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POLICY BRIDGE

Securing the future of US agriculture: The case for investing in new entry sustainable farmers

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Sustainable agriculture is among the most urgently needed work in the United States, for at least three reasons: we face an environmental crisis, a health crisis, and a rural economic crisis. Addressing these pressing crises through sustainability transition will require growing our agricultural workforce: both because the current farm population is aging, and because sustainable agriculture is knowledge-intensive work that substitutes experiential knowledge of farm ecosystems for harmful industrial inputs. Given its social value, sustainable agriculture ought to be a welcoming profession. But at present, US agriculture is decidedly unwelcoming for nearly all who work in it – and it puts new entry and sustainable farmers at a distinct disadvantage. In this paper, we first examine why it is so hard to enter and succeed in sustainable farming. We find that new entrants struggle to gain critical access, assets, and assistance, encountering substantial barriers that stand between them and the land, capital, markets, equipment, water, labor, and training and technical assistance they need to succeed. Secondly, we review promising policy and civil society interventions targeted at addressing these barriers, nearly all of which have already been piloted at the local and state levels or through modest public funding. These interventions are most effective, we find, when they are linked up through robustly governed networks to provide "wraparound" coverage for new entry sustainable farmers. Such networks can help patch together complementary sources of support (e.g. federal, state, local, NGO, cooperative) and synergistically address multiple barriers at once. Finally, we propose additional interventions that are more aspirational today, but that could offer important pathways to support new sustainable farmers in the longer term.

Keywords: Agriculture; Environmental policy; Rural economy; Agroecology; Political ecology

Introduction

Sustainable agriculture is among the most urgently needed work in the United States, for at least three reasons. For one, we need land stewards to tackle pressing environmental issues: sustainable agriculture is critical to reducing our carbon footprint, sequestering more carbon in the ground, curbing air and water pollution, conserving water and energy, stemming the loss of topsoil and biodiversity, and restoring habitat for pollinators and other keystone species (NRC, 2010). Secondly, we need greater supply of and access to nutritious food to curb epidemic rates of costly diet-related disease (McMillan, 2015). And third, economic development is vital in rural areas of the US, where nearly a quarter of children live in poverty (USDA, 2019). Meeting these pressing needs requires growing and supporting our agricultural workforce: both because the current farm population is aging, and because sustainable agriculture is knowledge-intensive work that substitutes experiential knowledge of farm ecosystems for harmful industrial inputs (Timmerman and Felix, 2015).

Fortunately, a growing, sizable number of US workers and youth are eager to do this work. As educators and community development professionals, we authors are flooded with inquiries from aspiring farmers looking to hone their skills and start agricultural operations. We admire these people for choosing such an impactful profession and want to encourage them. But unfortunately, we know how seriously the deck is stacked against their success. Given its social value, sustainable agriculture ought to be a welcoming profession. But at present, US agriculture is decidedly unwelcoming for nearly all who work in it – and it puts new entry and sustainable farmers at a distinct disadvantage.

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Methods, definitions, and scope

We define "new entry sustainable farmer" broadly, as any person interested in practicing low-input ecological agriculture, but not currently securely established in a farming career in the US. By low-input ecological agriculture, we mean biologically diversified farming systems that are designed to supply ecosystem services such as soil fertility and pest management rather than relying on external inputs for those services (Kremen et al., 2012). Farmers, ranchers, and agroforesters practicing this type of agriculture may describe their operations using terms like organic, permaculture, agroecology, ecological agriculture, or regenerative agriculture, distinguishing themselves from industrial farming systems heavily dependent on chemical and fossil-fuel inputs. These farmers range in age and experience with farming – from US-born teens with no agrarian background to middle-aged immigrants with decades of agricultural experience – which is why we do not use the terms "young" or "beginning" farmers. In fact, the highly-anticipated 2017 Agriculture Census released by USDA in April 2019 found that the average age of new and beginning farmers was 46.3 years, just a decade under the overall average of 57.5 years (USDA NASS, 2019a; See **Figure 1**).

Although "new entry sustainable farmers" encompasses a broad scope, we also recognize what it does not include: the challenges faced by established conventional farmers seeking to transition to sustainable agriculture, a topic which has been written about extensively elsewhere (Lamine 2011; Carlisle, 2016). We leave conventional and established growers out of our analysis not because we believe they are less pivotal to food system transformation. To the contrary, we see such transformations as requiring both the transition of existing farms *and* a bolstering of the US agrarian workforce with new entrants to sustainable farming. This paper addresses the latter objective, which we see as complementary to the first – and which requires analysis as a distinct policy challenge. While some policies we recommend cast a broader net – for example, supporting *all* farmers, supporting all *new entry* farmers, or supporting both established and new entry *sustainable* farmers – we highlight in this paper policies that target the particularly challenging situation of new entry sustainable farmers (who lack access not just to land, for instance, but to land free from chemical contaminants). Improving prospects for this particular group of farmers is likely to benefit both young sustainable farmers and sustainable farmers as a whole.

We opted for a narrative review rather than a quantitative meta-analysis or literature review, so that we could consider multiple sources of data that we recognize are

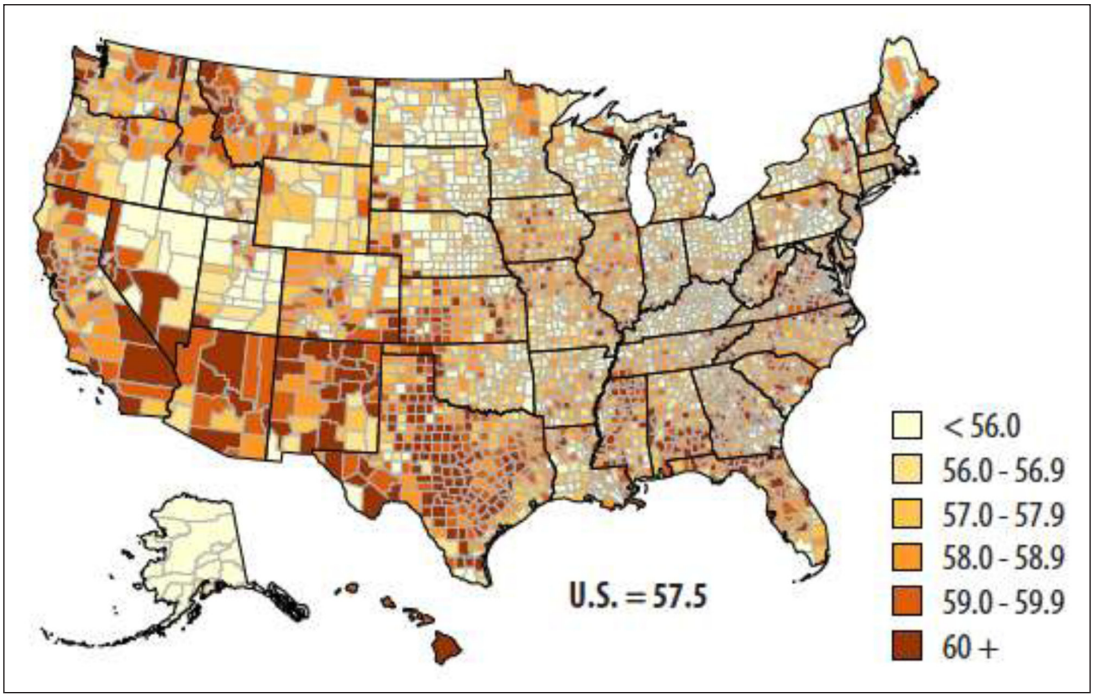

Figure 1: Average age of producers by county, 2017. The average age of all U.S. farm producers in 2017 was 57.5 years, up 1.2 years from 2012, continuing a long-term trend of aging in the U.S. producer population. On average, new and beginning farmers are 46.3 years old. Producers are older in Southern states and younger in Midwestern states. (Image credit: USDA NASS 2019b). DOI: https://doi.org/10.1525/elementa.356.f1

somewhat "apples and oranges." This more-inclusive methodology allowed us to capture peer-reviewed literature, public data, and additional sources such as online materials detailing existing policies and programs related to our subject. We felt that this scope of review was appropriate given that no similar review has been done previously, data on this topic is disparate, and much of the rapidly evolving activity is happening in policy and community spaces. We developed a core list of topics and keywords as guidance for an extensive search of the peer-reviewed literature and online materials using search engines and the collective knowledge of our author team.

The most standardized dataset relevant to our questions – the USDA Census of Agriculture – has informed this analysis, but has key gaps. Thus, we complement USDA data with other data that are not as standardized or comprehensive but help fill in these gaps. For example, data on the Beginning Farmer and Rancher Development Program (BFRDP) – USDA's competitive grant program for new farmer training, education, mentoring, and outreach – are helpful for understanding barriers faced by new entry farmers, but we recognize that not all prospective farmers interested in practicing low-input ecological agriculture as a career are participating in this program (Calo, 2018). Similarly, data on organic agriculture are helpful for understanding the specific conditions faced by low-input ecological farmers, but the overlap is not perfect in either direction. Not all organic farms are biologically diversified, and not all low-input ecological farmers are certified organic, often precisely because of barriers described in this paper such as insecure land tenure, costs of certification, and lack of access to markets (Obach, 2015). Given that the primary goal of our paper is to shed light on how to increase access for all new entry sustainable farmers, including those traditionally underserved, we do not want to limit our analysis to those already participating in BFRDP or organic certification.

Background: historical and structural context

Farmer demographic trends

The heavily concentrated structure of US agriculture helps illuminate multiple barriers that new entry sustainable farmers face. Currently, a mere 3.2 percent of US farms account for 51 percent of the total value of the nation's agricultural production (MacDonald et al., 2018; MacDonald and Hoppe, 2018). In almost every key sector of the food system, four firms alone control 40 percent or more of the market, creating a concentration of power that discourages sustainable agricultural initiatives unless these serve corporate interests (Howard, 2016). As fewer firms have garnered more market power, the US has seen a major demographic slide in rural populations. From roughly 6.5 million farms in the 1920s, the number had dwindled to only 2.04 million by 2017 (USDA NASS, 2019a. In parallel, production has continued to shift to larger farms that are highly specialized in two or three crops or in livestock. In 2017, farms with sales over $1 million managed an average of 2,600 acres, compared to an average of 80 acres for farms selling less than $10,000 (USDA ERS, 2018).

If entering a rapidly consolidating system poses challenges for any new producer, it is particularly treacherous for women and farmers of color. As of 2012, a mere 14 percent of principal farmers were women, reflecting a decline from a brief burst in the early 2000s of women entering agriculture without male co-farming partners. Even with co-farming partners counted, women comprised only 36 percent of farmer decision-makers by 2017 (USDA NASS, 2019a).[1] Racial demographics are similarly skewed, with only 5 percent of 2017 producers counted as non-white, and a mere 4 percent of new and beginning farmers counted as non-white.[2] But these data are also variegated and changing: minority farmers are growing more rapidly in numbers than white farmers, with over 40,000 Latinx entering farming since 2007.

Deep socio-economic divisions in US agriculture contribute to race, gender, and class disparities. A strong bifurcation has emerged between about 65,000 farms making over $1 million in sales and 1.6 million farms earning less than $100,000 (USDA ERS, 2018b). Most of these lower-earning farms sell significantly less – grossing under $10,000. Of the larger farms, few are owned by corporations; they mostly remain family owned and operated, if still embedded in consolidated agribusiness supply chains (USDA, 2017). This creates a key advantage for those farmers who can inherit land and capital – an advantage that is deeply racialized. In 2012–2014, white farmers generated 98 percent of all farm-related income from land ownership and 97 percent of income from farm owner-operatorship. By contrast, farmers of color (including African American or Black, Asian American, Native American, Hawaiian or other Pacific Islander, and Hispanic farmers) owned less land and generated less farm-related wealth per person than their white counterparts. Farmers of color were also more likely to be tenants rather than owners (Horst and Marion, 2018).

Income disparities strongly shape demographic trends among farmers of all races and genders. The 2017 Agricultural Census found farms selling over $1 million in sales accounted for 69 percent of all sales even though they comprised just 4 percent of all farms (USDA NASS, 2019a).[3] These much more profitable farms also expanded their landholdings by 1.3 million acres between 2016 and 2017 (USDA NASS, 2018), further squeezing out lower-income farmers. Such consolidation has been driven by several factors, including financial incentives, with larger farms tending to benefit from greater rates of return (MacDonald et al., 2018). Specialization in commodity crops has also allowed producers to take greater advantage of federal safety nets such as crop insurance. While a small number of high grossing farms capture disproportionate profits, the majority of farmers (over 70 percent) generate only a quarter of their income from agriculture, meaning that many contemporary US growers need multiple off-farm jobs in order to make ends meet (USDA ERS, 2019a).

Political economic origins of US agriculture

Global agri-food restructuring over the past 40 years has played a major role in steering these demographic trajectories (Goodman and Watts, 1997). Over the course of

these four decades, farmer incomes have become highly volatile because of trade liberalization and financial speculation (Lobao and Meyer, 2001; Baines, 2017). In general, crop prices are too low for farmers to make a living, due to structural overproduction, globalized competition, and externalized costs of industrial processes (Graddy-Lovelace and Diamond, 2017). Like all farmers, new entry farmers must contend with cyclical booms and busts, such as the temporarily high grain prices that encouraged Midwestern farmers to spend more on expensive equipment in 2012. As of 2018, soybean and wheat prices have collapsed, and Midwest growers are confronting steep debt repayments. Dairy farmers face similar conditions due to a milk glut and pricing below production costs (Barrett, 2019). The economic forecast for US farmers suggests that the worst is yet to come: Only 46 percent of growers in 2018 had positive income from their operations, and recent USDA figures indicate that US median farm income dipped to its lowest point since 2002 – a *negative* $1,553 (USDA ERS, 2019b).

Given that the majority of obstacles facing new entry farmers are rooted in an economic system favoring industrial agriculture, we now briefly review the political economic and policy history of US agriculture. To support new farmers is to understand what happened, and is happening, to the established ones – and those who have been pushed out of agriculture. Here, we highlight two key dimensions: racial and gender disparities in agrarian policy; and restructuring of agriculture through policy, technology, and trade.

First, the composition of US farmers points to the lingering legacy of a long history of racial, ethnic, and gender discrimination in both government programs and the private sector. In 1920, there were 925,000 Black farmers in the US, despite post-Civil War attempts by white landowners to deny freed slaves any opportunity for land ownership and, thus, the ability to vote (White, 2018). For many reasons, including Jim Crow laws, racial terrorism, discriminatory agrarian policies, and the Great Migration to northern and western cities, the USDA counted only 45,000 Black producers by 2017. Policy discrimination was not limited to African Americans. For many decades dating back to the Reconstruction Era, the USDA systematically discriminated against Black, Native American, Latinx, and women farmers in its credit lending and commodity payments (Daniel, 2013; Minkoff-Zern and Sloat, 2017). While Blacks were receiving just 1 percent of farm ownership loans as of 1982, Native peoples continued to have their agrarian history, expertise, and opportunities undercut through land loss, including a federal court-sanctioned seizure of Wind River Indian Reservation lands in 2017. Women, in turn, were systematically discouraged from entering agriculture at all. Told by USDA officials that "farming isn't women's work," women were instructed to leave agriculture to their husbands, brothers, or fathers (Bennett, 2011), and were not recognized as "farmers" despite their essential contributions. Since the 2000s, facing huge class action lawsuits, the USDA has sought to make its programs more accessible, including through target participation rates for "socially disadvantaged" (SDA) farmers. Unfortunately, the National Sustainable Agriculture Coalition (NSAC) reports, the total number of loans to SDA farmers and ranchers has decreased by four percent for the second year in a row. "Outreach," NSAC suggests, "has so far has not been adequate to keep up with the growing demand" (NSAC, 2018).

Second, the perilous economic predicament in which many growers find themselves can be traced back to a co-evolving history of (1) Farm Bill policy changes; (2) technological transformation; and (3) global food system restructuring. When the Farm Bill first materialized during the Great Depression, Congress paid farmers to set aside land to constrain overproduction, and applied the "doctrine of parity"[4] to set standards for commodity prices (Graddy-Lovelace and Diamond, 2017). Price floors and grain reserves further assured that farmers could cover their costs of production. Beginning in the 1950s, aggressive lobbying by agribusiness slowly eroded this supply control system. Companies such as Cargill and ADM were instrumental in replacing parity policies with mandates that pressed farmers to grow as much grain as possible, an imperative strengthened by the Soviet-American grain deal of 1973 (Friedmann, 1982). The federal government, in turn, was expected to help struggling farmers with direct and emergency payments, thus serving as an indirect subsidy to agribusiness. These commodity payments largely excluded farmers growing vegetables and fruits and pushed US agriculture into chronic oversupply of cheap, nutrient-poor food.

In tandem, federal government policies, private sector investment, agricultural extension, and university R&D systems helped create a strong bias toward intensified production, technological and pesticide treadmills, and expansion of specialized or monoculture farms (Iles et al., 2017). Secretary of Agriculture Earl Butz's call for fencerow-to-fencerow planting is one example; farmers faced extraordinary pressures to fall into line by adopting higher-yielding seeds, expensive machines, and chemical regimes. The 1980s Farm Crisis illustrated the folly of this arrangement. Fencerow-to-fencerow production schemes pulled many farmers into a dragnet of debt. Farm consolidation peaked as wealthier growers bought out poorer farmers – only to find their own control over decisions radically diminished (Buttel, 1989). Farmers' vulnerability was not of course delimited by US borders; it reflected characteristics of larger global food system restructuring. Beginning in the 1970s, as neoliberal policies began to influence markets and trade, multinational corporations came to dominate the organization of production and consumption on a world scale (McMichael, 2008). Contract farming became a way of life for many producers, especially in livestock and vegetables. Free trade agreements such as NAFTA made it more difficult for surviving farmers to insulate themselves from fickle prices and the whims of multinational companies and financial institutions. Collectively, these technological, legal, and market developments have shaped the context in which new growers are entering agriculture.

These trends suggest that strong barriers exist for new entry farmers overall; the next sections illustrate that the

obstacles may be yet higher for those wishing to establish operations based on ecological agriculture. A prevailing dynamic of concentration suggests, moreover, that most new entry farmers are under great pressure to quickly grow large and well-capitalized if they are to persist (MacDonald et al., 2018). Thus, the paradox of new entrants is that the easiest way for them to survive is to get big as fast as possible, adopt environmentally damaging methods, suppress expenditures on labor, and specialize in a few crops instead of diversifying their production – all antithetical to the core principles of socially-just, sustainable agriculture (Guthman 2000). At the same time, new entrants are pitted both against one another and against established growers who survive by consolidating land from those who leave.

The newly released USDA Census data reveal how this pattern plays out over a roughly ten-year time frame. As shown in **Table 1**, trends for new and beginning farmers are on an encouraging uptick for the first five years of entry into farming. In 2012, the Census counted 130,106 principal operators with 5 or fewer years operating on "any farm".[5] By 2017, that number had climbed to 237,838 – an 82 percent jump signaling improved conditions for new and beginning farmers. However, moving past the 5-year mark, the trends shift course. The number of farmers reporting 6 to 10 years of operating on any farm declined by roughly 7 percent between 2012 and 2017, and farmers reporting 11 years on the farm fell off by 9 percent. These shrinking populations beyond 5 years suggest that while entry into agriculture poses huge barriers, hanging onto a farm is more challenging still. In the following sections, we focus on the particular obstacles for new entry farmers, while recognizing that their fate is tightly hitched to the struggles of old ones.

Barriers faced by new entry sustainable farmers: assets, access and assistance

In order to farm, new farmers must build up and sustain productive *assets* that enable them to grow crops or raise livestock, and bring these products to market. These assets include, at a minimum, land, water, equipment, inputs, labor, and knowledge (or skills and information). New farmers also need social networks to transmit knowledge, pool resources, and lower the transaction costs of farmer-to-farmer collaboration. Some assets are physical, others are socio-economic, and others are cognitive or experience-based. Whereas some established farmers have been building human, social, organizational, political, and economic capital for generations, new farmers generally do not have these assets to begin with (unless they are fortunate to have family members who already have some of the requisite assets, or they already have resources due to their previous careers). These assets may be privately held or they may be common assets – that is, they may be shared or collectively owned between a group of farmers, a cooperative, or rural community.

Thus, what new farmers need is not necessarily ownership of these assets but rather *access* to them: they must be able to acquire and assemble everything they need, sometimes from scratch. They often struggle to gain this access, as we saw in the previous section, due to the existence of many barriers that we detail in the next section. Even when assets are available, they may not be accessible: For example, land may be available, but that is not enough for many new farmers because they cannot afford it or cannot locate it or cannot build relationships with landowners.

To facilitate new farmers gaining access to the assets they need, *assistance* is required, which can come from multiple sources, such as government, civil society, industry, and academia. It can take many forms, such as policies, bank loans, NGO programs, health insurance, college loan support, or extension training. Importantly, some assistance may not be targeted directly at new farmers; it may be aimed at agrarian, institutional, civil society, and industry actors to help them better provide the required assistance to farmers. Assistance is needed because new farmers do not necessarily have the economic power, social connections or credit-gaining capacity to garner access and use it – largely due to longstanding inequities in the US agricultural system. Well-designed assistance can not only help individual farmers, but can also begin to transform existing political-economic structures into an "enabling environment" for new entry sustainable farmers.

Ideally, such assistance would be delivered through policy networks that provide what we term 'wraparound assistance' for new sustainable farmers. These networks pull together rules, resources, actors, and assets to create meaningful, equitable access. Ultimately, access and assets are symbiotic: for example, farmers need land to produce food, but they also need access to this land. If there is no land available, then access is not possible. Access and assets must go together – and assistance can help with this coupling. In the following sections, we elaborate an array of access and assets barriers before turning to assistance in the form of policy networks.

Table 1: New Farmer Populations Over Time.[6] DOI: https://doi.org/10.1525/elementa.356.t1

New Farmer Characteristics	**2017 (# of farmers)**		**2012 (# of farmers)**	
Years Operating Any Farm	***All producers***	***Primary producer*[7]**	***All operators***	***Principal operator***
5 years or less	474,198	237,838	252,981	130,106
6 to 10 years	434,076	234,522	436,053	252,290
11 years or more	2,491,560	1,569,860	2,491,040	1,726,907

Land

New entrants face two consistent problems when it comes to land. First are the hurdles associated with finding available and affordable acreage. These are challenges of disappearing farmland, increasing farmland value, and depreciating new entrant purchasing power. Second are the historical and ongoing social relations that govern a farmer's ability to derive benefits from arable land, including landlord discretion, tenants' rights, and the history of land control and dispossession. In this section, we investivgate both of these problems.

Farmland loss, ballooning agricultural land values, and precarious tenant arrangements all contribute to a land access dilemma for new entrant farmers. As development pressures favor "productive" purposes like housing and infrastructure, national farmland acreage nationwide has decreased, often irreversibly (Ikerd, 2016). A recent report on farmland loss estimates a reduction of 31 million acres between 1992 and 2012 (American Farmland Trust, 2018). In California alone, 1.4 million acres of farm and grazing land were lost between 1984 and 2014, a decrease of about 50,000 acres per year (State of California Department of Conservation, 2015). In parallel–and perhaps as a result–remaining US farmland has steadily increased in value, with croplands doubling in appreciation in the 2004–2014 period (USDA NASS, 2017). During the same period, farmland value represented 81 percent of total farmer assets and farm landlords received $31.2 billion in rents.

As niche markets for organic, sustainable, and local foods in urban centers create openings for new direct-to-consumer enterprises, farmers must increasingly chase land in peri-urban and urban fringe environments in order to reach these markets more readily. In an era of rapid suburbanization and exurbanization, these lands are also highly sought after for residential use, and increasingly threatened by other urban encroachments (Ruhf, 2013). The predictable result worsens the land access dilemma for many new entrants: in order to access direct-to-consumer and farm-to-table markets, farmers must operate in spaces of maximum land value (Johnson, 2008).

Agricultural economists and policymakers often point to estimates that 10 percent of all agricultural land will "change hands" by 2019. While the national agricultural census indeed finds that aging and near-retiring farmers are looking to transfer land, given the immense value of the asset, new entrants appear the least likely constituency to benefit from this broad transition of farmland. Following a wave of international farmland acquisition, domestic farmland is now a major investment target that promises reliable returns to shareholders (Fairbairn, 2014). Institutional investors purchase large amounts of farmland, either to directly control the farm activity with the goal of increasing value, or to simply leverage the asset in large fungible portfolios (GRAIN, 2018). New entrants must then rely on tenant farming relationships.

While the imagery and discourse of new entrant farming paints a picture of small-scale landowners, the reality is that tenant farming and challenges associated with being a low-income renter predominate (Calo and De Master, 2016). Nationwide, 39 percent of all farmland is rented out and 81 percent of these farm landlords are absentee or "non-operator," that is, landlords uninvolved in the business of farming (USDA TOTAL, 2016). Landlords exercise ultimate discretion in taking on new tenants, creating a power dynamic imbricated with the legacies of white agricultural land ownership and racism. As tenants, farmers have less autonomy to make long-term management decisions on their land–decisions which have broad implications for farmer incomes and social responsibility as well as environmental sustainability. For example, tenant farmers may not be in a position to invest in perennial crops, conservation infrastructure, or soil health, because a tenant farmer, facing eviction, has not guarantee to recoup the value of any capital improvements made (Calo and De Master, 2016).

As land access is increasingly mediated by landlord-tenant interactions, the social and cultural capital required to secure tenure favor white, educated, and second career or "hobby" farmers. Socially disadvantaged farmers of color, facing structural discrimination, undergo additional barriers to entry. Being undocumented, for example, prohibits access to any direct federal beginning farmer supports.

When designing policy to alleviate land access barriers for new entry sustainable farmers, it is critical to distinguish between immediate technical barriers and ongoing structural ones. Placing conservation easements on farmlands, improving farmers' business acumen, and increasing farmland lending can help alleviate the proximate barriers. But addressing ongoing obstacles to access will require deeper structural change, including the aspirational policies discussed below.

Markets

Market access for new entry sustainable farmers is mediated through their access to resources, especially land and capital. Increased industry consolidation in wholesale markets means these are limited to larger-scale farmers, in both conventional and organic sectors (Howard, 2016). Most beginning farmers lack the production scale necessary to access wholesale markets and supermarket supply chain networks, which require large and consistent volume, so their main option is to access smaller-volume channels, particularly direct markets.

Each direct market channel – farmers' markets, community supported agriculture (CSA), you-pick operations, farm stands, and direct-to-retail – has advantages and disadvantages, although studies of profitability are limited (Galt, 2013). Research on CSA suggests that both returns to farmer labor and farmworker wages and benefits vary greatly across direct markets but are typically worryingly low (Galt, 2013).

Beginning farmers who raise animals face unique challenges accessing markets, many of which can be tied to USDA processing regulations and availability of processing facilities. Some farmers utilize herd or cow shares as a direct-market strategy, inviting consumers to buy a "share" of a cow, sheep, or goat so that they legally own the animals and can access meat and dairy without USDA processing.[8]

Many new entry sustainable farmers express concerns about direct market saturation, which can erode both profitability and positive aspects of social embeddedness, as has been shown in CSA (Galt et al., 2016). One proposed solution reflected in recent USDA policy is to create "food hubs," which act as aggregators for smaller-scale farmers. Yet, food hubs face numerous challenges (Fischer, Pirog, and Hamm, 2015), including the problem of competing against an already-low-margin industrial supply chain.

Capital, credit, and insurance

Given the capital-intensive nature of contemporary US agriculture, beginning farmers struggle to access enough capital to operate at a size sufficient to earn a profit (Ahearn, 2013). While capital needs vary by farming system, they are in nearly all cases staggeringly high. Shawn Williamson, an agricultural landlord and accountant in Missouri, recently estimated total startup costs for a beginning farmer at nearly $2.7 million for a Nebraska dairy farm, nearly $4.5 million for a Kansas winter wheat farm, and well over $5 million for an Iowa grain farm (Schiller, 2017). In addition to startup costs, farmers require significant capital for annual operating costs, even for small produce operations. Strawberry farmers in California, for example, need approximately $15,000 per acre to cover up-front operating costs, and up to $45,000 of additional operating capital later in the season (Bolda et al., 2016). Due to these high capital costs, farmers rely on three major means of capitalizing their operations. Many farmers lean on intergenerational capital transfer – which may finance up to 70 or 80 percent of midwestern farm starts (Schiller, 2017). Even still, most farmers require off-farm income, currently the majority income source for most farm households (Ahearn, 2013). And finally, farmers rely heavily on credit and insurance, the terms and accessibility of which strongly shape the structure of US agriculture and the prospects of new entry sustainable farmers. Up-front capital is critical to investing in soil health, the keystone feature that makes ecologically-based low-input farms both sustainable and profitable. Over time, investing in soil health saves money, reducing input costs and risk, while boosting fertility, carbon sequestration potential, and drought resilience. But this requires patient years of building up soils – through practices such as cover cropping, regenerative grazing, and application of organic matter – before realizing increased incomes from opportunities such as organic certification (which takes three years) and its associated premiums.

New entry sustainable farmers are at a significant disadvantage in accessing capital, credit, and insurance, which exemplify the old adage "it takes money to make money." Large established farms with high household incomes capture a disproportionate share of federal crop insurance subsidies: those in the top 10 percent of crop sales receive over half of these federal dollars (Belasco, 2017). Furthermore, federal crop insurance tends to undervalue, or even disincentivize, sustainable farming practices (Woodard and Verteramo-Chiu, 2017). Meanwhile, although beginning farms represent 22 percent of all farms, they receive only 9 percent of government direct payments (Ahearn, 2013). Beginning farms have notoriously low returns in the startup phase, making it challenging to secure loans. New entry sustainable farmers approaching lenders face what California FarmLink terms the "triple whammy": agriculture is inherently risky, small business is inherently risky, and the conventional credit market often excludes women and farmers of color due to institutional racism and sexism and perceptions of how to "minimize risk." As revealed by the class action lawsuit initiated by North Carolina farmer Timothy Pigford, thousands of farmers of color have been denied USDA loans due to their race. This history of discrimination in lending has led to "learned distrust" of capital sources, lower rates of federal loan program participation among beginning and socially disadvantaged farmers, and relatedly, vulnerability to predatory lenders (Cocciarelli et al., 2015). Similar structural barriers impact crop insurance: for example, only 10 percent of Latinx farmers in the US get crop insurance, compared to 35 percent of non-Latinx farmers (Cocciarelli et al., 2015).

Labor

Due to the increasing size of US farms, hired workers and contract workers are growing in importance in US agriculture: paid labor increased from 25 percent to 41 percent of total labor between 2003 and 2016, while farm operator labor as a percent of total labor decreased (USDA ERS, 2018a). Yet, while demand for workers has been growing, the labor supply has been shrinking. Increasingly severe farm labor shortages in recent years, the subject of a great deal of media and industry attention, are largely a function of an improved Mexican economy and reduced outmigration pressures within Mexico. Increased enforcement targeting undocumented immigrants along the US/Mexico border and in some interior regions has exacerbated the problem (Taylor et al., 2012). The dramatic decrease in migration has led to a shift in the demographics of farmworkers towards an older, more settled workforce with almost no newcomers, i.e., those who have lived in the US for less than a year. Noticeably, newcomers decreased from 29 percent of the workforce in 2000 to just 1 percent in 2014 (Hernandez et al., 2016). This scarcity of entry-level farm labor has made it particularly difficult for new entry farmers to access the farm labor market.

While a tight agricultural labor market poses challenges to farmers in general, these challenges are experienced differently due to variation in regional labor markets, scale of operation, cropping patterns, and farming systems. Because diverse, low-input, sustainable farmers rely on more labor-intensive production methods, the increasingly limited availability of labor is a particularly pressing constraint. On the one hand, these farms simply require more labor hours per acre, since diversified farms substitute labor in place of mechanical or chemical inputs. For example, small, diversified organic farmers are likely to have higher labor needs than their conventional counterparts because of a greater need for hand weeding in the absence of synthetic pesticides (Getz et al, 2008). More fundamentally, because ecological farms are designed with a whole-systems approach, their success depends heavily on the timely availability of experienced workers with the ability to manage diverse tasks depending on the needs of the farm (Johnston et al, 1995).

Traditional mechanisms often used by farmers to address labor shortages are particularly difficult for new entry farmers, who often do not have the capital, resources or economies of scale to implement them. For example, increasing wages and benefits, introducing productivity-enhancing mechanical aids, implementing labor-saving mechanization, and supplementing labor needs with H-2A

workers can be cost-prohibitive for many of these farmers (Martin, 2018). At the same time, some strategies used by organic farmers to fulfill their higher-than-average need for workers, such as formal and informal volunteer and internship arrangements, have been critiqued for diminishing the importance of hiring a reliable, well-paid and well-trained farm workforce (Guthman, 2017). These concerns echo larger critiques of US-based sustainable and organic agriculture movements for failing to adequately address labor and social justice in their vision of sustainability (Getz et al., 2008).

Tools to farm: equipment, inputs, crops and livestock

Following land, the second highest capital investment facing US farmers is for equipment (Koenig, 2016). Here again, needs vary by farming system: large grain farms require expensive tractors and combines, while small direct-market produce farms require expensive post-harvest cleaning and refrigeration facilities. To give a few examples, start-up equipment costs are about $1 million for an Iowa grain farm, $1.15 million for a Kansas winter wheat farm, $1.6 million for a Nebraska dairy farm (Schiller, 2017), and $800,000 for a 45-acre strawberry farm on the Central Coast of California (Bolda et al., 2016). Farmers who do not inherit family equipment are thus at a disadvantage, as are farmers seeking to transition a farm to a different farming system that requires different equipment (either to pursue more sustainable practices or new markets that will better support sustainable practices). As US agriculture has moved toward ever more expensive, high-tech, often proprietary equipment, farmers also incur greater costs to repair their equipment, which they may not legally or practically be able to do themselves (Wiens, 2015).

Access to well-functioning equipment is particularly critical to the success of low-input ecological farms, which rely heavily on careful timing of management. Thus, a broken-down piece of low-quality used equipment can spell disaster: too-late planting, too-late incorporation of a cover crop, too-late cultivation of weeds. Proper storage and post-processing equipment are also critical for such farms, which typically rely heavily on premium quality rather than high volumes of low value commodities. Finally, because such farms rely on biological diversity rather than external inputs for ecosystem services such as fertility and pest management, they host a greater variety of operations (e.g. vegetables, fruit, livestock, flowers) and a greater variety of crops and animals within those operations. As a result, these farms tend to require more diverse, potentially costly equipment that may be used only at certain times of the year. In some cases, appropriate equipment for diversified farming practices (such as intercropping) may not even be available for purchase, as US agricultural engineers and implement dealers have designed for large monocultures rather than small or biologically diversified farms.

Farmers access equipment in one of four ways: ownership, rental, hiring a service provider to perform a key task that requires equipment (e.g. "custom cutting" of grain with a combine), or some form of sharing. The sharing option may be particularly well suited to new entry sustainable farmers, who have been leaders in creating a number of innovative models: tool-lending networks, equipment co-operatives, shared ownership between two or more farms, and tool-lending libraries or low-cost rental services offered by NGOs or public agencies. However, such programs reach only a tiny share of US farmers, compared with Swedish "machine rings" (which engage 6 percent of Swedish farmers in equipment sharing clubs), their German equivalent (which engage five times as many German farmers in similar equipment sharing activities), or Canadian machinery cooperatives (Gilbert, 2018).

Aside from equipment, farmers require three other key tools: inputs, seeds, and breeds. Ecological agriculture is low input by definition – utilizing on-farm inputs or the farm system itself to replace external inputs such as fertilizers and pesticides. But like all other farmers, new entry ecological farmers require seeds (in the case of crop farming) or breeds (in the case of livestock farming). Given that both crop and livestock breeding have focused on high-input industrial systems (Khoury et al., 2014), low input ecological farmers may lack access to the seeds and breeds suited to their systems, leading to poor performance, or may incur the cost of adapting their own seeds and breeds.

Water

Water is yet another essential resource for farmers, and access to water represents a barrier for many farmers, particularly in the semiarid West. However, water-related challenges differ substantially depending on factors such as region and crop type. On rainfed farms, water access is less of a challenge, but anomalous rainfall amounts and patterns can pose problems. On many other farms, irrigation is utilized both to increase yields and improve resilience. In the US, about 28 percent of harvested cropland is irrigated, and irrigated farms produce 50 percent of the value of crops (NASS, 2014).[9] Crops with the most irrigated acres include corn (13.3 million), soybeans (7.4 million), and alfalfa (5.5 million), whereas irrigated permanent pasture (2.7 million) and horticulture crops (0.5 million) are more limited (NASS, 2014).[10]

Irrigation provides critical value for many farmers, but represents an additional expense due to the necessary equipment, labor, and energy for pumping. These costs are significant, especially considering that most irrigated farms (75 percent) earn less than $350,000 in annual sales (NASS, 2014; ERS, 2018). Just how much this irrigation costs depends largely on the water source: groundwater, which accounts for 55 percent of applied water, is typically the most expensive. Yet surface water can present significant costs too (NASS, 2014). Off-farm surface water is particularly important in Western states, which account for 97 percent of its use, and to low-sales farms, which represent 75 percent of farms using this water source. Meanwhile, shares of groundwater and on-farm water use are relatively higher on larger farms (NASS 2014).

Securing water resources may be more difficult for new farmers than for established operations. The costs associated with irrigation and water management are likely to be exacerbated for these entering farmers, particularly

given that they already face greater challenges accessing credit, capital, training, and labor. Difficulties related to land access are also closely connected, since water rights and sources are tied to land, particularly in regions relying on the riparian doctrine. These factors help to explain why access to *already* irrigated farmland and the associated water rights are listed as top obstacles in surveys and interviews of young and beginning farmers (NYFC, 2017; Calo and De Master, 2016). In comparison, established operations often have the financial resources for maintaining and updating water infrastructure, such as drilling new wells during times of water scarcity (Shannon, 2018). During the most recent drought years in California, senior water rights holders (many of them family-owned, corporate farms) have been able to use water unavailable to junior rights holders and have also had the financial resources to drill deeper wells to access dwindling groundwater resources (Pincetl and Hogue, 2015). Established operations that hold senior water rights often have a better understanding of the history of their water rights, which can be complex and variable, locally and regionally (Apple, 2001). Finally, water rights systems are the result of long-running political and economic developments and have not necessarily been developed to distribute water conservatively or equitably (Zilberman et al., 2017).

In addition to facing cost and water rights barriers, new farmers are likely to be farming for many years into the future and thus are potentially highly vulnerable to the variable water availability associated with climate change**;** (USGCRP, 2018). In a survey of young farmers, 66 percent have already observed unpredictable weather attributed to climate change (NYFC, 2017). In Western states, a majority (82 percent) of young farmers expressed concerns about water availability or access (Greenberg et al., 2016). Fortunately, low input, ecological farming methods that are already used by many new farmers (Greenberg et al., 2016) can improve soil health and water holding capacity, positioning these farms to adapt to limited water resources and contribute to water shortage solutions. However, the many challenges these farmers face make it difficult to scale up such practices (Morris and Bucini, 2016; DeLonge and Basche, 2017).

Training and technical assistance

Training and technical assistance are important for all farmers, who face a constantly evolving series of challenges and opportunities with respect to weather, climate, pest pressures, and new technologies. For new entrants practicing sustainable agriculture, the learning curve and need for assistance may be even higher. Not only do low-input ecological farming practices tend to be more knowledge-intensive (Gliessman, 2016), but there is a relative lack of government, extension, and agricultural R&D resources for sustainable farming practices and systems (Miles et al., 2017; DeLonge and Basche, 2017; DeLonge et al., 2016). Meanwhile, new entry sustainable farmers face unique challenges associated with diversified farm operations, like niche marketing arrangements, acquiring loans from unfamiliar lenders, and working with specialty crops (Calo, 2018).

While sustainable agriculture and agroecology continue to be a low federal priority, support specifically geared towards "training the next generation of farmers" has begun to emerge in the past decade. Notably, Congress directed the USDA to establish the Beginning Farmer and Rancher Development Program (BFRDP) with an earmark of $100 million over 10 years in the 2012 Farm Bill. This federal program, the largest of its kind, complements a constellation of private sector activity with the goal of creating new farming enterprises.

Given the variety of training and technical assistance programs now available for new entry farmers, it is crucially important to understand how the injection of new knowledge resources influences their ability to overcome barriers to entry. Moreover, it must be considered to what extent a focus on knowledge resources as the primary intervention supports a broad coalition of farmers versus farmers with superior social and financial capital. While existing efforts to fill the gap in training and technical assistance are assisting many new entry sustainable farmers, they may be leaving some behind.

The BFRDP, for example, funds activities that overwhelmingly focus on building horticultural and business acumen skills among participants, fostering an ideal of individual capacity building and entrepreneurism. This "knowledge deficit" approach tends to overlook the structural barriers that plague new entrant experience and thus may have the effect of supporting a privileged class of farmers who may benefit from capturing niche markets with entrepreneurial savvy. Socially disadvantaged farmers may be in fact disenfranchised by such programs, because they end up placing responsibility for success on the individual businessperson, rather than the larger agricultural system (Calo, 2018).

Analysis of new farmer incubators have shown that farmers benefit from innovative land use and resource arrangements while enrolled, but then face high structural barriers upon exit (Calo and De Master, 2016). Furthermore, the impact of incubators may be overemphasized as the average acreage of farm incubators nationwide is only 10 acres (Overton, 2014). Apprenticeship programs have been viewed by some as pedagogically distinct from top down and knowledge deficit approaches to new entrant learning (MacAuley and Niewolny, 2016). At the same time, enrollment in costly programs by educated and mostly white constituents leads researchers to draw cautious conclusions about the potential for transformative impact of apprenticeship programs. Instead, these programs are more often revealed to be important in forming a sort of agroecological political consciousness that may lead towards a cultural shift, rather as a tangible pathway towards farm establishment (LaForge and Levkoe, 2018, MacAuley, 2016).

Policy solutions to foster new entry sustainable farming

Given the many barriers that limit the growth of new entry sustainable farming, a suite of assistance policies are urgently needed to support the workforce required for US agriculture's current and future success. It is essential

that these tools work together to: 1) increase the *capacity* of new entry sustainable farmers, improving access to the assets they need to become securely established and 2) proactively enhance *social justice and equity*. Given the importance of "leveling the playing field" in transitioning toward a truly resilient and sustainable food system, policies must not only work for new entry sustainable farmers as compared to the larger farming community. They must work especially well for farmers and ranchers of color and those who are economically disadvantaged.

Existing policies: promising models, persistent gaps

Fortunately, relevant policies, programs, and efforts already exist across the US and elsewhere, a number of which are summarized in **Table 2**. The Farm Bill is the primary federal source of funding and assistance for US agriculture, and it enables a wide array of programs (e.g. crop insurance, support for transitioning to organic agriculture) that new farmers can potentially access. For example, the aforementioned Beginning Farmer and Rancher Development Program offers technical and business training, while the Farm Services Agency (FSA) makes loans to new farmers who cannot obtain financing from commercial lenders. Many state government departments of agriculture also offer their own programs and services, aiming to retain farmers and attract new ones at a time of rapid loss or consolidation of farmland, growing farmer debt, and ongoing technological change. Locally, counties and cities may also have their own programs. Hundreds of private and civil society organizations – such as the Sustainable Iowa Land Trust, the Agriculture and Land Based training Association, the Equitable Labor label, and the Greenhorns – deliver a wide variety of services and resources to nurture new entrants. They thus provide excellent models and demonstration projects, but are typically intertwined with state and federal programs that require public policy to scale geographically and financially. Several extant efforts constitute burgeoning networks, insofar as they pull together actors across private, civil society, and government sectors.

Table 2: Select examples of existing policies, initiatives, or organizations dedicated to supporting new entry sustainable farmers by either increasing their capacity or lowering barriers to access or assets, such as water, land, markets, capital, equipment, labor, or technical assistance. Such interventions could be expanded and improved to create an enabling environment for new entry sustainable farmers. DOI: https://doi.org/10.1525/elementa.356.t2

	Increase Capacity			Address Equity	
Need Category	**Federal Government**	**State Government**	**Other (Non-Government)**	**Government (Federal or State)**	**Other**
Water	Conservation Stewardship Program[11]	CA State Water Efficiency and Enhancement Program[12]	Dry Farming Collaborative[13]	CA Sustainable Groundwater Management Act[14]	Black Mesa Water Coalition Food Sovereignty Project[15]
Land	Transition Incentives Program[16]	MN Beginning Farmer Tax Credit[17]	Sustainable Iowa Land Trust[18]	CA Farmer Equity Act[19]	Agrarian Trust FaithLands[20]
Markets	Local Agriculture Market Program (Farmers Market & Local Food Promotion Program)[21]	CA Healthy Soils Initiative (payment for ecosystem services)[22]	Detroit Eastern Market[23]	Local Agriculture Market Program (USDA Value Added Producer Grants)[24]	Good Food Purchasing Program[25]
Capital, credit, Insurance	Whole Farm Revenue Protection[26]	NY State Young Farmers Loan[27] Forgiveness Incentive Program	Kiva Zip 0% loans for farmers[28]	USDA Noninsured Crop Disaster Assistance Program[29]	California FarmLink[30]
Equipment & Labor	FSA Microloans[31]	CO Agricultural Workforce Development Program[32]	ME Organic Farmers and Gardeners Association's Shared-Use Farm Equipment Program[33]	FSA Microloans Socially Disadvantaged Applicant funding[34]	Farmhack Tool Library[35]
Technical Assistance & Training	Farmer Opportunities Training and Outreach Program (Beginning Farmer and Rancher Development Program)[36]	Cooperative Extension[37]	Farm Commons[38]	Farmer Opportunities Training and Outreach Program (USDA Outreach and Assistance for Socially Disadvantaged and Veteran Farmers and Ranchers Program (2501))[39]	Planting Justice[40]

Nonetheless, many gaps in support for new entry farmers persist, such that programs and networks (when they do exist) are often either underutilized or ineffective for lack of scale or connectivity. There are a variety of reasons for these gaps.

1. Public measures aimed at new entry farmers are often poorly connected within sectors (eg. water management networks) and across different levels of government.
2. Legislators may not be responsive to local farmers' needs if the system in which they work is bound up with industrial agriculture (Frison, 2016).
3. Farmer assistance programs rarely receive the funding needed either to reach large numbers of growers or to make truly transformative differences in farm bottom lines, as is the case with the USDA's Environmental Quality Incentive Program and Conservation Stewardship Program.
4. Some federal programs are not utilized in states that refuse to support progressive public services for farmers.
5. Other federal programs, limited in scope and access, only cover certain states and certain farmers, as is the case with diversified farm crop insurance.
6. Sub-national programs, by definition, apply only in certain states.
7. Even the most advanced, well-conceived private sector and NGO programs simply cannot cover much territory, nor offer substantial funding on a national level.
8. Moreover, even when valuable measures are put into place, desired outcomes may not materialize if key elements – such as adequate knowledge, capacity, rules, or accountability – are missing (Calo and De Master, 2016).

In sum, existing programs and networks are often isolated from each other, reflecting the tendency of policymaking processes and organizations to address problems in a siloed manner.

Knowledge of these gaps in support for farmers is an essential starting point in identifying where and how current policies can be modified and scaled up to overcome the barriers we have described. For both the capacity and equity dimensions of assets and access, examples of gap-bridging tools can be drawn from different scales (from local to national) and different sectors (including governments and private organizations). These interventions offer lessons in what actually works, newer ideas that deserve to be tested more widely, and aspirational policy objectives. In addition, they point to a wide range of possible strategies: technical training programs, direct marketing incentives, and greater access to land, equipment, low-interest loans, and credit. Combining models that are feasible in the short-term (incremental) with more ambitious ideas that inspire longer-term change (transformational) can create pathways toward a future that supports sustainable farmers, not only to enter agriculture but to thrive over the course of their careers (Gliessman, 2016).

Connecting up solutions: a polycentric governance network approach

Rather than a centralized clearinghouse of new entry farmer resources, we suggest that a network model of governance can be used to meet new farmer needs in each asset area, while acknowledging that the institutions involved have their own histories, interests, and values (Carlisle and Ruby, 2017).

A network model of governance can help integrate these entities into a web of cumulative, mutually reinforcing supports. Networks can also confer resilience by creating redundancies and multiple pathways, enabling actors to bypass gaps or resistances (e.g. a neglectful state government) that would otherwise result in breakdowns (Marshall, 2009).

As seen above, some networks already exist at local or regional levels to support new farmers. Other networks exist, for example, around specific Farm Bill or USDA programs. More attention to the *governance of* networks can help improve their ability to design, coordinate, and monitor measures across an asset area (e.g. Rhodes 1997; Bressers 2009). For example, actors providing similar forms of assistance to new entry farmers could benefit by establishing rules to resolve conflicts, processes to set and revise shared goals, and platforms to enable "many to many" collaborations (Ansell and Gash, 2017).

Well-governed networks offer many potentially beneficial outcomes. Researchers have pointed to the ability of networks to mobilize local knowledge, create more room for policy experimentation, meet diverse needs, and adapt to changing ecological and social conditions (Carlisle and Ruby, 2017). At the same time, poorly governed networks can have adverse consequences. For example, poorly governed networks can lead to high transaction costs, and the dispersion of responsibilities can make it difficult to hold decisionmakers accountable for their activities (Lieberman, 2011). The power, interests, and strengths of different actors within a network can vary enormously, and disagreements and tensions among actors can stymie progress on shared goals (Blomquist and Schlager, 2005).

Thus, there also needs to be a *network of networks* approach —bridging asset areas from land to water to capital —to promote shared goals and to provide as close to wraparound coverage[41] as possible. New farmers can build their capacity more quickly by assembling a cohesive package of assistance from networks across all asset areas, not just in one or two areas. Furthermore, farmers will be better supported in practicing ecological agriculture if their supports are systematically developed with the objective of sustainability from the start. They are also more likely to thrive if overarching structural safeguards protect them from racial discrimination and exploitative industry practices; such protection is vital in helping farmers create hardy niches in which they can survive and from which they can expand. But to enable all these things to happen, decisionmaking institutions and processes are needed to coordinate across and knit together disparate networks in many asset areas without weakening their autonomy and power. This calls for "polycentric governance" which seeks to find practical ways to balance between more

centralized policymaking and decentralized activities (Newig and Fritsch, 2009; Ostrom, 2010).

Case 1. Access to land: the case for interconnected interventions

As described earlier, new farmers face numerous hurdles in gaining access to land, including nationwide disappearance of farmland, the high cost of land combined with low purchasing power of new farmers, historical discrimination in land access, and a lack of autonomy and security in land management and tenure.

Some government agencies have begun to offer new farmers tools to address these barriers. For example, the USDA established the nationwide Transition Incentives Program, which incentivizes retiring farmers to sell or rent lands previously enrolled in the Conservation Reserve Program to beginning or socially disadvantaged farmers or ranchers. Incentive programs to protect land and make more of it available for farmers have also been piloted at the state level. In California, the Williamson Act of 1965 has long allowed local governments to grant property tax relief if growers contract with buyers to protect farmland from conversion. Similarly, Minnesota recently passed a tax credit for established farmers selling land (along with livestock, equipment, and facilities) to resident beginning farmers. Other states have taken an approach that more directly incentivizes new farmers. In Rhode Island, the state purchases land via the Farmland Access Program and imposes agriculture-only use covenants before making it available for purchase or rental at affordable rates. Such policies offer ideas for ways to get land in the hands of new sustainable farmers, but many of these are only available in specific states and each takes on only a small portion of existing barriers.

Fortunately, many NGOs have recognized gaps in public policies and are also working to address land access barriers by protecting farmland, establishing conservation easements, and offering long-term leases or land sharing arrangements. These organizations include groups that work at local to national levels, such as the Peninsula Open Space Trust, the Sustainable Iowa Land Trust,_California FarmLink, and Agrarian Trust. Among these groups, some specifically work to create equitable opportunities for new growers as part of their mission, while others work more directly to enact racial equity. Other organizations, such as the Center for Agroecology and Sustainable Food Systems at the University of California, Santa Cruz and the Stone Barns Center for Food and Agriculture in New York, have helped foster a community for beginning farmers while also placing a clear focus on sustainable agriculture.

Locally, farmland cooperatives are also starting to make a comeback. As a recent Civil Eats piece notes, "in a cooperative, farmers can pool financial resources and strengths, thus spreading out costs and drawing from a range of work experience. This means more adaptability and resiliency–two things any farmer will tell you are essential" (Jolley, 2018). Such cooperatives were common among Black farmers in the US South during the late 19th century to the 1930s. In the 1960s, the Federation of Southern Cooperatives began reviving this tradition (White, 2018). More recently, New Roots Cooperative Farm in Maine, Intervale Community Farm in Vermont, and Solidarity Farm in California, are all variants on the farmland cooperative model. Linking cooperative farms with additional programs, such as food, community, or education hubs, may offer even more stability and opportunity, potentially helping small investments achieve greater reach. This larger-scale cooperative model has been demonstrated by centers such as the Intervale Center and the Stone Barns Center for Food and Agriculture. Meanwhile, Soul Fire Farm in upstate New York has built a map to help Black, Latinx, Indigenous, and Asian growers identify where reparations of land could be made to enable them to become secure (Penniman, 2018). The organization is also working to create a regional Land Trust to support land sovereignty for farmers of color. As with public policies, these efforts offer the framework for a path forward, but only scratch the surface of what is needed.

Ensuring that land stays as farmland and is made readily available and affordable to farmers is important, but not enough to ensure that new entry farmers benefit from land access and can farm sustainably. This is where gaps can be filled by other initiatives, such as measures that help build healthy soils and conserve water (e.g., USDA conservation programs, the California Sustainable Groundwater Management Act, the Dry Farming Collaborative, Black Mesa Water Coalition). Addressing other barriers, such as lack of access to capital, credit, insurance, and markets, are also essential. Given the multitude of interconnected needs, building a network of networks across all these asset areas is critical to ensure sufficient and efficient deployment of wraparound support and resources.

Case 2. Access to equipment: a case for solutions in the sharing economy

According to the agricultural census (USDA NASS, 2019a), US farmers own about $272.3 billion in machinery and equipment, nearly half of that on oilseed and grain farms, most of those in the Midwest, and most of them quite large. Farm equipment thus closely mirrors the pattern of general farm consolidation described above, with just 5 percent of US farms holding nearly 50 percent of all machinery assets (Koenig, 2016). It is challenging for any farmer to purchase agricultural machinery and equipment, when the price tag easily ranges into the hundreds of thousands of dollars. This barrier can be insurmountable for new sustainable farmers.

Some public policies have contributed to addressing this barrier with direct subsidies for equipment or very low interest loans. For example, nationwide Farm Service Agency (FSA) Microloans or other FSA loans can be used for equipment, and at the state level, the Minnesota Beginning Farmer Incentive Credit helps farmers finance these essential tools. Civil society financing, such as crowdsourced loans through Kiva Zip, can also put farmers in a better position to purchase the equipment they need.

However, the more innovative and promising solutions to address this barrier may stem from the long history of shared farm machinery in North America. Recently, Canadians have actively founded and revitalized farm

machinery cooperatives, taking advantage of digital tools and social media to facilitate equipment use (Harris and Fulton, 2000). In Québec alone, some 60 "CUMAs" (Coopératives d'Utilisation de Matériel Agricole) enroll nearly 2000 farm operations, making available more than $20 million (CAN) worth of equipment (Portrait des CUMA au Québec, Gouvernement du Québec, 2018). Similar solutions have emerged in the US, including Maine's Shared-Use Farm Equipment Program and the industry group MachineryLink, which became known briefly as the Uber of farm equipment, connecting farmers with vital equipment to growers in need. Meanwhile, many farmers who may not be sharing physical equipment are nonetheless sharing designs and instructions to build and modify tools through open source networks such as Farmhack.

While some policies and programs exist to alleviate the barrier of equipment costs, many more are needed and a fully-fledged network needs to be nurtured. Privately organized groups can take on a major piece of this challenge, but public policy is necessary to provide rules for setting up cooperatives, facilitate material and financial transactions, and incentivize participation in cooperative institutions. Finally, as with land access barriers, equipment barriers are closely linked to the many other barriers facing new farmers. Thus, although it is helpful to address solutions specific to these unique challenges, developing a wraparound web of policy supports – through forming a network of networks – is imperative.

Building infrastructure for polycentric governance

New farmers require access to a wide range of resources and services, each of which can and must be provided through targeted policies and programs within networks. However, as discussed above, a network of networks — governed polycentrically — is also needed. Such a comprehensive approach can meet farmer needs that balkanized targeted efforts are less likely to facilitate. We discuss below how to begin building this network of networks; here, we note some emerging examples of the coordinating infrastructure and initiatives that could eventually undergird such a governed network. These interventions can already help identify gaps, connect actors, share knowledge, and build equity and justice into existing measures.

There are currently a few overarching initiatives that carry out this coordinating function. At the national level, the USDA has created a New Farmers website and Discovery Tool, which cohesively summarizes federal resources available for new entry producers. Concurrently, the National Young Farmers Coalition has emerged as an NGO that analyzes the experiences and challenges of young farmers, increases their visibility, and advocates for supportive national policies. Local chapters of this coalition offer community, professional networks, and support at the regional and state level. Meanwhile, another NGO, the HEAL Food Alliance, is working to build new governance networks and policy platforms for food justice. HEAL defines itself as "a multi-sector, multi-racial coalition building collective power to transform our food and farm systems."

While comprehensive support for beginning or sustainable farmers is growing, a limited subset of efforts explicitly address the social barriers that continue to prevent transformative change. A leader in this regard, the California Farmer Equity Act of 2017 represents an essential breakthrough. This state law builds on a national-level policy, Section 2501 of the Food, Agriculture, Conservation, and Trade Act of 1990, which defines "socially disadvantaged" groups and enables government programs to target needs of these groups (USDA 2010). Following the implementation of this national law, the California law requires the California Department of Food and Agriculture (CDFA) to ensure inclusion of socially disadvantaged farmers and ranchers "in the development, adoption, implementation, and enforcement of food and agriculture laws, regulations, and policies and programs." The law also creates a staff position within CDFA to review state policies for their inclusivity and report on progress by 2020. This law could be expanded and replicated in other states as well as extended at the federal level. If fully implemented, the law will help reduce discrimination against farmers of color in securing access to land, credit, and extension assistance. While there is much room for progress when it comes to creating overarching initiatives, expanding and improving on these existing examples is an important step.

A policy vision for a polycentric network: when more farmers is a sign of progress

Encouragingly, legislators and civil society groups across the US have recently taken more interest in helping new sustainable farmers enter agriculture. Several bills focused on new farmers were introduced during the 2018 Congressional session, such as the Beginning Farmer and Rancher Opportunity Act (HR4316) and the Young and Beginning Farmers Act (HR201). While the 2018 Farm Bill faced long delays due to political differences over nutrition assistance and conservation policies, Congress enacted a final version in mid-December that included many benefits for young farmers, including increased permanent funding for a new "Farming Opportunities, Training, and Outreach Program" that combines the BFRDP and the aforementioned 2501 Program, which targets socially disadvantaged farmers. Other positive outcomes of this Farm Bill include boosts for local food programs, improvements to conservation programs, amendments that support owners of heirs property, and strengthened programs for protecting farmland and making it more accessible to new farmers (including an expansion of the Transition Incentives Program).

Such federal initiatives can help fill gaps in assistance for new sustainable farmers and strengthen specific networks across the country. Nonetheless, these measures still do not amount to wraparound support, nor do they represent a social and cultural commitment to valuing the work of farming. Just a few months after this Farm Bill was passed, Nobel Prize winning-economist and *New York Times* columnist Paul Krugman tweeted that "the fundamental fact is that we no longer need many farmers… The average farmer produces 24 × times as much as in 1948" (Krugman, 2019). Clearly, the technology-intensive

productivity that Krugman points to as success has also created vast environmental and social externalities, such as the Gulf of Mexico dead zone, widespread glyphosate contamination, and a global collapse in insect biodiversity – all without translating 24-fold increases in yields into a food secure country.

Building out an ecological agriculture to curb these environmental and human health crises can only happen if we successfully recruit thousands of new farmers to put knowledge-intensive techniques into practice. But for many like Krugman, farming remains stigmatized as a relic – a doomed profession beyond rescue. Hence, in addition to assets, access, and assistance delivered through polycentric networks, we need to transform such cultural attitudes about rurality. Farming must come to be seen as meaningful work (Timmerman and Felix 2015), with revitalized rural economies acknowledged as a powerful way to provide employment to a large number of Americans. Contrary to Krugman's arguments, we need more farmers – not fewer – to tackle the converging crises of climate change, food insecurity, and an industrial agricultural system that is manifestly unsustainable over the long-term.

The Green New Deal proposal put forward by Congresswoman Alexandria Ocasio-Cortez and Senator Edward Markey in late 2018 provides one possible way to anchor rural revitalization in system-wide shifts. Much as President Roosevelt's New Deal of the 1930s spawned massive public investments in infrastructure and public works, the proposed Green New Deal puts public spending at the center of a bold pact to decarbonize the US economy, repair and upgrade infrastructure, and provide a federal jobs guarantee. In line with the vision of polycentrism laid out in this paper, the GND calls for:

> ...providing and leveraging, in a way that ensures that the public receives appropriate ownership stakes and returns on investment, adequate capital (including through community grants, public banks, and other public financing), technical expertise, supporting policies, and other forms of assistance to communities, organizations, Federal, State, and local government agencies, and businesses working on the Green New Deal mobilization (GND 2018, p10).

Crucially, this wraparound vision is anchored in a concept of justice – with three of the five goals in the resolution focused on frontline and vulnerable communities – and a process of consultation, collaboration, and partnership that puts such communities at the center of decision-making in developing the Green New Deal.

As a resolution, the Green New Deal is notably thin on specifics about agriculture. But its overarching plans for just transitions and public investments have provided the catalyst for others to begin sketching those details. In early 2019, farmer unions, civil society organizations, and coalitions of scientists began developing proposals for integrating food and agriculture into the Green New Deal – including what it might look like and whom it should include. New entry sustainable farming and a revitalized rural workforce are at the center of several proposals, which we see as an auspicious sign for the way in which the Green New Deal is likely to develop.

The Green New Deal could do two important things to support new entry sustainable farmers. First, it could provide an opening for deeper structural change through an ensemble of policies that would reposition rural areas and farming as central to the nation's future. **Table 3** summarizes some

Table 3: Aspirational policy opportunities. Within each category of new entry sustainable farmer needs, opportunities exist for policies that could drive transformational change by improving access, assets, and assistance. Here we summarize ideas that have emerged within each need category within the US or other contexts. DOI: https://doi.org/10.1525/elementa.356.t3

Need Category	Select Aspirational Policy Opportunities
Comprehensive	Sharing economy (i.e., pooling labor, equipment, etc.), food commons (e.g., land, finance, facilities)
Water	Protect farmers' water rights, incentivize conservation (urban use, drought tolerant agriculture), address "use-it-or-lose it" water policy, promote water-sharing
Land	Establish right to land, stipulate land performs a social function
Markets	Create national food policy to equitably establish and coordinate markets, ensure broadband access for all, implement parity pricing and/or supply management, enable alternative certification models (e.g., farmer-verified)
Capital, credit & Insurance	Loan forgiveness, support public banks, align crop insurance with stewardship, establish single-payer health care
Equipment	Incentivize shared, sustainably-designed equipment; establish right to repair
Labor	Reform immigration, create a prisoner-to-farmer pipeline, invest in infrastructure to revitalize agricultural communities
Technical Assistance & Training	Develop affordable education and apprenticeships and more robust participatory research partnerships between land grant universities and ecological farmers (e.g. University of Vermont Participatory Action Research Program, newly appointed UCCE Specialist in Organic Production, University of California)

examples. One vital change would be to move to a rights-based policy approach across the asset areas. Farmers, for example, could be given the legal right to acquire or lease land for their productive work – as is happening under Scotland's new human rights-based land regime (Shields 2018). Protecting farmers' water rights, promoting water conservation and water sharing (as opposed to today's use-it-or-lose-it policies), and committing to investments in drought-tolerant agriculture would protect farmers and water resources. Developing food policies from local to national levels could play a role in creating equitable market access, and could similarly be anchored in a right to food (De Schutter 2010). Building on the model being piloted by the Food Commons in Fresno, California, food could be treated as a commons, in which production and consumption would be understood in terms of shared resources instead of a commodity market (Vivero-Pol et al., 2018).

Secondly, the Green New Deal could begin building the infrastructure and diffusion mechanisms needed for a polycentric "network of networks" to function effectively. One example is collaboration platforms, namely "organizations or programs with dedicated competencies and resources for facilitating the creation, adaptation and success of multiple or ongoing collaborative projects or networks" (Ansell and Gash, 2017, p. 16). A hypothetical case would be a statewide commission that works to nurture urban-rural agricultural zones. Such a commission could fund, train, and communicate with networks of governments, NGOs, and communities in counties across California to design and implement their own location-specific plans.

Historian Jess Gilbert has recently uncovered that we have done this before. Such collaboration platforms and networks, if not by these names, supported agrarian reform in the "old" New Deal. By the early 1940s, 75 percent of rural counties and over 200,000 of farm community members were involved in collaborative land-use planning with bureaucrats and scientists, helping set priorities for spending federal funds to solve their most-pressing local problems (Gilbert, 2017). Local councils were created to support such activities – and were connected to each other via regional channels. Gilbert's history reminds us not only that agriculture was central to the original New Deal, but that the "moonshots" of today have strong precedents.

Conclusions

Sustainable agriculture is central to the future, in the US and beyond. Building sustainable food systems across the country can help buffer against climate change and other environmental disruptions, renew declining rural and urban areas, and provide employment. Often motivated by a desire to help steward land and cultural heritage, a sizable number of people would like to become sustainable farmers. But as we have shown, new sustainable farmers face a harsh, unwelcoming reality due to persistent barriers to entry. New farmers struggle to build enough assets to thrive in a world where tremendous pressures exist for farms to grow much bigger in size, reduce production costs, and specialize in a very few crops or animals. Such challenges are compounded by historical legacies of racial and gender discrimination and dispossession of Native American lands, making it even harder for farmers of color to gain the access to assets they need.

Understanding the barriers to entry and the deep socio-economic inequalities that divide farmers is an important step toward formulating policy interventions to support new sustainable farmers. Many promising policies and civil society initiatives have blossomed across the country, signaling greater awareness of the need to better support new farmers. Nonetheless, these developments are frequently fragmented, under-resourced, and subject to local and state neglect, despite steadily growing support. The next step should be to work toward what we have described as a "wraparound" approach that aims to envelop new sustainable farmers in a web of many mutually reinforcing supports that allow them to become securely established. To deliver these supports, polycentric networks of government, civil society, and industry actors will need to be nurtured via innovative policymaking that sets the rules and provides many of the resources. Even if a Green New Deal legislative plan does not materialize, much can be done at all levels of government and society to work toward the aspirational ideas we have proposed, while also strengthening the existing new entry farmer policy framework. One day, new sustainable farmers may become agrarian elders, passing their wisdom on to the next generation.

Notes

[1] The USDA has changed its methodology of measuring farmers in the Agricultural Census. Starting in 2012, the USDA began asking for data on all producers involved in making farm decisions (up to a total of 4 people), as well as principal operators. As a result, the numbers of people involved in farm decisions have increased markedly. For example, while there are 2.01 million farms, there are 3.4 million producers. This change has meant that the proportion of women recognized as decision-makers of some type has expanded greatly from 2012 to 2017 (from 0.97 million out of 3.18 million to 1.23 million out of 3.4 million, or a rise of 26 percent. (USDA NASS, 2019a).

[2] The 2017 Agricultural Census (USDA NASS, 2019a) found that of 908,749 total new and beginning producers, 861,491 are white (the USDA includes 40,858 Latinx in this group), 12,884 are Black, 8,683 are Asian, and 15,347 are Native American or Alaska indigenous. The racial disparities for new and beginning farmers are thus even worse than for all farmers.

[3] Further underlining income disparities, the 2017 Agricultural Census also found that farms selling more than $5 million accounted for 35 percent of sales even though they were only 1 percent of all farms. By contrast, farms selling less than $250,000 counted for only 8 percent of sales and 12 percent of all farms. Farms selling less than $50,000 counted for only 3% of sales but were 76 percent of all farms (USDA NASS, 2019a).

[4] The doctrine of parity refers to a government policy, first introduced in the early 1930s, that farm profitability should be maintained at a level comparable to

the period between 1909 and 1914 – supposedly an era of high farmer prosperity. In other words, the aim was to uplift farmer living standards by setting price controls such that farmers would be guaranteed a certain income level.

[5] As opposed to years operating on "present farm", a figure the USDA also tracks.

[6] In this table, we combine data from the 2017 and 2012 USDA Agricultural Censuses for "Selected Producer Characteristics" (Table 52) and "Selected Operator Characteristics" (Table 55), respectively. Because the year-to-year categories are non-identical in these tables, we made the following two assumptions: (1) less than 2 years + 3 to 4 years ≈ less than 5 years; (2) 5 to 9 years ≈ 6 to 10 years.

[7] To allow comparison of 2017 Agricultural Census data with 2012 and prior years, the census results contain a "bridging table" that compares a single "primary producer" per farm (determined through a complex statistical edit) with the "principal operator" of 2012.

[8] See: https://www.farmtoconsumer.org/cow-shares/.

[9] The extent and value of irrigation is even more pronounced in Western states where 71 percent of harvested cropland is irrigated, and 71 percent of farm sales are from irrigated farms.

[10] But up to 40 percent of California's irrigated crops are high-value perennials (Mount et al., 2015).

[11] https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/csp/.

[12] https://www.cdfa.ca.gov/oefi/sweep/.

[13] https://www.capitalpress.com/state/oregon/oregon-state-s-dry-farming-project-hosts-field-days-in/article_2229a1d6-36cb-5700-b5d3-0ff30b260fb1.html.

[14] https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management.

[15] https://blackmesawatercoalition.org/.

[16] https://www.fsa.usda.gov/programs-and-services/conservation-programs/transition-incentives/index.

[17] https://www.mda.state.mn.us/bftc.

[18] https://silt.org/.

[19] https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180AB1348.

[20] https://agrariantrust.org/faithlands/.

[21] http://sustainableagriculture.net/blog/2018-farm-bill-local-agriculture-market-program/.

[22] https://www.cdfa.ca.gov/oefi/healthysoils/.

[23] https://www.easternmarket.org/.

[24] https://www.rd.usda.gov/programs-services/value-added-producer-grants.

[25] https://goodfoodpurchasing.org/.

[26] https://www.rma.usda.gov/Fact-Sheets/National-Fact-Sheets/Whole-Farm-Revenue-Protection-2018.

[27] https://www.hesc.ny.gov/pay-for-college/financial-aid/types-of-financial-aid/nys-grants-scholarships-awards/new-york-state-young-farmers-loan-forgiveness-incentive-program.html.

[28] http://www.farmersguild.org/kiva-zip-0-interest-loans-for-farmers.html.

[29] https://www.fsa.usda.gov/programs-and-services/disaster-assistance-program/noninsured-crop-disaster-assistance/index.

[30] https://www.californiafarmlink.org/.

[31] https://www.fsa.usda.gov/programs-and-services/farm-loan-programs/microloans/index.

[32] https://www.colorado.gov/pacific/agmain/agricultural-workforce-development-program.

[33] http://www.mofga.org/Programs/Education/Shared-Equipment.

[34] https://www.fsa.usda.gov/Internet/FSA_File/socially_disadvantaged.pdf.

[35] https://farmhack.org/tools.

[36] http://sustainableagriculture.net/blog/closer-look-foto-2018-farmbill/.

[37] https://nifa.usda.gov/cooperative-extension-system.

[38] https://farmcommons.org/.

[39] http://sustainableagriculture.net/blog/fy2017-2501-grants/.

[40] http://plantingjustice.org/.

[41] In the child protective services literature, 'wraparound' has come to mean a "comprehensive, holistic, and youth and family-driven way of responding when children or youth experience serious mental health or behavioral challenges." Policy-makers and academics explain: "Back then, the kinds of intensive and helpful services and supports that children and families needed were often simply not available in their communities. And as for the services that *were* available, they were often focused on what the systems or providers wanted families and children to do, and not focused on what children and families needed in order to thrive. This meant that children and families would be involved with multiple systems and providers, with each one developing a separate plan telling the child and family what to do. Not surprisingly, outcomes from this situation were not good. Many children ended up placed in residential treatment far away from their families and communities, often for very long periods of time. After being out of home, it was hard for children to come back and do well in their home communities and schools." See: https://nwi.pdx.edu/wraparound-basics/.

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