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The Progressive Agriculture Index: Assessing the advancement of agri-food systems

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Abstract
Indicators and metric systems are crucial tools in efforts to reach societal objectives, and these systems are being employed increasingly in initiatives to improve the environmental, economic, and social sustainability of agri-food systems. Indicators can help clarify values and objectives, providing assessment criteria useful for tracking movement toward or away from targets. Unfortunately, the application of indicators and metrics to agricultural

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systems has been hindered by conflicting definitions of agricultural sustainability and progress, leading to metrics that lack a holistic consideration of social, economic, and environmental factors. To address this shortcoming, we argue for a definition of progressive agriculture that includes all three of the abovementioned factors, stressing the need for multidimensional improvements in the impact of agri-food systems. Our proposed Progressive Agriculture Index (PAI) integrates data from the U.S. Census of Agriculture, the U.S. Census, and other databases to assess nine variables at the county level for the contiguous United States. Including data from both 2007 and 2012 permits analysis of time trends along with regional and county-level trends in individual and aggregate measures of progressivity. By ranking counties within their Farm Resource Regions (as defined by the U.S. Department of Agriculture [USDA] Economic Research Service [ERS]), as well as within their Urban Influence Categories, the PAI also makes it possible to compare counties with similar socioeconomic and environmental contexts. Given the important goal of improving social, economic, and environmental conditions in concert, we present this index to draw attention back to the often-neglected social facets of progressivity and thus contribute to advancing more integrated, participatory approaches to measuring progress in agri-food systems.

Keywords
Agriculture, Sustainability, Progressive, Economics, Index, Indicator, Metrics, Environmental, Social

Introduction
Over the last ten thousand years, agriculture has significantly shaped the development of human society, in part by enabling a growing human population. However, agriculture has a checkered historical record of social and ecological impacts (see, e.g., Carter & Dale, 1974; Walker, 2004; Worster, 1979). A growing suite of social, economic, and environmental consequences of contemporary agricultural practices and organizational forms are argued to be hindering progress toward a more sustainable and just future for people and the planet (Gliessman, 2015; Kiley-Worthington, 1980; Pretty, 2008; Tilman, 1999). In light of these problems, there have been a number of calls to pursue a "better" agriculture, namely, one that does not sacrifice human and ecological well-being for economic efficiency and maximum production at all costs (Allen, Van Dusen, Lundy, & Gliessman, 1991; Gliessman, 2015, ; Pretty, 2008). Yet the question remains: what exactly does "better" look like, and how do we get there?

The First Challenge: What Is Better?
Unfortunately, the task of agreeing upon a vision of a "better" agri-food system is complicated by the numerous and often contradictory ideas advanced by different sectors of society (Bell & Morse, 2008; Binder, Feola & Steinberger, 2010; Bockstaller, Guichard, Keichinger, Girardin, Galan, & Gaillarde, 2009; de Olde et al., 2016; National Research Council [NRC], 1999). One of the descriptors used most often to identify features of a more desirable agricultural model is "sustainability." In the past, there has often been conflict over whether sustainability encompasses solely environmental concerns or whether it also includes social and economic factors. There has also been conflict over whether it should be defined as an approach or a property of systems (Elsaesser et al., 2012; Hansen, 1996). Since the 1987 Brundtland Commission,[1] the definition of sustainability has commonly included social and economic factors, but the degree to which these elements have been integrated into metrics claiming to measure sustainability varies greatly (de Olde et al., 2016). Some authors have suggested that the lack of an agreed-upon conception currently limits the usefulness of any concept of "agricultural sustainability"; however, this has inhibited, but not prevented, the development and application of the term by a range of important institutions (Blowers, Boersema, & Martin 2012; Hansen, 1996).

[1] The Brundtland Commission was established by the UN in the 1980s to bring countries together with the purpose of addressing human-environment relations. The commission published a report entitled "Our Common Future," which discussed the new term "sustainable development" and establishing the concept of the three pillars of sustainability (environment, society, and economy).

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Other terms related to the development of an improved agricultural system have also been proposed; this includes the idea of "resilience" advanced by Worstell and Green (2017) as a perspective on agricultural sustainability that supports adaptability and continued innovation stemming from local self-organization. The proliferation of terms like "resiliency" and others such as "biodynamic" agriculture moves forward the discussion of a "better" agriculture; however, it may further complicate efforts to conceptualize and agree upon the attributes of an agriculture that would be more beneficial for both people and the planet. Thus, we introduce a new term rather than adding to the many labels currently in use. In our work we have chosen to use the word "progressive" to characterize a multidimensional vision of agricultural systems that fosters the betterment of social and economic conditions in addition to the traditional focus on environmental conditions associated with sustainability. Our vision therefore parallels the goals outlined in Agenda 21 of the United Nations Conference on Environment and Development (UNCED) (Allen et al., 1991; Binder & Feola, 2012; Binder et al., 2010; Christen & O'Halloranetholtz, 2002; Clayton, 2016; Gliessman, 2015; UNCED, 1992). The breakdown of our definition of progressive agriculture into operationalized variables is presented in the Methodology section. Although different stakeholders may emphasize different elements of progressivity according to their own beliefs, values, and interests, achieving goals of social justice, environmental sustainability, and economic viability will require major shifts in agricultural practice and policy (Allen et al., 1991; Bell & Morse, 2008; Gliessman, 2015; Kiley-Worthington, 1980; Pretty, 2008; Tilman, 1999).

The Second Challenge: Measuring Progress

Developing multidimensional indicators for measuring changes in progressive agricultural arrangements and practices is important for understanding current conditions and trends related to the goals under this new vision of progress (Bell & Morse, 2008; Bockstaller, Feschet, & Angevin, 2015; de Olde et al., 2016). Binder, Feola, and Steinberger (2010) list indicators as only one of several methods for assessing progress in agriculture; however, the use of these measurement tools in similar movements, such as sustainable development or corporate social justice, illustrates their usefulness in defining objectives and steering transformative efforts (Christen & O'Halloranetholtz, 2002; de Olde et al., 2016; NRC, 1999).

Appropriate standards and metrics can help social actors in a wide range of institutions clarify their values and desired outcomes; de Olde et al. (2016) assert that this process can be one of "joint learning and knowledge development" (p. 11) that enhances the ability to accept and reach a consensus on objectives. Indicators can provide baseline measures against which we can track progress and gauge our movement toward or away from goals, informing decision-making, and focusing attention on the areas in which performance is not advancing as quickly (McRae, Smith, & Gregorich, 2000; NRC, 1999).

Given the benefits provided by metrics and indicators, it is not surprising that there has been a recent growth in the number of indicator systems available. While some assert that this development has plateaued, it can be argued that indicators for progress in agriculture have been improving and becoming more common over the past decades (Clayton, 2016; de Olde et al., 2016; Marchand, Debruyne, Triste, Gerrard, Padel, & Lauwers, 2014). We do not assert that this process is complete, as current metrics are still far from the ideal agricultural assessment described by Gliessman (2015, pp. 292–293). His proposed indicators are categorized into soil resources, hydrological factors, biotic factors, ecosystem level characteristics, and socioeconomic parameters.

Gliessman's (2015) goal was to highlight the environmental, social, and economic factors that require urgent attention if agriculture is to be developed to its fullest potential. While Gliessman provides quantitative metrics for biophysical factors such as soil organic matter, his assessment of the socio-economic elements of progressivity, including social justice, remains qualitative. However, quantitative metrics are easier to measure and track than qualitative ones, and may be more readily accepted by a variety of social actors. Since moving forward on goals for social and economic equality has great potential to produce substantial benefits for farm-level workers, communities, animal welfare, and ecosystems, it is important to apply quantitative metrics for these areas, as well (Hansen, 1996). This sometimes requires the use of indicators with known flaws, including difficulties in implementation, low influence on policy, failure to consider the interaction between indicators, conflicting goals, and inadequate data. However, several authors argue that the most troubling limitation present in many indicator systems is their neglect of social elements in favor of ecological or economic dimensions (Binder & Feola, 2012; Binder et al., 2010; McRae et al., 2000; Rigby & Caceres, 1997).

Despite the shortcomings of many indicators, their potential usefulness and the need to illuminate change has led to continued development of metrics intended to quantify movement toward a "better" agricultural system. Below we offer an overview of the literature on existing indicators to provide context for our response to current assessments with the development of a Progressive Agriculture Index (PAI).

Current Efforts and Challenges

We explore the challenges of creating metric systems that are both inclusive and integrated, beginning with two national-level indicators. We then examine private-sector efforts and highlight the general exclusion of social variables in existing systems. Next, we discuss the importance of using participatory development methods to create indicator systems that are responsive to the priorities and visions of community members, before exploring the difficulties these methods can create as developers attempt to balance stakeholder engagement and specificity with scale and adaptability. We review some of the various classification schemes for existing indicators, followed by an examination of the extreme diversity of purposes, methods, and perspectives behind existing systems. Finally, we reiterate the suggestion of many authors that continuing the development and assessment of indicators are essential, expressing optimism that the many resulting systems will complement one another and serve their intended purposes in a variety of contexts.

Integration and the National Level

At the national level, the USDA's Census of Agriculture includes several measures that pertain to the development of progressive agriculture under our definition (USDA National Agricultural Statistics Service [NASS], 2007). This includes measures of environmental impacts, such as conservation tillage practices, as well as those intended to capture socio-economic conditions, such as the development of community supported agriculture operations (CSAs) (USDA NASS, 2012). However, these metrics are not integrated into a cohesive whole, limiting their utility as an indicator system.

A similar government-affiliated system is the Agri-Environmental Indicator Project pioneered by Agriculture and Agri-Food Canada (AAFC), which uses a driving force–outcome–response model and considers farm management, soil, water, air, biodiversity, and production intensity (McRae et al., 2000). While this indicator system is more integrative than the isolated variables in the USDA's Census of Agriculture, it is limited by gaps in data availability and quality as well as geographic limitations, all of which imply the need for caution in interpreting the resulting measurements and in making comparisons in time and space (McRae et al., 2000). Most importantly, social factors remain largely absent from this metrics framework.

The Private Sector and Social Variables

The need for assessment models more suited to multidimensional yet integrated analyses of the state of agriculture has led actors outside the public sphere to create their own indicator systems. Recent efforts to track agricultural progress have been focused on the concept of sustainability; they have been largely private sector or multistakeholder initiatives (MSIs) that often work with industry to develop sustainability reports and scorecards (Konefal, Hatanaka, & Constance, 2014; Vorley, 2001). One example is the assessment created by Field to Market, which includes several environmental and socio-economic variables (Field to Market: The Alliance for Sustainable Agriculture, 2016). Yet with the exception of a worker-safety variable, the system does not track progress toward "worthwhile social goals" (Gliessman, 2015, pp. 292–293) such as racial and gender equality or equity in the distribution of returns. Furthermore, the indicator is limited to the national scale and thus provides no analyses of local-level sustainability.

The AAFC and Field to Market projects support Konefal, Hatanaka, and Constance's (2014) argument that the movement from public to private and MSI indicators has been accompanied by a shift toward defining and measuring sustainability in terms of increased resource-use efficiency. Konefal et al. (2014) argue that this approach diminishes the potential for indicators developed by private-sector entities to advance a more beneficial model of agriculture, a worry shared by many others. Vorley (2001) argues that private-sector indicators are part of buyer-driven supply chains, and may become tools for creating specialized new markets and increased profit opportunities rather than true measures of progress. Similarly, Nelson and Tallontire (2014) call attention to the lack of consultation with smallholders, laborers, and their communities. The authors describe MSIs as narrowly focused, possibly limiting the ability of agricultural communities to even participate in the definition and advancement of agriculture that benefits communities in the social, economic, and environmental spheres (Nelson & Tallontire, 2014).

The Importance of Participatory Development

Concerns such as this have led some to question the merits of allowing one system or its creators to define and measure progress toward a more beneficial agriculture. As de Olde et al. (2016) assert, asking whether a particular definition really helps to unify and guide transformation is important, as is asking whether it leads to the exclusion of certain voices or perspectives. Addressing this dilemma requires active participation by representatives of the many sectors of society that will be affected by the design and use of a particular indicator, from farmers to academics to policy-makers. Several authors argue that metric systems must be designed and tested by the scientific community in collaboration with other actors in society to support a participatory definition of progress and address existing inequities (Bell & Morse, 2008; de Olde et al., 2016; McRae et al., 2000). Open dialogue can facilitate acceptance of a "new guiding vision" of progressive agriculture that addresses the complexities of ecological, social, and economic problems as they are truly experienced by people on the ground (Binder et al., 2010; Christen & O'Halloranetholtz, 2002).

Indeed, many authors hold that participatory and transdisciplinary research efforts are crucial to creating legitimate and effective indicator systems (Bell & Morse, 2008; de Olde et al., 2016; Gasparatos, El-Haram, & Horner, 2008; Korhonen, 2004; Ravetz, 1999; Thompson Klein, Grossenbacher-Mansuy, Haberli, Bill, Scholz, & Welti, 2000). After analyzing seven recently developed indicators, Binder, Feola, and Steinberger (2010) concluded that bottom-up, integrated methods of constructing agricultural assessments are more suited to creating indicator systems capable of illuminating socio-economic factors, as compared to top-down initiatives that lack stakeholder involvement and may neglect social issues. Other authors suggest that indicators constructed to measure linked environmental, social, and economic factors need to incorporate expert opinion in addition to scientific analyses, especially when the required data are limited, expensive, or time-consuming to collect.

Incorporating expert opinion into the assessment of agricultural progress requires the use of multicriteria analysis (MCA) or multicriteria decision aids (MCDA), as well as further validation of the strength of these models and of stakeholder trust in their results (Kamali, Borges, Meuwissen, Boer, & Lansink, 2017; Sadok et al., 2009). These tools should embody a broader range of contexts and stakeholder perspectives, ensure transparency, and increase the incorporation of informal knowledge into the development of indicators that can facilitate the multidimensional assessment of progressivity (Sadok et al., 2009).

Participatory Methods: Balancing Scale, Specificity, and Adaptability

Suitable participatory models require involvement from communities and experts, each of which will contribute unique perspectives to the design of indicators (Binder & Feola, 2012; Binder, Feola & Steinberger, 2010; Gasparatos, El-Haram, &

Horner, 2009; Pischke & Cashmore, 2006). At smaller spatial scales this can result in greater specificity, making the resulting indicators suited to the assessment of progress in unique local contexts (Binder, Feola, & Steinberger, 2010; de Olde et al., 2016; Gasso, Oudshoorn, de Olde, & Sørensen, 2015). Yet it can be difficult to translate this degree of engagement into the creation of national-level metrics that provide useful large-scale benchmarking and comparability across regions (Binder, Feola & Steinberger, 2010). Balancing local and national, top-down and bottom-up assessments will continue to challenge those developing indicators to provide an integrated analysis of social, economic, and environmental progress—one that accounts for stakeholder views while maintaining applicability at broader spatial and administrative levels.

Some recent initiatives were devised to overcome these obstacles and combine national-level indicators with participatory development models. An example of one of these initiatives is the LEO-4000 "American National Sustainable Agriculture Standard." Produced by the Leonardo Academy—a 501(c)(3) standards developer accredited by the American National Institute of Standards (ANSI)—these non-proprietary indicators resulted from seven years of stakeholder input and public engagement. They encompass measures of economic prosperity, social responsibility, and environmental stewardship (Hatanaka & Konefal, 2017). The difficulty of achieving effective stakeholder participation at this scale is illustrated by the fact that the LEO-4000's development was disrupted when representatives from several agri-food industries and corporations walked out on the discussions and issued a public statement claiming bias (Hatanaka & Konefal, 2017). Despite these setbacks and the challenges of implementation, the LEO-4000 achieved ANSI certification and may contribute to the quantification and characterization of agricultural progressivity.

Classifying Indicator Systems

Even as initiatives like ANSI-LEO-4000 approach the goal of an integrated conception of indicators described in the literature, many problems remain to be addressed in the development of metric systems. While the process of developing and refining indicator systems has advanced as the number and variety of indicators has grown, few such systems have been seen as truly successful, practical, and comprehensive (Marchand et al., 2014). Furthermore, the many approaches to measuring progress in agricultural systems diverge in their spatial and temporal scales as well as in the number of variables they include; this variation is the result of contrasts in the underlying ideas of "progress" and the purpose behind each of the indicators (Bell & Morse, 2008; Christen & O'Halloranetholtz, 2002; de Olde et al., 2016). Finally, the goals of particular developers influence the characteristics of their indicator systems; thus, the outcomes will differ according to such goals (de Ridder, Turnpenny, Nilsson, & von Raggamby, 2007). Therefore, Christen and O'Halloranetholtz (2002) argue that this great variability necessitates careful classification of different metric systems to avoid misinterpreting or inappropriately applying an indicator.

Marchand et al. (2014) agree with this argument and distinguish between two types of indicators: (1) "Rapid Sustainability Assessments" and (2) "Full Sustainability Assessments." Binder, Feola, and Steinberger (2010) provide a more detailed classification framework. They describe not only a method for classifying indicators, but also a model for assessing the diverse development and implementation processes employed in various indicator systems. They categorize indicators based on what the authors term the "normative" aspect of indicator systems, which is complemented by procedural and systemic elements as well.

Diversity in Purpose and Structure of Indicator Systems

Although differences among indicator systems may make classification difficult, such variation provides elements to adapt indicators for particular contexts and purposes. No single approach is applicable to all regions, purposes, or situations; thus, the diverse variety indicators in development may need to be combined in ways that complement one another's strengths and limits (de Ridder et al., 2007). The task of choosing specific indicators to incorporate into an assessment system carries with it as many difficulties as does the agreement on a vision of progressive agriculture (Bell & Morse, 2008; de Olde et al., 2016; Gasparatos, El-Haram, & Horner, 2009; Korhonen, 2004; Ravetz, 1999). However, these same authors also point to the benefits of including diverse perspectives in the development of indicators. De Olde et al. (2010) suggest that the process of creating assessment systems may actually be more important to the success of such systems than the final shape they take. As several authors assert, the integration of a plurality of methods and perspectives will permit the creation of indicators that are both practical and adaptable to local contexts (Gasparatos, El-Haram, & Horner, 2008; Gasso et al., 2015).

Along the same lines, the specific variables included in an indicator system must be relevant to the scale and intent of that system. Christen and O'Halloranetholtz (2002) highlight the importance of balancing an adequate number of variables with the practicality of implementation and measurement. The use of fewer individual metrics or simpler measurement methods may make quantifying and communicating data easier; therefore, it could potentially improve farmer understanding of and engagement in action for reshaping agri-food systems (Marchand et al., 2014). However, it is also true that the more simplified an indicator becomes the less informative it may be (Gasparatos, El-Haram, & Horner, 2008).

To ensure that a metric system provides decision-makers with useful information, evaluators need to consider how the indicator system was developed and its prospects for success in the context of its application. Rossing et al. (2007) contend that many indicators focus simply on filling gaps in knowledge or technology but fail to provide any follow-up or assessment of change time. This is an important limitation to address because the evolution of agri-food systems require the development of effective processes to manage, monitor, and update indicator systems (Rigby & Caceres, 1997).

The Need for Continued Development

Given this need for evolution, it remains crucial to continue developing and improving metric systems. According to Christen and O'Halloranetholtz (2002), it is especially urgent that "different systems be actually implemented and their advantages and disadvantages with regard to the various purposes be analyzed in comparative studies" (p. 8). Multiple coexisting efforts to create indicator systems will foster the exchange of ideas, the comparison and assessment of different approaches to measuring complex socio-economic variables, and the development of more efficient data collection and sharing techniques (Binder, Feola, & Steinberger, 2010).

The Progressive Agriculture Index

To contribute to this adaptation and growth, we have created a Progressive Agriculture Index (PAI). We believe this index addresses some of the shortcomings identified in various indicators currently available. The PAI is intended to measure the degree to which local agricultural systems display properties consistent with conceptions of "progressivity" (see our definition, below) to support communities in making decisions to move toward more progressive mode of agriculture. The system incorporates the most detailed and practically available data present at this time by drawing on the USDA Census of Agriculture, the U.S. Census, and other databases. We combine data from these sources to create a multi-variable analysis of progressivity. The PAI brings social, economic, and environmental goals back into balance, based on objectives identified through a process of grassroots engagement in three New York State counties in various states of urbanization and development.

We think that the PAI will be valuable in permitting comparisons of the state of agriculture both in time and in space. This is something that has not yet been done at the county level for the entire continental United States. Furthermore, it offers a more well-rounded picture of progress that includes environmental, social, and economic factors as well. Some recently developed indicators have taken such a multidimensional approach, for example Green, Worstell, and Canarios's (2017) Sustainability/Resilience Index (SRI). Their system includes a thoughtful array of individual indicators designed to measure the 8 elements of resilience identified by the authors in previous case studies.

Although some of the variables in the SRI are present in our PAI, we believe our proposed index adds to the efforts of the SRI by facilitating comparison between geographically disparate counties with similar demographic and environmental contexts. Finally, the PAI facilitates a comparison between geographically disparate counties with similar demographic and environmental contexts. We believe this will provide communities with information that will aid them in discerning trends in local agri-food systems and in making decisions to advance progressive agriculture.

Methodology

We operationalize "Progressive Agriculture" through specific indicators as a first attempt in an ongoing effort to define and advance a more progressive agricultural system. The importance of developing a more holistic definition of progressivity is evident in the majority of extant indicators, which often focus on environmental factors alone. This narrow perspective has led to persistent and ongoing criticisms of existing measurements of agricultural progressivity, which concentrate almost explicitly on ecological impacts and neglect social outcomes. As Guthman (2004), Allen (2004), Gray (2013), Minkoff-Zern (2017), and many others point out, the sustainable agriculture movement—and emergent food movements more broadly—are focused primarily on the environmental consequences of agricultural production. Additional areas of concern include human health implications of the American diet, animal welfare, food miles, and even questions of taste, craft, and authenticity. Traditionally neglected are broader social concerns such as farm worker protections and wages; racial, ethnic, and gender diversity within agriculture; and economic and political inequity within the food value chain. The need to address these overlooked concerns has been an important consideration in developing the PAI.

The selection of our nine variables was based on a participatory process involving diverse grassroots people organized in focus groups. Participants were given the opportunity to define situations and offer their perspectives and input on topics relevant to agriculture. This input was gathered over two years from informants in three counties within New York State. The three counties were defined as urban-influenced, stable rural, or urbanizing. They were selected to represent conditions present in various New York regions. In each county, the authors worked with community members to develop a shared vision of the future of progressive agriculture. This process was carried out using a modified version of the proprietary process established by Yellow Wood Associates, Inc., of St. Albans, Vermont.

Participating focus group members were selected with the help of local Extension staff. These staff also participated in the conception and implementation of the indicator system. The groups were guided though three separate visioning, goal-setting, and "key leverage indicator" identification sessions, which were open-ended and intended to identify shared goals of grassroots actors in the three counties. The goals highlighted during these sessions focused on achieving the following conditions:

1. Farmers are using land and other natural resources in ways that maintain agricultural productivity and environmental quality.
2. Agriculture maintains a return on investment that makes farming a viable business.
3. The community (government officials and the public) understands and appreciates agricultural businesses, and these values are reflected in government policies and decision-making that supports agricultural viability.
4. Farmers have ready access to and are able to take advantage of good markets for their products.
5. Agriculture has a legal, reliable, well-trained, and highly dedicated workforce, including farmers, agribusiness, and farm labor.

Interestingly, these emerging goals were remarkably similar across the counties, despite geographic and demographic differences. This suggests the existence of a fundamental core of desires and beliefs about the future of agriculture.

Based on the vision articulated by community members during this participatory process, we contend that our concept of Progressive

Agriculture can be viewed as an ideal type as defined by Max Weber (1977). As such, it is a stylized yardstick for assessing social action and institutions, but not a tool for precisely measuring current and future realities. An ideal type can be thought of as a theoretical construct useful in identifying the key elements of a concept, but every instance fitting this concept does not necessarily show all the characteristics associated with the concept. The adjective "ideal" refers to the typology being a mental template, rather than a desired goal or ethical condition. In this light, we define progressive agriculture as a multidimensional, evolving agricultural system that benefits the social, economic, and environmental conditions of communities. Our goal for describing progressive agriculture as an ideal type is to enable others to grasp the concept and to increase practitioners' awareness of its various facets in their localities. At the same time, we believe that achieving more progressive agricultural systems is a worthwhile objective given the benefits that such systems can have for the domains of community, the environment, and local economies. We thus argue that agricultural systems that are more progressive are associated with better social, economic, and environmental conditions in communities. Therefore, we developed several "local agriculture viability indicators" to facilitate an increase in the progressivity of agriculture in communities through the act of measuring its state over time. We see these indicators as proxy measures of progress in each of the three domains, and believe that these measures are highly relevant to the goals identified by community members in the three counties. These indicators have evolved through continued discussion into the components of agricultural progressivity under our definition, as listed here:

- the continual improvement of the well-being of all farm-level workers involved in agricultural production;
- the provision of economic opportunities for diverse populations by minimizing social exclusion;
- broadening the ownership of productive assets and maximizing the retaining of economic value at the farm-level of the sales to final consumers;
- reducing economic concentration in agricultural production;
- enhancing decision-making and control of production at the local farm-level;
- forging links with consumers to support desirable social outcomes; and,
- protecting or improving the natural resource base on which all agricultural production depends.

We chose several proxy measures to represent these facets of progressivity. We wanted to address the need for simplicity and allow any interested governmental unit or other organization in a community to measure and report on them; we also wanted to keep the index accessible by limiting the cost of gathering data. Additionally, the variables were chosen from those with available national datasets because we considered comparison across counties and geographies to be crucial. We acknowledge the potential for these measures to be limited by data lag, inaccuracy, or their proxy nature; however, we also believe that measuring temporal change in the variables is more important than achieving precision at any one time.

To encompass the facets of progressivity articulated above, we included nine variables in the PAI. Our variables include:

1. Percent of farms with female principal operators: a proxy measure of gender equality, social progressivity, and recognition of the centrality of women within progressive agricultural production systems.
2. Percent of farms with non-white principal operators in proportion to the percent of non-white county residents: another measure of social progressivity, diversity, and economic opportunities for minorities.
3. Percent of farms with sales of organic products[2] (including both certified and self-

[2] The authors acknowledge that, due to a change in the definition of organic agriculture employed by the 2007 and 2012 Census of Agriculture, any comparison of organic agriculture over this particular period may not be entirely accurate. However, the

identified organic producers): an indicator of reduced adverse environmental impact (Pimentel, Hepperly, Hanson, Douds, & Seidel, 2005) and potentially of the development of entrepreneurial attitudes.
4. Average wage of farmworkers as a percent of the federal minimum wage: calculated from the "Combined Field and Livestock Worker Wage Rates" published by the USDA's National Agricultural Statistics Service. The data for this measure is only available at the regional level since labor markets are regional and not constrained by county boundaries. Therefore, in the PAI every county within a region contains the same value for this indicator. We contend that farmworker wages are likely similar across a particular region and are important to include because they constitute a crucial element of social justice and the sustainability of local economies.
5. Percent of farms selling value-added products: a practice that allows farmers to access new markets and signals the potential development of entrepreneurial attitudes. Value-added sales may also increase farm incomes and yield greater return on investments, as a greater share of the difference in price between the producer and consumer is captured as profit at the farm level (USDA ERS, 2017).
6. Number of farms making direct sales per 10,000 residents: selling directly to consumers helps farmers build social capital, while narrowing the farm to consumer price spread and facilitating access to new markets. Additionally, farms engaged in direct marketing often employ environmentally sustainable techniques such as rotating crops and growing a more diverse set of crops, promoting increased farm biodiversity and fostering food system transparency (Lyson & Welsh, 1993).
7. Number of farms participating in CSAs per 10,000 residents: CSAs contribute to economic sustainability by providing farmers with guaranteed markets for their products, again narrowing the farm to consumer price spread while building social capital and trust within communities. In cases where shares are subsidized, CSAs may contribute to the food security of participating local households. Finally, they may improve environmental sustainability, as farms participating in CSAs often employ organic farming techniques and diversified farm production that support biodiversity and agroecosystem stability (Hanson, Dismukes, Chambers, Greene, & Kremen, 2004).
8. Percent of farms with operators residing on-farm: a variable which indicates the degree to which farm enterprises are owned and operated by farmers as opposed to being owned by absentee landlords and operated by employees. Our assumption is that local farm owners will be more responsive to the social and economic conditions of the region in which they farm.
9. Sales distribution across farm size classes (classified by sales in dollars): measured as the Coefficient of Variation of the total sales in each size class. This variable indicates the degree to which sales are concentrated in one or more size class, as opposed to being distributed more evenly across classes; we argue that the latter situation would represent a more ideal progressive agricultural system.

Together these variables address the social, economic, and environmental pillars of the progressivity mentioned in our definition above. Variables 1, 2, 8, and 9 address social facets of progressivity; variables 4, 5, 6, and 7 address economic issues; and variables 3, 6, and 7 measure aspects promoting environmental sustainability. The variables may appear to be somewhat imbalanced in their consideration of the three facets of progressivity (environmental, social, and economic). However, we interpret several of these variables as overlapping in certain elements of progressivity. Additionally, our decision to include

establishment of a consistent Census definition in 2008 should render future temporal comparisons significantly more reliable.

Table 1. Progressive Agriculture Index Classification of Variables

#	Indicator	Indicator Type
1	Percent of farms with female principal operators	Social
2	Percent of farms with non-white principal operators in proportion to the percent of non-white county residents	Social
3	Percent of farms with sales of organic products*	Environmental
4	Average wage of farmworkers as a percentage of the federal minimum wage	Economic
5	Percent of farms selling value-added products	Economic
6	Number of farms per 10,000 residents making direct sales	Economic, Environmental
7	Number of farms per 10,000 residents participating in CSAs (community supported agriculture operations)	Economic, Environmental
8	Percent of farms with operators residing on-farm	Social
9	Sales distribution across farm size classes	Social

* The USDA definition of organic agriculture changed in 2008, but for consistency with the rest of the measurements for 2007 we used the data collected under the 2007 definition for this year.

a roughly equal number of economic and social variables reflects our attempt to provide an index with more balance than the preponderance of existing metric systems focused largely on environmental concerns. Our classification of variables is displayed in Table 1.

The inclusion of a broad array of indicators—relating to the environment, race, ethnicity, farm worker welfare, and value chain development—does not confound the measures within an index. The diversity of indicators, while not intended to produce an index suitable to predict or explain changes in social, economic, or environmental variables, makes the index comprehensive and inclusive in its ability to illuminate trends in these variables. Based on this principle, the PAI measures movement toward progressivity for those counties which score highest in all categories: e.g., raising farm worker wages, increasing the number of acres of organic management, increasing the number of CSAs, being more inclusive of racial and ethnic groups in farming, increasing gender diversity within agriculture, and capturing value at the farm level. We do not propose that the included variables represent an exhaustive list of the elements present in a progressive agricultural system. However, based on the feedback we received from communities, we do contend that they are amongst these elements.

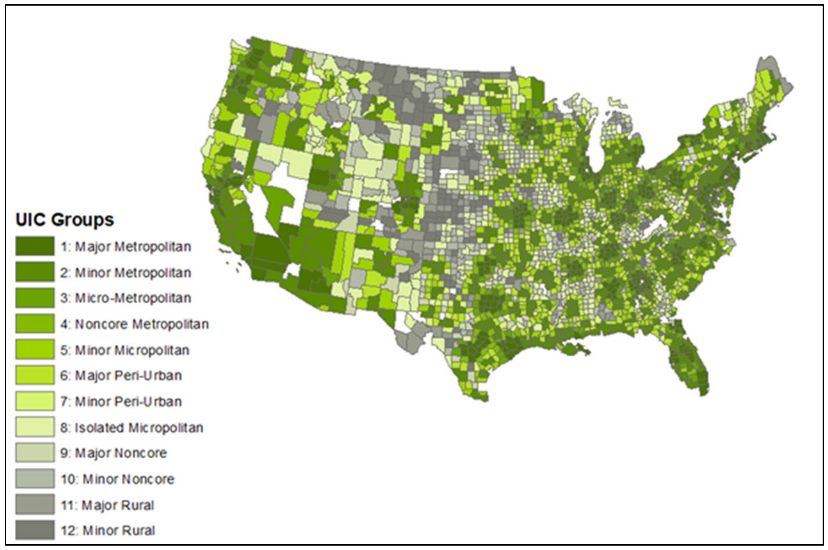
In the PAI, we included only those counties that contained 100 or more farms because we sought to avoid misleading results from outliers in cases with very few farms and little agricultural infrastructure. Additionally, only counties with data for both 2007 and 2012 were included to permit a more consistent analysis. These exclusions reduced our cases by approximately seven percent, from a total of 3,120 counties in the contiguous United States to 2,904 counties. Counties with no reported data for a variable were assigned a value of zero for that variable. This allowed us to calculate their rank without excluding them entirely.

For all the above variables, Location Quotients for each county were calculated by dividing the percentage of a county's farms displaying the given characteristic by the percentage displaying the characteristic in the entire United States. These LQs were then used to rank the counties within each category, from highest to lowest LQ. Finally, counties were given an average ranking (based on their rankings across all categories). This average was then used to calculate the overall ranking of each county in comparison to all others in the index. Using the mean rank across all categories instead of the mean of the component indicators normalizes the index. In addition, a composite index is less likely to privilege one measure over another and allows for a more meaningful assessment of overall agricultural progressivity.

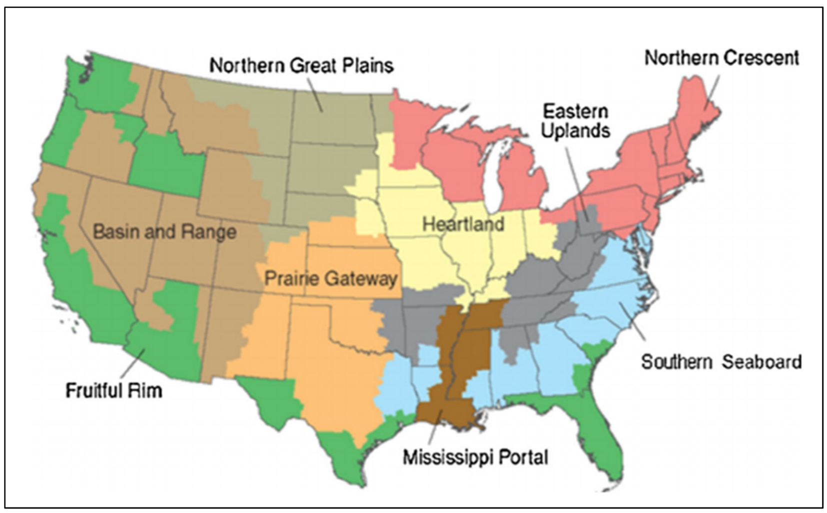
To allow for a more equitable comparison between counties located in very different socio-economic environments and with different production focuses, rankings were also calculated for counties within their Farm Resource Regions (as defined by the USDA ERS, see Map 1), and within their Urban Influence Category (UIC group, see Map 2). Thus, counties with similar populations and locations relative to urban areas can be compared side by side, as opposed to being judged against counties situated in environments with entirely different opportunities for progressive development.

To obtain these rankings, counties were sorted into their UIC groups or regions and then ordered within this group based on their overall rank. Finally, rankings were calculated for farms within the same UIC group in each separate region. This allowed for comparison between farms with the most similar environmental, social, and economic constraints or opportunities.

Map 1. UIC Groups and Shorthand Names



Map 1. Farm Resource Regions



The collected data are displayed in a comprehensive set of tables that will be made available after publication at the Lyson Center website.[3] Additionally, we have extracted information from these tables and the rankings produced by the PAI to create additional tables displaying the top 100 counties overall in 2007 (excerpt in Table 2) and 2012 (excerpt in Table 3). Tables containing the top 50 counties in each region and UIC group were also created for both years. Finally, county-level variables and overall rankings were transformed into a set of maps which allow the visualization and spatial analysis of the trends described here.

This combination of diverse indicators and ranking systems has resulted in a Progressive Agriculture Index that we hope will contribute to accurate and contextually relevant comparisons of agricultural progressivity between counties. We do not suggest that this index represents a universal solution to measuring progress in agricultural systems. Rather, our hope is that the PAI will be

[3] https://www.lysoncenter.org

Table 2. EXCERPT FROM Progressive Agriculture Index Top 100 Counties Overall, 2007

Overall rank	State	County	Region	UIC Group	UIC Description
1	Washington	San Juan	Fruitful Rim	12	Noncore not adjacent to a metro/micro area and does not contain a town of at least 2,500 residents
2	Oregon	Hood River	Basin and Range	3	Micropolitan adjacent to a large metro area
3	Oregon	Josephine	Fruitful Rim	2	Small—in a metro area with fewer than 1 million residents
4	California	Trinity	Basin and Range	6	Noncore adjacent to a small metro with town of at least 2,500 residents
5	Oregon	Columbia	Fruitful Rim	1	Large—in a metro area with at least 1 million residents or more
5	Virginia	Rappahannock	Southern Seaboard	1	Large—in a metro area with at least 1 million residents or more
7	Washington	Stevens	Basin and Range	2	Small—in a metro area with fewer than 1 million residents
8	Michigan	Leelanau	Northern Crescent	8	Micropolitan not adjacent to a metro area
9	Oregon	Wallowa	Fruitful Rim	10	Noncore adjacent to micro area and does not contain a town of at least 2,500 residents
10	Washington	Wahkiakum	Fruitful Rim	4	Noncore adjacent to a large metro area

Table 3. EXCERPT FROM Progressive Agriculture Index Top 100 Counties Overall, 2012

Overall rank	State	County	Region	UIC Group	UIC Description
1	California	Trinity	Basin and Range	6	Noncore adjacent to a small metro with town of at least 2,500 residents
2	Maine	Waldo	Northern Crescent	6	Noncore adjacent to a small metro with town of at least 2,500 residents
3	Vermont	Orange	Northern Crescent	8	Micropolitan not adjacent to a metro area
4	California	Nevada	Basin and Range	3	Micropolitan adjacent to a large metro area
5	Oregon	Hood River	Basin and Range	3	Micropolitan adjacent to a large metro area
6	Oregon	Josephine	Fruitful Rim	2	Small—in a metro area with fewer than 1 million residents
7	New Hampshire	Carroll	Northern Crescent	4	Noncore adjacent to a large metro area
8	Washington	Jefferson	Fruitful Rim	6	Noncore adjacent to a small metro with town of at least 2,500 residents
9	Vermont	Bennington	Northern Crescent	5	Micropolitan adjacent to a small metro area
10	Maine	Oxford	Northern Crescent	6	Noncore adjacent to a small metro with town of at least 2,500 residents

useful to researchers attempting to identify the factors that may promote positive economic, environmental, and social trends in agricultural development—especially those identified as important by people in the communities that participated in our development process. Additionally, these rankings may contribute to the efforts of NGOs, government aid programs, and nonprofits. Communities may consider using the PAI as a benchmark to measure and compare their progress with that of others in their region or UIC group, or with the U.S. as a whole.

Results and Discussion

Regional Patterns

Numerous trends are evident from the PAI, with some patterns appearing at the county level and others at regional scales. For example, average rankings are highest for the Northern Crescent, Basin and Range, and Eastern Upland regions in both 2007 and 2012 (Tables 4 and 5, Maps 3 and 4). These regions also tended to rank highly within many of the individual variables; however, there were also several cases in which regions that did

Table 4. Region Ranking, 2007

Rank	Region	Average Rank of Counties in Region
1	Northern Crescent	770
2	Basin and Range	794
3	Eastern Uplands	1,229
4	Fruitful Rim	1,449
5	Northern Great Plains	1,464
6	Prairie Gateway	1,526
7	Heartland	1,587
8	Southern Seaboard	1,989
9	Mississippi Portal	2,258

Table 5. Region Ranking, 2012

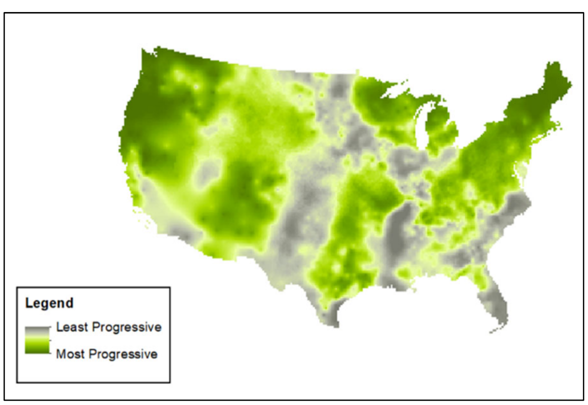
Rank	Region	Average Rank of Counties in Region
1	Northern Crescent	700
2	Basin and Range	882
3	Eastern Uplands	1,047
4	Fruitful Rim	1,412
5	Prairie Gateway	1,661
6	Northern Great Plains	1,718
7	Southern Seaboard	1,731
8	Heartlands	1,788
9	Mississippi Portal	2,215

not contain many highly progressive counties based on overall rankings did perform well in one of the individual variables. Such differences indicate that progress in agri-food systems may occur unevenly in the character and order of the changes that occur. The resulting variation is not entirely unexpected, as the extant literature shows technological change, rural development, and economic growth all follow uneven patterns within and between regions (Ascani, Crescenzi, & Iammarino, 2012). This may be due to differences in proximity to markets for agricultural goods produced in progressive systems, but it is important to consider other drivers of variation as well.

This uneven development is illustrated by the divergent performance of the various regions in several of the economic, environmental, and social variables in the PAI. (Unless otherwise noted, the statistics that follow refer to 2012, although many of the same trends are evident in 2007.) Together, counties from the Northern Crescent, Eastern Uplands, and Basin and Range regions constitute 73% of the 100 highest ranking counties within the Value-Added Sales category, 71% of the top 100 counties in the On-Farm Operator category, and 59% of the top 100 counties in the Female Principal Operator categories (Tables 6, 7, and 8; Maps 5, 6, and 7, respectively).

The Northern Crescent region did particularly well in the Organic Sales category. Within this

Map 3. Overall Progressive Agriculture Index Rank, Overall Trends, 2012



Map 4. Overall Progressive Agriculture Index Rank, County Rank, 2012

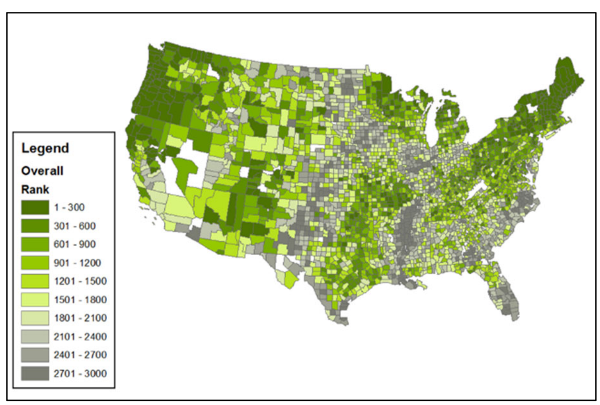


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Table 6. Region Ranking: Value Added, 2012

Rank	Region	Average Rank of Counties in Region
1	Eastern Uplands	900
2	Basin and Range	905
3	Northern Crescent	941
4	Fruitful Rim	1,185
5	Southern Seaboard	1,378
6	Mississippi Portal	1,679
7	Prairie Gateway	1,797
8	Northern Great Plains	2,034
9	Heartlands	2,051

Map 5. Value Added Rank, 2012

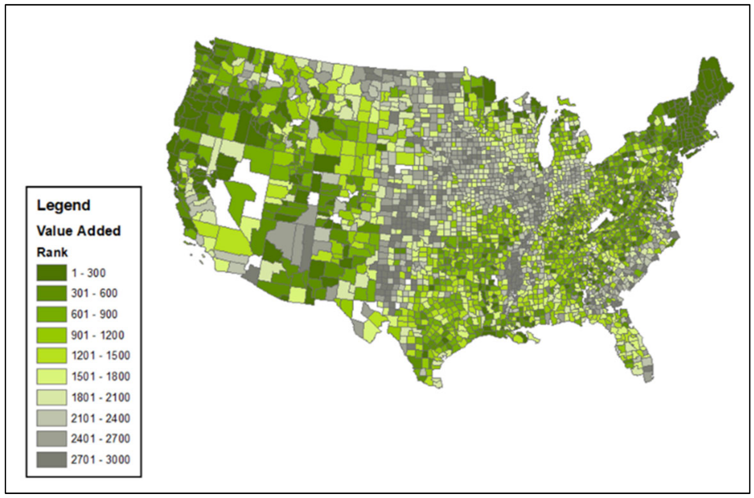
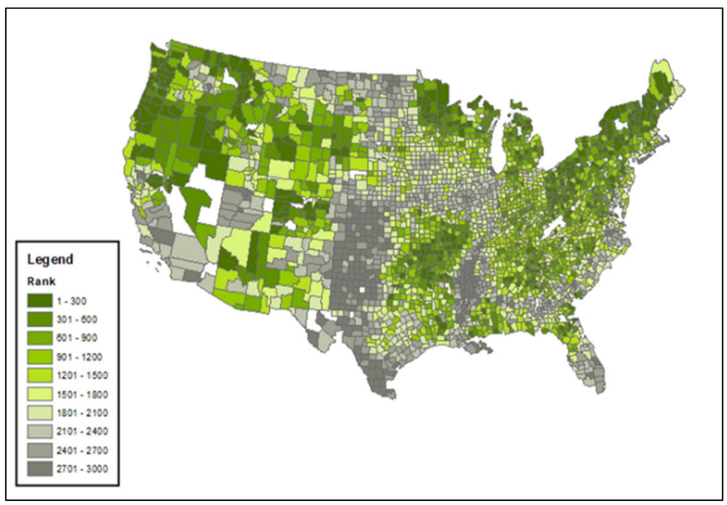


Table 7. Region Ranking, On-Farm Operators, 2012

Rank	Region	Average Rank of Counties in Region
1	Northern Crescent	761
2	Eastern Uplands	852
3	Basin and Range	1,101
4	Southern Seaboard	1,441
5	Fruitful Rim	1,501
6	Heartlands	1,677
7	Northern Great Plains	1,824
8	Mississippi Portal	2,062
9	Prairie Gateway	2,110

Map 6. On-Farm Operators Rank, 2012



variable, the average ranking of counties in the Northern Crescent was 571 (Table 9, Map 8). Just behind the Northern Crescent in the Organic Sales category were the Fruitful Rim and Basin and Range regions, with average rankings of 798 and 993, respectively.

The Basin and Range region also scored well in the Female Principal Operator category, with an average ranking of 1,008. This put it second to the Fruitful Rim's average ranking of 893 and just ahead of the Northern Crescent's average ranking of 1,075. In contrast to the dominance of these three regions in the Female Principal Operator category, a different set of regions dominated in the Non-White Principal Operator variable. Here the Mississippi Portal exhibited the most favorable ranking. Counties from this region received an average ranking of 851 for this variable (Table 10, Map 9). The region was ranked far above the second-place Southern Seaboard, which had an average ranking of 992 for Non-White Principal Operators.

This trend likely reflects the presence of the "Black Belt" in these regions, illustrating the enduring link between rural African American populations and agricultural production in the southern

Table 8. Region Ranking, Female Principal Operators, 2012

Rank	Region	Average Rank of Counties in Region
1	Fruitful Rim	893
2	Basin and Range	1,008
3	Northern Crescent	1,075
4	Southern Seaboard	1,149
5	Prairie Gateway	1,394
6	Mississippi Portal	1,601
7	Eastern Uplands	1,625
8	Northern Great Plains	1,865
9	Heartlands	2,094

Map 7. Female Principal Operators Rank, 2012

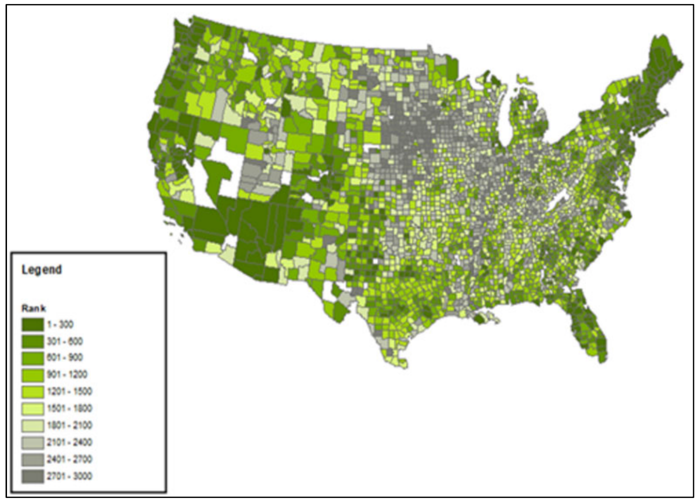
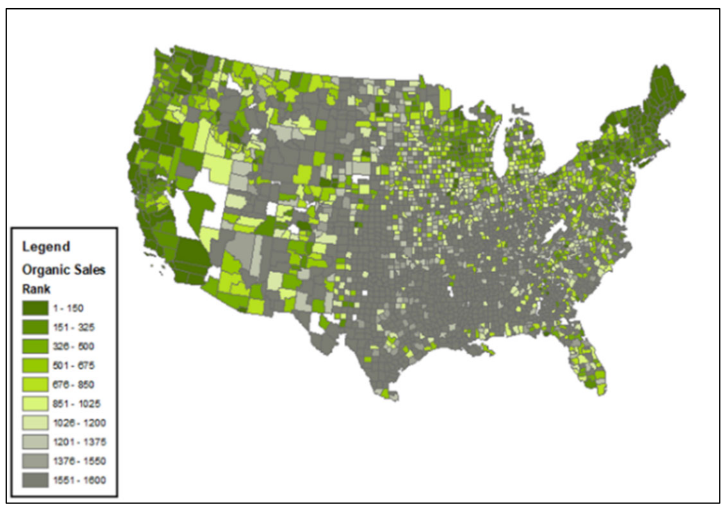


Table 9. Region Ranking, Organic Sales, 2012

Rank	Region	Average Rank of Counties in Region
1	Northern Crescent	571
2	Fruitful Rim	798
3	Basin and Range	993
4	Heartlands	1,193
5	Northern Great Plains	1,193
6	Southern Seaboard	1,314
7	Eastern Uplands	1,370
8	Prairie Gateway	1,428
9	Mississippi Portal	1,510

Map 8. Organic Sales Rank, 2012



U.S. (Rankin & Falk, 2010). The authors acknowledge that the large number of Non-White Principal Operators in the southern regions may not represent a particularly progressive trend, as these operators may be faring poorly compared to White operators in the same vicinity. However, the inclusion of this variable in the PAI alongside many other indicators ensures that our assessment of progressivity does not rely solely on one measure of social justice. Additionally, the viability of operations with Non-White Principal Operators will be measurable as the PAI continues to track this variable through subsequent census years. If Non-White operators are indeed doing poorly, and their numbers decline as a result, this trend will be visible and may spur further research on the topic.

In contrast, the Heartland, Northern Crescent, and Northern Great Plains regions contain the counties with the lowest percentages of Non-White Principal Operators in proportion to non-white residents. Together, these regions were home to over 60% of the counties that did not contain any farms with non-white principal operators, despite the presence of non-white residents in the county. Compared to the average ranking of 851 for Mississippi Portal counties under this category, the

Table 10. Region Ranking: Non-White Principal Operator, 2012

Rank	Region	Average Rank of Counties in Region
1	Mississippi Portal	851
2	Southern Seaboard	992
3	Fruitful Rim	1,173
4	Eastern Uplands	1,191
5	Basin and Range	1,405
6	Prairie Gateway	1,501
7	Northern Great Plains	1,669
8	Northern Crescent	1,727
9	Heartlands	1,813

Map 9. Non-White Principal Operators Rank, 2012

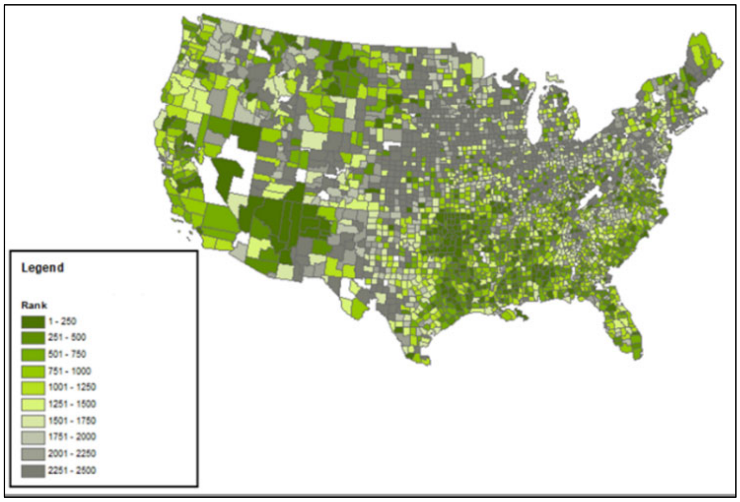
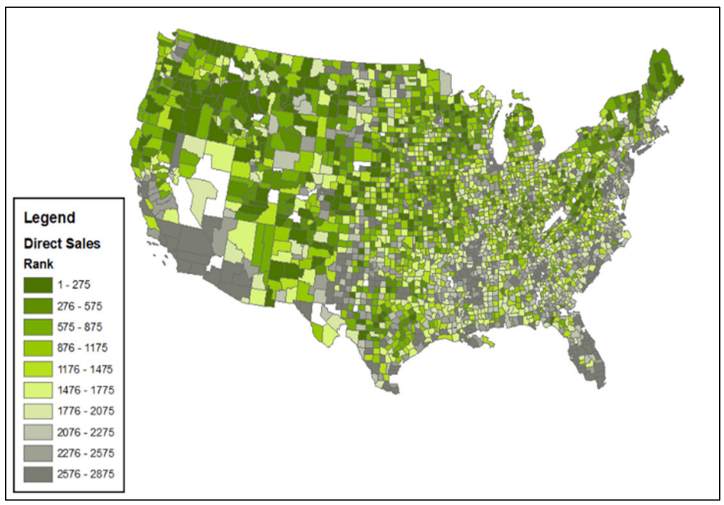


Table 11. Region Ranking: Direct Sales, 2012

Rank	Region	Average Rank of Counties in Region
1	Basin and Range	872
2	Northern Great Plains	1,115
3	Northern Crescent	1,225
4	Eastern Uplands	1,349
5	Heartlands	1,384
6	Prairie Gateway	1,404
7	Fruitful Rim	1,656
8	Southern Seaboard	1,909
9	Mississippi Portal	2,066

Map 10. Direct Sales Rank, 2012



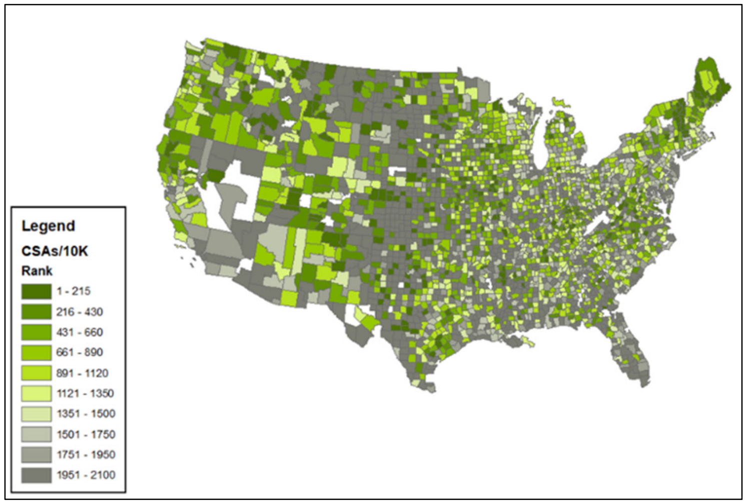
averages for the Heartland, Northern Crescent, and Northern Great Plains were 1,813, 1,727, and 1,769, respectively. We do not imply that non-white residents in those particular regions wish to farm or do not look for better, off-farm opportunities. Rather, we argue that these statistics reflect historical trends in occupational segregation in the operation of farms. This may indicate the persistence of cultural, social, economic and political barriers to entry into farm ownership for non-white farmers, thus diminishing opportunities in this economic sector (Collier, 2017).

The Prairie Gateway and Mississippi Portal regions showed the lowest percentage of farms with operators residing on-farm; 83 of the lowest 100 counties in the on-farm operator category were located in these two regions. The average ranking of Prairie Gateway counties in the on-farm operator category was 2,110; for Mississippi Portal counties it was 2,062. These rankings put these two regions in last and second-to-last place, respectively, for this category. In contrast, the Northern Crescent region generally had higher proportions of on-farm operators. This region contained 40 of the 100 top counties in the category. The average ranking of Northern Crescent counties was 761,

Table 12. Region Ranking: CSAs per 10,000 Population, 2012

Rank	Region	Average Rank of Counties in Region
1	Basin and Range	1,074
2	Northern Crescent	1,143
3	Eastern Uplands	1,282
4	Heartlands	1,316
5	Fruitful Rim	1,404
6	Prairie Gateway	1,429
7	Southern Seaboard	1,429
8	Northern Great Plains	1,490
9	Mississippi Portal	1,493

Map 11. CSAs per 10,000 Population Rank, 2012



putting it ahead of the Eastern Uplands and Basin and Range regions, which had average on-farm operator rankings of 852 and 1,101, respectively.

The number of operations with direct sales per 10,000 residents was highest in the Basin and Range region, followed by the Northern Great Plains and the Northern Crescent (Table 11, Map 10). The average Direct Sales rankings of these regions were 872, 1,115, and 1,225, respectively.

CSA participation in proportion to population was also high in the Northern Crescent region, with roughly a fifth of the top 100 counties in this category hailing from the Northern Crescent. The region's counties had an average ranking of 1,143 in the category, just behind the Basin and Range at 1,074 (Table 12, Map 11). Unlike many of the other categories, no one region had an average ranking below 1,000 for the CSA variable. Whereas one or more regions tended to stand out from the others in most other categories, the regions all displayed fairly similar rankings for this particular category. This is an interesting trend to note, especially since the USDA has documented a recent growth in CSAs along with rising interest in direct marketing and local food production (Woods, Ernst, & Tropp, 2017).

Contrary to the trend for the CSA category, the Value-Added Sales category had several regions with average ranks below 1,000. The Eastern Uplands had the most favorable ranking of 900, followed by the Basin and Range and Northern Crescent with average rankings of 905 and 941, respectively. As in the Value-Added category and the Organic Sales category (discussed above), a few regions stood out in the rankings for Wage as a Percent of the Federal Minimum (Table 13, Map 12). The Heartland region performed very well in this category, with an average ranking of 574, followed by the Northern Great Plains at 631 and the Northern Crescent at 821. In contrast, the Southern Seaboard and Mississippi Portal had average rankings of 2,156 and 2,440, respectively. The differences in wages between these regions may be related to the influence of urban areas. That is, income tends to be higher around metro centers (D'Costa & Overman, 2014). For example, with fewer large urban areas, the Southern Seaboard and Mississippi Portal may exhibit less favorable wage rates than the more urbanized Northern Crescent region (Crosset, Culliton, Wiley, & Goodspeed, 2004).

The Southern Seaboard and Mississippi portal also exhibited poor rankings in the Sales Concentration variable, along with the Fruitful Rim. With averages of 1,793, 1,849, and 1,807, respectively, the three regions demonstrate the trend toward uneven distribution of sales between farms of different size classes in the southern regions of the country, a phenomenon that is concerning given the need for more equitable distribution of income

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Table 13. Region Ranking: Wage as Percent of Federal Minimum, 2012

Rank	Region	Average Rank of Counties in Region
1	Heartlands	574
2	Northern Great Plains	631
3	Northern Crescent	821
4	Prairie Gateway	987
5	Fruitful Rim	1,656
6	Eastern Uplands	1,721
7	Basin and Range	1,757
8	Southern Seaboard	2,156
9	Mississippi Portal	2,440

Map 12. Wage as Percent of Federal Minimum Rank, 2012

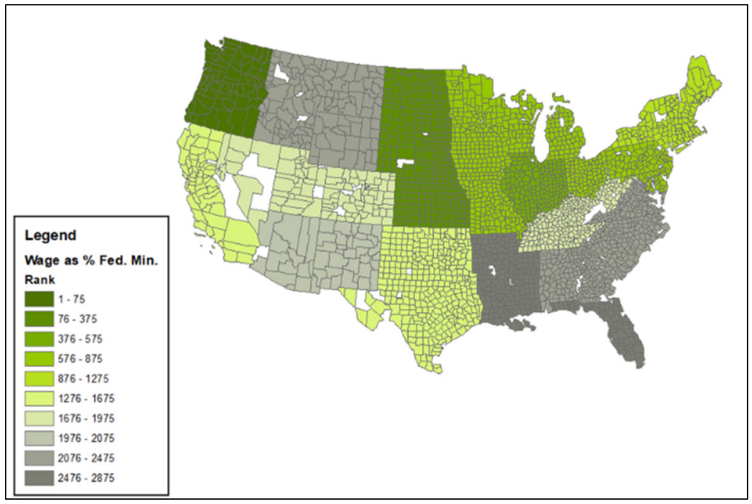
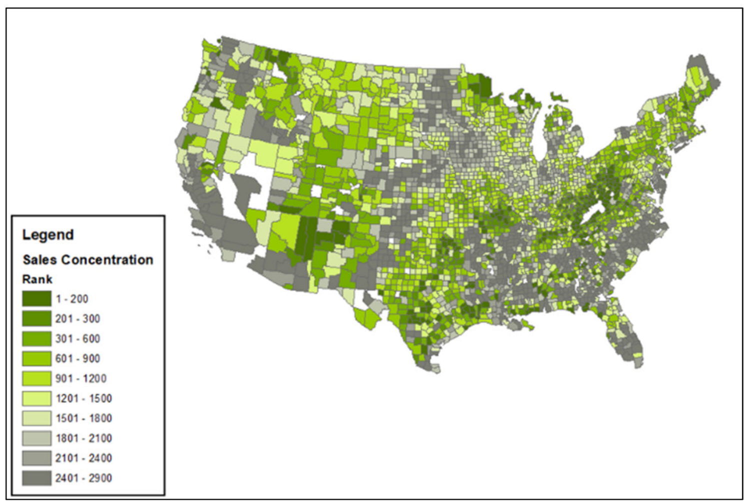


Table 14. Region Ranking: Sales Concentration, 2012

Rank	Region	Average Rank of Counties in Region
1	Eastern Uplands	884
2	Basin and Range	1,076
3	Northern Crescent	1,271
4	Prairie Gateway	1,315
5	Heartlands	1,608
6	Northern Great Plains	1,664
7	Southern Seaboard	1,793
8	Fruitful Rim	1,807
9	Mississippi Portal	1,840

Map 13. Sales Concentration Rank, 2012



for farmers with operations of all sizes (Table 14, Map 13).

Urban Influence Categories

In addition to the regional trends, UIC groups also displayed some correlation with specific variables and overall progressivity, but these relationships were generally weaker and often differed between 2007 and 2012. For example, the top-ranking UIC groups in 2007 were 4 (Noncore Metropolitan), 7 (Minor Peri-Urban), and 12 (Minor Rural), with group 1 (Major Metropolitan) ranking 6th overall. In 2012, group 1 had moved to first place, ahead of both group 3 (Micro-Metropolitan) and group 4 (Noncore Metropolitan) (Tables 15 and 16, Map 14).

Furthermore, while it may appear that higher ranked counties cluster around urban areas, a quantitative analysis shows this is not the case. We created a binary variable for each county in the data set where 1=UIC code of 1, 2, 3, or 4 (dominantly urban) and 0=UIC code 5, 6, 7, 8, 9, 10, 11, or 12. We then calculated a Pearson correlation between the overall PAI ranking and the new binary variable. The correlation coefficient was –0.14, indicating that a correlation is not present.

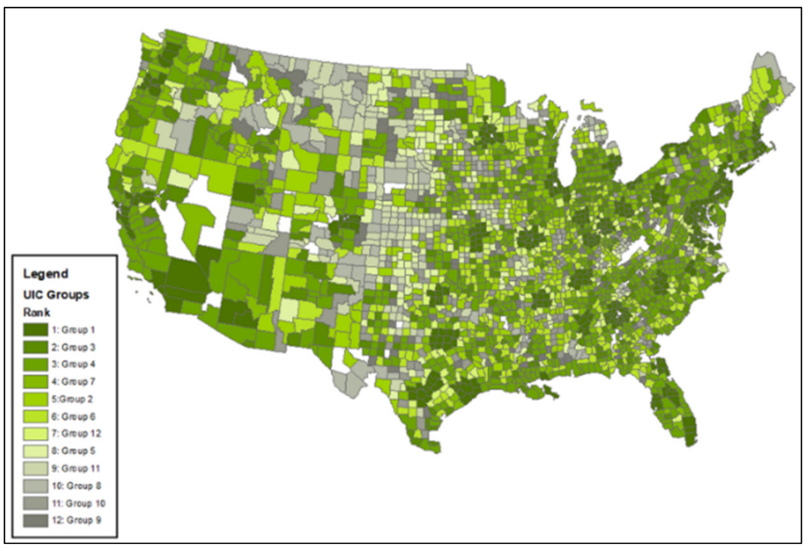
Table 15. UIC Group Ranking, 2007

Rank	UIC Group	UIC Description	Average Rank of Counties in UIC Group
1	4	Noncore adjacent to a large metro area	1,176
2	7	Noncore adjacent to a small metro and does not contain a town of at least 2,500 residents	1,236
3	12	Noncore not adjacent to a metro/micro area and does not contain a town of at least 2,500 residents	1,316
4	3	Micropolitan adjacent to a large metro area	1,321
5	11	Noncore not adjacent to a metro/micro area and contains a town of 2,500 or more residents	1,346
6	1	Large-in a metro area with at least 1 million residents or more	1,388
7	10	Noncore adjacent to micro area and does not contain a town of at least 2,500 residents	1,434
8	9	Noncore adjacent to micro area and contains a town of 2,500-19,999 residents	1,440
9	6	Noncore adjacent to a small metro with town of at least 2,500 residents	1,448
10	5	Micropolitan adjacent to a small metro area	1,561
11	2	Small-in a metro area with fewer than 1 million residents	1,573
12	8	Micropolitan not adjacent to a metro area	1,610

Table 16. UIC Group Ranking, 2012

Rank	UIC Group	UIC Description	Average Rank of Counties in UIC Group
1	1	Large-in a metro area with at least 1 million residents or more	1,164
2	3	Micropolitan adjacent to a large metro area	1,199
3	4	Noncore adjacent to a large metro area	1,246
4	7	Noncore adjacent to a small metro and does not contain a town of at least 2,500 residents	1,398
5	2	Small-in a metro area with fewer than 1 million residents	1,447
6	6	Noncore adjacent to a small metro with town of at least 2,500 residents	1,510
7	12	Noncore not adjacent to a metro/micro area and does not contain a town of at least 2,500 residents	1,516
8	5	Micropolitan adjacent to a small metro area	1,524
9	11	Noncore not adjacent to a metro/micro area and contains a town of 2,500 or more residents	1,582
10	8	Micropolitan not adjacent to a metro area	1,634
11	10	Noncore adjacent to micro area and does not contain a town of at least 2,500 residents	1,636
12	9	Noncore adjacent to micro area and contains a town of 2,500-19,999 residents	1,696

Map 14. UIC Group Rank, 2012



This inconsistency may stem from the fact that, while UIC groups share demographic trends related to population and urbanization, counties in the same group may perform very differently in environmental, social, and economic variables that depend largely on regional trends in agricultural systems. For example, the Corn Belt region stretching across much of the Heartland and Northern Great Plains regions tends to be dominated by large industrial-scale farms. Such farms are not conducive to the practices of organic agriculture or engagement in services like CSAs, which rely upon more diversified crop production. Attitudes toward progressive practices such as organic agriculture may also correlate more strongly with a certain region due to the different cultural and political trends associated with the country's coastal and central regions.

However, while some variables did not show much correlation between UIC group and average rankings, in a few cases one or more UIC groups had higher average rankings within a variable than did other groups. For example, UIC group 1 (Major Metropolitan) outranked other UIC groups in the Female Principal Operator category, with an average of 805. This average was far better the average rankings of the remaining groups (Table 17). The next-best group in the category was UIC group 2 (Minor Metropolitan), with an average ranking of 1331. The rankings of the remaining groups continued into the 1,700s. This large gap between UIC group 1 and the rest of the groups may present an interesting topic for further research concerning the impacts of urban areas on economic opportunities for a large county located in a metro area with greater than 1 million residents.

UIC group 1 (Major Metropolitan) also performed well in the Organic Sales category, with an average ranking of 1,032 (Table 18). This was just behind UIC group 3 (Micro-Metropolitan),

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Table 17. UIC Group Ranking: Female Principal Operator, 2012

Rank	UIC Group	UIC Description	Average Rank of Counties in UIC Group
1	1	Large—in a metro area with at least 1 million residents or more	805
2	2	Small—in a metro area with fewer than 1 million residents	1,331
3	3	Micropolitan adjacent to a large metro area	1,449
4	4	Noncore adjacent to a large metro area	1,527
5	5	Micropolitan adjacent to a small metro area	1,573
6	11	Noncore not adjacent to a metro/micro area and contains a town of 2,500 or more residents	1,594
7	6	Noncore adjacent to a small metro with town of at least 2,500 residents	1,639
8	8	Micropolitan not adjacent to a metro area	1,639
9	12	Noncore not adjacent to a metro/micro area and does not contain a town of at least 2,500 residents	1,653
10	10	Noncore adjacent to micro area and does not contain a town of at least 2,500 residents	1,669
11	7	Noncore adjacent to a small metro and does not contain a town of at least 2,500 residents	1,720
12	9	Noncore adjacent to micro area and contains a town of 2,500–19,999 residents	1,775

Table 18. UIC Group Ranking: Organic Sales, 2012

Rank	UIC Group	UIC Description	Average Rank of Counties in UIC Group
1	3	Micropolitan adjacent to a large metro area	1,017
2	1	Large—in a metro area with at least 1 million residents or more	1,032
3	2	Small—in a metro area with fewer than 1 million residents	1,077
4	5	Micropolitan adjacent to a small metro area	1,150
5	7	Noncore adjacent to a small metro and does not contain a town of at least 2,500 residents	1,199
6	6	Noncore adjacent to a small metro with town of at least 2,500 residents	1,208
7	11	Noncore not adjacent to a metro/micro area and contains a town of 2,500 or more residents	1,208
8	4	Noncore adjacent to a large metro area	1,213
9	8	Micropolitan not adjacent to a metro area	1,223
10	12	Noncore not adjacent to a metro/micro area and does not contain a town of at least 2,500 residents	1,249
11	9	Noncore adjacent to micro area and contains a town of 2,500–19,999 residents	1,296
12	10	Noncore adjacent to micro area and does not contain a town of at least 2,500 residents	1,365

with an average ranking of 1,017; group 2 (Minor Metropolitan) was close in ranking to group 1, with an average of 1,077. The prevalence of organic sales in these three UIC groups may once again be related to the proximity of counties in these groups to large metropolitan areas, which (as mentioned above) may affect economic conditions and opportunities due to higher population densities and wages.

In particular, the higher incomes associated with urban areas may result in larger populations of consumers willing to pay the price premium associated with organic products (Bonti-Ankomah & Yiridoe, 2006; D'costa & Overman, 2014). Additionally, some studies have shown the populations of large cities to be younger on average than rural areas (Thomas, Serwicka, & Swinney, 2015), and many authors suggest that younger consumers are increasingly interested in purchasing organic products due to their concern for environmental and health issues (Buzby & Skees, 1994; Hay, 1989). In combination with higher average education levels, the demographics of large cities may also play a significant role in the prevalence of organic farming near urban areas (Hay, 1989; Thomas, Serwicka, & Swinney, 2015). These relationships deserve further investigation and may provide an interesting topic for future research on the drivers of consumer responses to progressive agricultural practices.

In contrast to the organic sales variable, the highest-ranking groups in Direct Sales per 10,000 Residents tended to be from non-urban UIC groups. Within this variable, UIC groups 12 (Minor Rural), 7 (Minor Peri-Urban), and 10 (Minor Noncore) exhibited the most favorable average rankings of 821, 920, and 937, respectively (Table 19).

Interestingly, the percentage of farms reporting direct sales was higher in the more urban UIC groups 1 through 5, with group 1(Major Metropolitan) averaging just over 10% of farms reporting direct sales. This counters the trend seen in UIC groups 6–12, which all averaged less than 6% of farms reporting direct sales. The contrast between high rates of direct sales per 10,000 residents and actual percents of farms with direct sales reflects once again the influences of urban areas on the variables included in the PAI. The higher per-capita rates of direct sales in the less urbanized counties of UIC groups 7 (Minor Peri-Urban), 10 (Minor Noncore), and 12 (Minor Rural) illustrate how lower population densities in rural areas can result in greater rates of direct-to-consumer sales; conversely, high population densities in urban areas result in lower per-capita direct sales despite a greater percentage of farms selling products directly to consumers. These trends offer interesting insights into the possibility for population structure and urbanization to affect characteristics associated with progressive agriculture and should be investigated in future studies.

Table 19. UIC Group Ranking: Direct Sales, 2012

Rank	UIC Group	UIC Description	Average Rank of Counties in UIC Group
1	12	Noncore not adjacent to a metro/micro area and does not contain a town of at least 2,500 residents	821
2	7	Noncore adjacent to a small metro and does not contain a town of at least 2,500 residents	920
3	10	Noncore adjacent to micro area and does not contain a town of at least 2,500 residents	937
4	4	Noncore adjacent to a large metro area	1,124
5	11	Noncore not adjacent to a metro/micro area and contains a town of 2,500 or more residents	1,147
6	6	Noncore adjacent to a small metro with town of at least 2,500 residents	1,234
7	9	Noncore adjacent to micro area and contains a town of 2,500–19,999 residents	1,308
8	3	Micropolitan adjacent to a large metro area	1,451
9	5	Micropolitan adjacent to a small metro area	1,488
10	8	Micropolitan not adjacent to a metro area	1,554
11	2	Small—in a metro area with fewer than 1 million residents	1,760
12	1	Large—in a metro area with at least 1 million residents or more	1,960

Temporal Patterns

Another useful element of the PAI is its inclusion of data from both the 2007 and 2012 Census of Agriculture. This allows for direct comparisons between the two years, facilitating the quantification of changes in the variables included within the PAI. Based on changes in the overall rankings, it is apparent that many of the counties displaying the most significant progress in their agricultural systems are located in the southern and coastal areas of the country. Based on the average percent change in the overall rankings of their counties, the Southern Seaboard, Mississippi Portal, and Eastern Uplands regions displayed the greatest improvements in overall ranking between 2007 and 2012.

Also useful in measuring change is the percent of a region's counties that displayed an improvement in overall rankings; this does not consider the magnitude of change in rankings but rather the general trend of improvement or decline in ranking. The Southern Seaboard and Mississippi Portal again performed well under this measure of improvement, with 68% and 62% of the counties from these regions, respectively, showing improvement from 2007 to 2012. Interestingly, a similar percentage (62%) of Northern Crescent counties showed an improvement in overall rank, despite the apparent lower magnitude of these improvements according to percent change in rankings. Future studies should continue monitoring the development of progressive agriculture in both the regions where it is already well established and the areas in which it is still less prevalent. A comparison of these changes could help determine what level of programming or funding is most successful at spurring progress in agricultural operations.

A problematic trend is evident in the category of average farmworker wages as a percentage of the federal minimum wage, which decreased for all regions in the U.S. This trend may be due to the gradual increase in federal minimum wage that has taken place since the Fair Minimum Wage Act of 2007 (U.S. Department of Labor, Wage and Hour Division, 2017). As the minimum wage has risen, the average wage of farmworkers has not risen at a comparable pace, thus reducing the average wage as a percentage of the minimum wage. The topic of farmworker wages is one that should continue to be watched closely as wage rates are a key element of healthy local economies and more just food systems.

In contrast, the percent of farms with sales direct to consumers has shown growth on both the East and the West coast, with the Basin and Range, Fruitful Rim, and Northern Crescent regions leading in terms of the number of counties exhibiting an increase in direct sales per 10,000 residents. Seventy percent of counties in the Basin and Range region showed increases in this variable. Sixty

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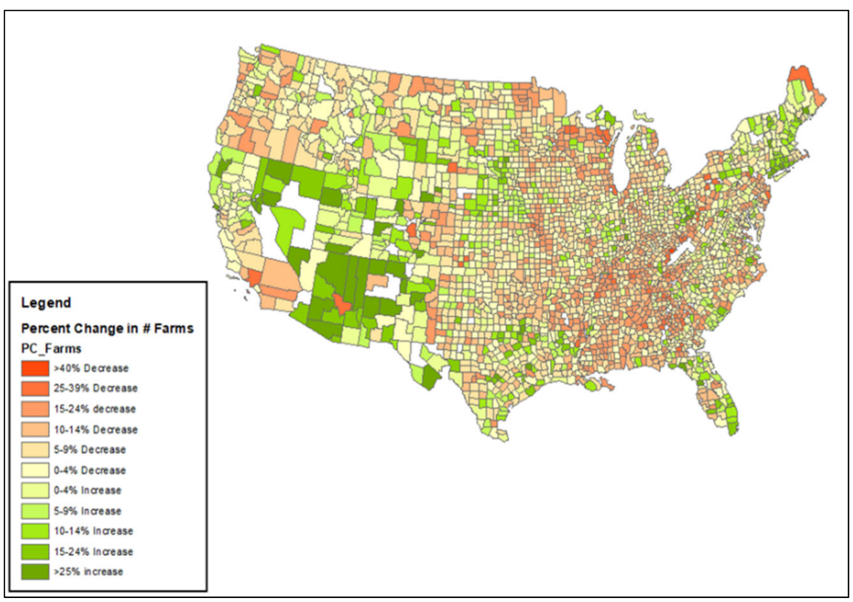
percent and 56% of counties in the Fruitful Rim and Northern Crescent regions, respectively, reported increases in direct sales. This could be viewed as a very positive trend and one that is crucial to the development of local social capital. As direct links grow between farmers and consumers, local food systems will be strengthened, which may lead to both economic growth and positive environmental impacts. Furthermore, Dimitri and Lohr (2007) demonstrated that direct sales constitute a large proportion of the organic market. This suggests that growth in the former may contribute to the development of organic agriculture and thus further support the transition to more progressive food systems.

Interestingly, over 70% of the total counties included in the PAI exhibited a decline in the number of farms from 2007 to 2012; however, only about half of those included in the overall top ranking 100 counties displayed a decrease in total farms (Map 15).

A decline in the number of farms could indicate either consolidation, with a few larger farms replacing many smaller ones; or, it could simply indicate a decline in farms with no consolidation and thus simply point to declining participation in agriculture. In either case, the fact that high-ranking counties do not show as much of a decline in total farms would suggest that involvement in agriculture has a positive impact on overall agricultural progressivity. The areas with the largest decreases in total farms per county were the Mississippi Portal, Eastern Upland, and Southern Seaboard regions. Eighty-eight percent of counties in the Mississippi Portal, 84% of those in the Eastern Upland, and 77% of those in the Southern Seaboard reported a decrease in number of farms from 2007 to 2012.

Another surprising finding is the overall decline in operations reporting organic sales within the U.S. as a whole; in 2007, over 18,000 farms reported organic sales; in 2012, this number fell to just over 14,000. Some counties did show increases in Organic Sales, but such cases appear somewhat rare as only about a quarter (26.6%) of counties included in this index reported growth in the variable. Some regions exhibited even lower percentages of counties with increases in organic sales. On the opposite end of the spectrum, over 65% of counties in the Basin and Range region showed a decrease in farms reporting organic sales. These trends merit further investigation, as they appear to contradict the observed increase in consumer interest in organic products and the actual increase in organic farms between 2007 and 2012 (Forssell & Lankoski, 2017). Interestingly, a large portion of the counties that exhibited growth in organic sales also exhibited growth in the direct sales category. As discussed above, this may reflect the importance of direct marketing practices in generating sales of organic products. It is also possible that there is a correlation between the willingness of consumers to buy from local sources and their increasing interest in organic products—both of which are actions that may appeal to consumers interested in environmental sustainability (Dimitri & Lohr, 2007; USDA NASS, 2015).

Map 15: Percent Change in Total Farms per County, 2007–2012



Conclusions

This paper examines only a few of the many trends and patterns that can be identified from the PAI. As new data is collected, the perspective provided by the PAI will continue to change and be updated. The system is by no means perfect and we encourage discussion concerning opportunities for its improvement. We recognize the limitations of metrics in which all variables are weighted equally. This may not accurately reflect the importance of the many aspects of progressivity perceived by farmers, workers, and communities on the ground. However, the challenge of agreeing upon a weighting system may be even more complex than the development of the indicators themselves. Just as the definition of progressivity will vary in the eyes of the many stakeholders engaged in the pursuit of a better agri-food system, opinions will also diverge concerning the relative weight that should be given to each environmental, social, and economic element of progressive agriculture (Bell & Morse, 2008; De Olde et al., 2016; Gasparatos, El-Haram, & Horner, 2009; Korhonen, 2004; Ravetz, 1999).

The difficulty of engaging with diverse views and values should not prevent efforts to do so, as a weighted metric system could help move indicators toward a more inclusive, flexible, and holistic paradigm for measuring the progress of the nation's agriculture (Cloquell-Ballester, Cloquell-Ballester, Monterde-Dıaz, & Santamarina-Siurana, 2006; de Olde et al., 2016; Elsaesser et al., 2015). The same applies in the case of other shortcomings, including a lack of data availability, an over-emphasis on economic goals, and variables that are contradictory or difficult-to-measure. Better cooperation and integration between private and public-sector initiatives, as well as greater engagement with communities and workers, will also be necessary if indicators are to fulfill their potential as tools for informing the transition to progressive agriculture. We hope these issues and others that will surely arise may be dealt with through collaborative and inclusive efforts that consider economic, social, and environmental challenges. Our PAI is intended to act as a step toward this important goal. Its ability to distill and combine indicators of progressivity across geographies and time suggests it may have value in improving the understanding of trends associated with social, economic, and environmental progress. Ultimately the balanced perspective we believe our index begins to approach will allow the creation of indicator systems that will support decision-making to advance progressive agriculture.

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