how his neighbor was able to integrate corn into his cropping system, Jeff, a mid-zone wheat–fallow farmer (M4), said,

> [My neighbor's farm] east of me is just small enough—it's intensive. He can get out there and get it done at the right time. I kind of rely on more acres rather than fewer acres with more yield.

As wheat–fallow farmers add acres in pursuit of profitability, as opposed to intensified farmers who add more crops, time and labor constraints may make it more difficult to intensify in the future. Moreover, farmers who are intensifying may encounter challenges in scaling for similar reasons.

In addition to added time and labor and risk management concerns, producers identified a lack of profitable crops other than wheat as a barrier impeding their motivation to intensify. When asked what type of research he would like to see the university conduct, Chris said,

> The big thing to me is if we could find a crop that was suited to our area to put in that summer fallow period that would be economical. If you could make money on that crop, I'd be willing to give up wheat yield in order to eliminate that fallow period.

Mounting economic, environmental, and market challenges will further threaten the viability of wheat monocultures, and the mitigation of risks afforded by crop diversification will likely be an important adaptation strategy (Lin 2011; Maaz et al. 2018). Additionally, with herbicide-resistant weeds and macroeconomic forces driving up the cost of inputs, there is now a stronger economic case than ever for an input reduction strategy, and we may see greater abandonment of the high-input model in the pursuit of profitability. Alan observed the consequences for those who do not adapt to changing environmental or economic conditions:

> When it got so dry in the 2000s, everybody thought they should keep summer fallowing.... You know it's funny. All the guys my age that used to farm ... they're all gone. They're all working for the railroad or they're crop advisers at Simplot.

Theme #3: Crop Insurance

Farmers' decisions about cropping system intensification are influenced by their perception of specific risks, the timescale on which risks and profitability are perceived, and the social landscape that is shaped by and gives shape to these perceptions. Crop insurance is inextricably linked to these perceptions as it sets the "rules of the game" of dryland farming and makes explicit or implicit distinctions about the riskiness of agricultural practices, thereby legitimizing certain beliefs about risk management and delegitimizing others. The high risks inherent in dryland agriculture make federal crop insurance an influential factor in agricultural decision-making in the High Plains. Crop insurance can affect the profitability rankings of dryland cropping systems (Nail et al. 2007), and mitigate short-term risk by allowing farmers to hedge against uncertainty in yield and price (Bowman and Zilberman 2013). While theoretically crop insurance may enable practices with high short-term yield risk like continuous cropping, in reality we found that farmers generally viewed crop insurance policies as a barrier to cropping system intensification.

The clearest policy impediment to continuous cropping is that it is not an insurable practice in every county in the High Plains (Figure 2). In other words, farmers in counties not designated for continuous cropping by the Risk Management Agency (RMA) are unable to purchase subsidized crop insurance for wheat, usually their most profitable crop, unless there is a year-long summer fallow period preceding wheat planting. An exception is that a farmer can apply for an individualized crop insurance plan, called a written agreement, if they wish to deviate from the current policies offered in their county. But several farmers noted the difficulty in obtaining these agreements. Many mid-intensity producers cited these prohibitive policies as a reason for not even considering continuous cropping, as they were unwilling to take risks with uninsurable wheat. Michael, a mid-zone mid-intensity farmer (M7) said that if continuous cropping was an insurable practice in his county, "we would look into it … but that's the thing, there's no way you can really do it if it's not insurable because it's a really huge gamble."

Even in counties that are insurable for continuous cropping, farmers often have to pay significantly higher premiums for continuously

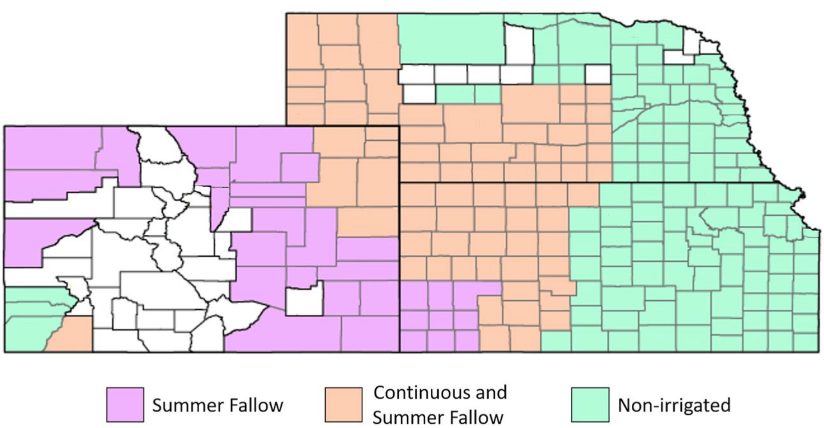

Figure 2. Allowable Crop Insurance Practices by County as Designated by the Risk Management Agency.

cropped versus summer fallowed wheat. Higher premiums for lower guarantees are presumably justified because of the greater assumed wheat yield risk associated with continuous cropping. However, not all farmers practicing continuous cropping agree that it is riskier than summer fallowing. When asked what challenges he faced in eliminating summer fallow, Connor said,

> We still to this day are being penalized in paying double premium because we don't fallow before our wheat. Even though we've had 20 years of success, [RMA] won't change the policy. We couldn't insure it for quite a while and they eventually allowed us to insure it but … they would cut your APH in half, your guarantee in half, and double your premium when I first did that. So I just dropped my insurance for 5 years. I came back with actual production history and proved my yields so they couldn't cut it in half. And then I took insurance again, but I'm still paying a higher premium … I've been on the phone with [RMA], I've sent them PowerPoints, I've written letters describing our system, to no avail. Can't change it.

Despite these impediments, some farmers still practice continuous cropping throughout the full extent of the High Plains, either by paying higher premiums or by foregoing crop insurance completely, and relying on diversification to mitigate risk.

In addition to posing an economic barrier, crop insurance also serves to reinforce conventional ideologies and norms that can impose social, as well as economic, barriers on those seeking to break from historically dominant practices. Continuous farmers, particularly in the southernmost counties of Colorado and Kansas where there is a summer fallow mandate for wheat insurance (Figure 2), and where drier conditions make continuous cropping even riskier, note a sense of local social isolation. When asked with whom he talks about farming, Sean, a southern-zone continuous farmer (S8) noted, "I really don't talk to that many people locally, like neighbors and stuff. Most of the people I talk to [are on] an online discussion group." Tim said, "[I] quit going to the coffee shop because [other farmers] look at you like you're- I mean you may as well have flown a UFO in because they think you're crazy." We point to the existing insurance regime, which supports the persistence of wheat–fallow, at least in certain counties, as evidence to support our conclusion that this practice is associated with the conventional agricultural field. Historically dominant fields get to shape the rules of the game by the nature of their historical dominance. Insurance policies are evidence of this historical legacy, though as we have also indicated, this legacy—this field—is being heavily contested.

Suggested Strategies for Change

How might we leverage these findings to motivate and enable farmers to innovate? We offer the following strategies specific to the case of facilitating cropping system intensification, but also with potential implications for sustainable agriculture more broadly.

Strategies for Change #1: Lessons from the Soil Health Movement

By effectively communicating stories of successful intensification and diversification, and establishing networks of trust with experts that are open to these practices, the soil health movement has catalyzed a transformative departure from the traditional practice of dryland farming. Our findings support others who have shown that farmers are highly influenced by their peers who have used an agricultural practice with success (Warner 2008). Demonstrating successful continuous cropping in the High Plains may contribute to greater use of this system throughout the region. When asked what resources he found helpful in making cropping system decisions, Alex said,

> [I] read some other publications from other farmers or people who been successfully doing it. There's always negative stuff out there, but if you can read stuff from people that have successfully done it, I think that really helped with the cover crops and the rotation thing.

Additionally, as mainstream researchers tend to have more cultural capital with farmers outside of the soil health field, it will be important to keep an open mind about what constitutes a viable practice by considering the successes that some farmers have achieved with a soil health approach. Likewise, there is a need for more mainstream research to test the claims made by soil health proponents using systems-based approaches that avoid focusing solely on wheat yields as the metric of success. Recently, established funding sources for soil health research like the Foundation for Food and Agriculture Research, state-level soil health initiatives like those in California and Nebraska, and the development of nonprofits seeking to research soil health like the Soil Health Partnership and the Soil Health Institute may help in this regard. Establishing mainstream scientific support for the soil health practices and principles that hold up under empirical scientific inquiry could serve to reshape the dominant social field by associating conventional networks of trust with knowledge claims about soil health.

Strategies for Change #2: Profitability

The soil health movement catalyzed transitions to continuous cropping within a group of producers that take a long-term view of profitability and place a high value on natural capital (i.e., soil health). But soil health practices like continuous cropping may not be appropriate for all dryland farmers unless new innovations can reduce the risk and enhance the short-term profitability of these emerging systems. Breeding efforts and market development for important regional rotational crops like millet, grain sorghum (called milo), or field peas could increase the short-term profitability of intensified cropping systems, and consequently catalyze more transitions to intensified and diversified systems, as has been observed in Canada, Australia, and most recently in the inland Pacific Northwest (Maaz et al. 2018). In lieu of strong markets for traditional commodities, several soil health practitioners have begun integrating livestock and grazed cover crops (or forages) into their crop rotations to generate another income stream. When asked about recent changes on his farm, Alan said,

> [I'm putting] cover crops in with the livestock right now … I don't have the answers to all that, but if it will promote biology and organic matter and all those things we've been talking about then that's what I'm after.

Dryland farmers are also growing nontraditional crops for this region, which allows them to enter alternative markets. Studying and communicating the potential for livestock integration and alternative crops to enhance profitability may be another way to facilitate intensification, as some farmers said they would be willing to assume added risks if they could make more money.

Additionally, there is a need to better understand and communicate the potential for intensified cropping systems to enhance profitability by enabling input reductions and improving soil health. Linking abstract concepts like biodiversity to highly visible outcomes like herbicide payments could serve to make the effects of soil health practices more tangible and help to overcome epistemic barriers to sustainable agriculture (Carolan 2006a). Similarly, elucidating the link between soil health and water utilization would enable more farmers to perceive the risks associated with poor soil health, thus increasing their likelihood of adaptation (Mase et al. 2017). This would require a shift in the way mainstream research is conducted and interpreted, from defining the success of an agronomic practice from a short-term productivist view to a longer term view of profitability and multi-capital optimization. As input reduction is likely to become more advantageous over time relative to yield maximization, the benefits of this profitability strategy are increasingly persuasive.

Strategies for Change #3: Crop Insurance

The barriers imposed by crop insurance are linked to the policies that focus on specific commodities or practices. In 2015, RMA began offering whole-farm revenue protection in every county in every state in the country, signaling a shift toward diversity-friendly insurance policies that enable more freedom in crop management. However, we observed that whole-farm insurance itself might be impeded by barriers to adoption. Only one farmer interviewed in this study utilized this new policy (S8, continuous), whereas everyone else had crop-specific yield or revenue protection policies. While potential barriers to whole-farm insurance adoption did not emerge as a topic of inquiry in the bulk of the interviews, one farmer cited over-complexity and privacy issues as a hindrance to adoption (N2, continuous).

Changes in crop insurance policy alone may not be enough to foster agricultural innovation. Crop insurance provides an important safety net, but it is inherently risk-averse and unwelcoming to new practices due to the requirements for established yield and income histories. Establishing and supporting other financial incentives, such as conservation and similar programs, may be a more desirable route for encouraging innovation.

Conclusion

Moving beyond simple economic rationales to explain a growing wave of cropping system intensification, we provide evidence for a social dynamic shaping the degree to which farmers are willing to intensify. For almost a century, the dominant social body of dryland agriculture ascribed to a field that embedded the use of summer fallow in dryland agricultural practice. The soil health movement served to socially construct a new field that rejects this traditional notion, and gave rise to a new social field of soil health practitioners with different values, perceptions, and associated networks of trust than other dryland farmers. In examining these social dynamics, we find that the presence of continuous cropping in the High Plains does not represent a technical advancement resulting from the traditional set of values, but rather the emergence of distinct sets of values that prioritize multi-capital optimization, strategies that focus on longer term resilience, and beliefs about the connection between soil health and profitability. Soil health practitioners leverage continuous crop rotations to build natural capital and reduce reliance on external inputs, while other farmers have transitioned from wheat–fallow to mid-intensity cropping systems via a high-input and high-output model. Still, the perceived risks associated with cropping system intensification, reinforced by crop insurance policies squared in the traditional imaginary, prevent many dryland farmers from moving beyond a wheat–fallow or mid-intensity rotation.

To facilitate innovation in sustainable agriculture generally, and cropping system intensification specifically, we suggest strategies like encouraging long-term viewpoints and profitability strategies beyond yield maximization among mainstream agronomic researchers, which would help to reshape the conventional social fields through existing networks of trust. Additionally, we suggest strategies such as maximizing short-term profitability of intensified cropping systems through market development, which would leverage our understanding of farmer perceptions in their existing social positions to facilitate intensification. A combination of these two types of strategies may help fit sustainable agricultural practices into existing imaginaries, and form new imaginaries that drive sustainable innovation.

This paper identified the regional impact of a larger nascent agricultural movement. The evolution of this movement and its broadening impact on other regions merits further inquiry. In recent years, numerous organizations traditionally associated with the dominant social body of agriculture like commodity groups and agrichemical companies have adopted and championed soil health, but it is unclear the extent to which the values and understandings underlying these newer initiatives align with the value set of soil health practitioners such as those identified in this study. Additionally, examining the impact of similar concepts like regenerative agriculture that have a distinct set of knowledge claims and proponents will help to elucidate how agricultural movements reverberate through, and reposition themselves within, knowledge networks and farming communities to ultimately impact the landscape.

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