Appendix I

Materials and Methods

Introduction

With our overall goal of defining the key constraints and opportunities to sustainable agricultural systems in the South, we collected data for key economic, social and environmental indicators for all counties in the South. We compared this to data obtained twenty years ago.

This goal required both qualitative and quantitative research methods. In complex adaptive systems, few variables can be tightly controlled because nearly all systems adapt, making response to stimuli unpredictable. Non-experimental observational quantitative methods allow the researcher to track the effects of complex adaptive systems on variables of interest. However, to determine which variables reflect the most important factors, qualitative research is necessary. Therefore, we will use a mixed-methods research approach: qualitative research methods (comparative multiple case study methods and group methods) and quantitative survey methods and analysis of secondary database indicators determined by the results of the qualitative results.

Case studies

Case study is now recognized as an important research approach for agricultural systems (Abatekassa and Peterson, 2011; Bitsch, 2005) and in the social sciences (Yin, 2014). Today, numerous agricultural journals publish several case studies every year. The cases developed here will primarily be used to generate and inform hypotheses for our quantitative research process and to explore issues not readily accessible through quantitative methods.

Few published cases have involved study of integrated production, processing and marketing businesses in the South. One recent example is the Maumbe and Brown (2013) study of Acres of Land winery in Kentucky. Kentucky along with North Carolina, Virginia and South Carolina have been hotbeds of entrepreneurial agricultural activity in the last 20 years. One prominent 2015 index put two of the Southern states (South Carolina and Virginia) in the top half of all US States in presence of local food systems. North Carolina was 28th, Kentucky 29th and the other nine Southern states are ranked in the lowest 11 states. All the lowest ranking Southern states are decreasing yearly relative to the rest of the nation, according to this index. Those four high ranking states are also similar in geography and demography to regions of three Southern states (AR, TN, and MS) which have not experienced high levels of creation.

We used standard case recruitment and selection methods (Lauckner et al., 2012) to choose the subjects for our case studies. In addition to being from one of the three states with low LOVA creation (AR, TN and MS), the primary selection criteria were that the enterprise must integrate sustainable production, processing and marketing, must have lasted for a minimum of five years, must have arisen and be located in an area where few such enterprises (also known as locally-owned value-added enterprises or LOVAs) have developed, and must be whole-heartedly willing to participate in all aspects of the study.

A multiple case study design was chosen to study our topic from several perspectives and contexts (Yin, 2014). We examined systems in four regions where integrated agricultural system managers worked independently in different contexts and communities, providing the opportunity to identify common and distinct processes.

We used a case study protocol that outlines the key information to be gathered from each case and primary sources (Yin, 2014). Initial issues for exploration were extrapolated from project leaders' experience, previous ecological resilience research, and related literature. These initial issues were points of departure to guide interview questions and preliminary analysis. The initial researcher-identified issues evolved and be influenced by issues raised by the study's participants. Particular issues were developed and explored in each case to guide data collection and analysis for the individual case descriptions. The emerging issues from each case were then examined to identify shared issues, which then directed the cross-case analysis. Regularly revisiting and refining these issues during data collection and preliminary analysis provided an emergent theoretical structure from the data collection processes.

As is consistent with case study design, data collection methods in this study included in-depth semi-structured interviews, document review, direct observation and participant observation. Information was gathered from the inception of the initiative to the time of data collection in order to capture process changes.

Data analysis occurred in two stages following the method of Eixenhardt.[400] Stage 1 involved the independent, in-depth analysis of each case. Stage 2 involved a cross-case analysis of the four cases. In stage 2, each case's main processes were compared to explore how different contexts and processes varied across the cases. The key issues that are identified for each case (as described previously) were re-examined to distill common issues that were addressed differently across the three cases. Finally, case-specific issues were identified that affect all cases.

The cross-case model were used to select secondary data to analyze and questions to ask in survey. Participants reviewed the questions included in the original SOS survey and were engaged in a process of refining and expanding the survey instrument and making recommendations for secondary database indicators.

Case studies were finalized after each case has been reviewed by as many active practitioners as possible. This process enabled refinement of concepts and relationships from all cases. These cross-case processes will develop a theoretical framework applicable to all cases.

Nine case studies of resilient local food systems in Tennessee, Arkansas and Mississippi were developed and analyzed in the context of the frameworks noted above--resulting in the indicators of the eight qualities of ecological resilience.

[400] Eisenhardt, K. M. (1989). Building theories from case study research. *The Academy of Management Review, 14*(4), 532-550.

Survey

The case study process tested the original questions of the first State of the South survey[401] and developed new questions addressing issues and trends emerging since 1995.

A robust survey instruments was constructed using standard methods to compare results from 1995 and explore new areas. The design and administration of the questionnaire was informed by the Tailored Design Method developed by Dillman et al. (2008). Particular attention was directed toward having a survey instrument that can be answered by both farmers and agricultural and natural resource professionals.

With assistance from Kentucky State University, State Cooperative Extension Services, State Farm Bureaus, NRCS, SSAWG and National Sustainable Agriculture Coalition, we compiled a list of target respondents' email addresses. We also contacted all these organizations representatives in the 13 Southern States to enlist their support in recruiting participants via their own email distribution lists. This convenience and snowball approach was not intended to represent all farmers, resource professionals, etc. Instead, the focus was to gain input from those stakeholders interested in having their perspectives included in developing priorities and recommendations for agrifood system resiliency.

Through the University of Mississippi Center for Population Studies, we managed the survey using Qualtrics. This online survey platform allowed us to manage the sample, monitor completion rates, send out invites, reminders, etc. It also provided data immediately in Excel and SPSS compatible formats. Results were tabulated and made available to the participants.

A total of 1,491 people clicked on the survey link and started the questionnaire by answering the "18 years or older" question. Of those, 587 (39.4%) respondents answered what state they lived in. Because of the importance of identifying geographic patterns in the survey data, much of the analysis presented in the report is focused on those respondents. All of the states targeted for this survey were represented in the final database. The highest percentages of respondents were from Kentucky (15.0%), North Carolina (13.6%), and Mississippi (12.1%).

Secondary databases

Indicators from publicly accessible databases were selected which reflected levels of each of the qualities of resilience defined by integrating eight case studies of resilient local food systems in recalcitrant areas of the Southern U.S. with previous frameworks for assessing resilience. Aggregate county-level data were accessed from the following data sources: 2012 and 2007 National Census of Agriculture, 2010 Decennial Census, American Community Survey 2012 Five-Year Estimates, Winkler et al. Net Migration Patterns for US Counties, County Health Rankings, 2013 USDA Food Atlas, USDA Farm to School Database; and a Meat Processing Facilities Database assembled by Jody Holland, at the University of Mississippi.

[401] Worstell, J., 1995. Southern Futures: Opportunities for Sustainable Agricultural Systems. Almyra, AR: Delta Land & Community. pp. 161-163. http://mysare.sare.org/mySARE/assocfiles/483Southern%20Futures.pdf

The total number of counties is 1344 in the 13 state Southern Region as designated by USDA: Alabama, Arkansas Florida Georgia Kentucky Louisiana Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia. Forty counties were treated as missing due to insufficient data on number of farm operations in either 2007 or 2012. All other missing values were in the index were counted as 0. Final analysis was based on 1304 cases (counties) and 1302 when the assets measure was included.

All percentages were transformed to z-scores. Multi-variable indicators were calculated by summing z-scores across component variables. Z-scores were then ranked (higher scores have higher ranks) by county across the entire region. Ranks were then recoded into quartiles for analysis and mapping: Because of low organic certification rates, this variable was only ranked in two categories. On color maps the quartiles were organized as: very low (red), low (orange), moderate (yellow), and high (green). These were later transformed to blue scale (from light to dark) to assist people with color blindness and to make patterns distinguishable when the maps are printed in black and white.

Indicators were selected from the available databases which matched the eight qualities derived from integrating the eight resilient local food system case studies with the ecological resilience literature. Numerical values for each county for each of the eight resilience qualities were obtained using the following variables from the above data sources.

Locally self-organized

Data on three variables were used to calculate scores for locally self-organized: local farm management, and locally-organized community marketing and processing. Local farm management was measured by one variable: % of principal operators living on farm. Locally-organized on-farm processing and marketing was composed of three indicators (alpha = .739): % operations with on-farm packing; % operations with direct marketing to retail; and % operations with community supported agriculture. Locally-organized community marketing and processing was composed of a cumulative score of meat processing facilities, farmers markets, and farm to school programs.

Ecological integration

Data from four variables were used to calculate Ecological Integration scores. A low chemical input index (alpha = .759) was created from two variables, % agricultural land not treated with herbicides and % agricultural land not treated with insecticides. Acres of crop land was the denominator. The numerator for insecticides excludes treatment for nematodes.

The two other variables included were organic practices (% operations certified organic) and the ecologically integrated practice off management intensive/rotational grazing (% operations practicing management intensive/rotational grazing).

Modular connectivity

Only one indicator was available in county level databases which addressed connectivity: % operations with internet access. None addressed modularity.

Building physical infrastructure

The only available county level data relevant to the Building Assets quality was financial value of machinery. Percentage change in the value of farm machinery between 2007 and 2012 comprised this indicator.

Responsive redundancy

Scores for this quality were obtained by integrating data from two variables. First variable was average age of farm operator: First each county was given a score of the % of the highest average age in the region (68.7). Then these scores were reverse coded for lower average ages to have higher scores on the final indicator based on the assumption that younger farmers provided greater redundancy. Second variable was % decrease in number of farm operations between 2007 and 2012. Scores were reverse coded such that counties with lower percent decrease had higher scores.

Complementary diversity

No county level data were available to reflect complementarity of diversity, so scores for this quality reflect only diversity. Diversity at the county level was derived from three indicators: row crop diversity (average percent of operations producing across seven different row crop options); vegetable production (percent of operations with vegetables harvested) and livestock production (percent of operations with livestock sales).

Conservative innovation

A number of variables indicated conservative innovation but they also are indicators of other qualities. We did not include them in calculations of the resilient index since we didn't want the index to be heavily influenced by repetition of one variable. As the farm scale index is developed, indicators specific to this quality are available and will be incorporated.

Periodic transformation

At the county level, transformation can only be measured as innovation. No direct measures of transformation are possible. As the farm scale resilience index is developed, the transformation quality will be measureable. However, since this study was focused on county level data, no specific measure of transformation was possible.

Summary Sustainability/Resilience Index (SRI)

All individual variable values were converted to standardized values (z-scores) using the southeastern region as a whole as the base. Multi-variable indicators were calculated by summing z-scores across component variables. An overall summated "Sustainability/Resilience Index (SRI) was then constructed, adding the standardized scores across all of the separate indicators, and then the final index was standardized.

Thirteen standardized scores were summed to create SRI:

1. Principal operator lives on farm (1 variable)

2. Farmer alternatives(3 variables combined into one indicator)
3. Community alternatives (3 variables combined into one indicator)
4. Financial value of machinery (1 variable)
5. Average age of farm operator (1 variable)
6. Stability-change in number of farms (1 variable)
7. Row crop diversity (7 variables combined into one indicator)
8. Vegetable production (1 variable)
9. Livestock production (1 variable)
10. Low chemical input (2 variables combined into one indicator)
11. Organic practices (1 variable)
12. Management intensive/rotational grazing (1 variable)
13. Internet connectivity (1 variable)

It is important to note that the SRI was not conceptualized to be equivalent to a scale where multiple indicators would be expected to be highly inter-correlated, each one measuring relatively the same concept and thereby serving as indicators of some broader latent construct. Instead, this index combined a range of indicators that were: a) not expected to be highly correlated, and that b) were better thought of as causes of or contributors to a latent construct, that is "sustainability/resilience" of a specific system.[402]

Methods for demographic and socioeconomic variables

In order to identify the demographic and socioeconomic factors that statistically associate with the sustainability/resilience index, additional indicators were added to the analysis. These included total population as measured through the 2010 Decennial Census. This was based on the assumption that more highly populated areas would likely be able to support more markets and alternative practices. Total net migration between 2000 and 2010 was included from the perspective that places with high levels of out-migration might have trouble supporting local markets and that net out-migration serves as an indicator of a place in somewhat of a downward socioeconomic spiral. Finally, the percent of adults 25 years and older with a college degree and the percent of the families living below poverty according to 2012 ACS five-year estimates (data drawn from 2008 through 2012) were used because these are widely used measures of the general socioeconomic conditions of an area.

Methods for health measures

Two general health measures were used for this study to explore the connection between sustainability/resiliency and health status. One measured focused on adults' self-rated health, and the other concerned maternal and child health in the form of low birth weight rate. These are common population health measures used in the literature, both domestically and internationally.

[402] For more information on this issue of differentiating between scales and indices, see: Bollen, K., & Lennox, R. (1991). Conventional wisdom on measurement: A structural equation perspective. Psychological Bulletin 110(2), 305-314.

County-level self-rated health estimates were obtained from 2014 University of Wisconsin/Robert Wood Johnson Foundation County Health Rankings Program, drawing on 2012 five-year aggregated data collected by the Centers for Disease Control and Prevention Behavioral Risk Factor Surveillance System (BRFSS) survey.The original telephone (landline and telephone) survey question asked respondents age 18 years of age and older to rate their health on a five-point scale ranging from poor to excellent. For the county-level estimates, responses were combined in the poor and fair categories to reflect overall poor health.

County-level low birth weight rate data were obtained from the National Vital Statistics System-Natality (NVSS-N) section, drawing from the Centers for Disease Control and Prevention, National Center for Health Statistics (CDC/NCHS), and state departments of health. Pooled data from 2011-2013 measured the percentage of live births with birth weights of less than 2,500 grams (5 lbs, 8oz). These were standardized into rates per 100 live births.

Analyses of the association between sustainability/resiliency and these health outcomes should be interpreted with caution. The relationships should not be viewed as causal, because the health data were drawn from aggregated time periods that include some years before and overlapping with the times in which local agrifood system resiliency data were obtained. Instead, the patterns should be viewed as suggestive for future analysis as more recent health data become available.

Methods for integrating resilience index and demographic and socioeconomic variables

Analysis of the relationship between the resilience index and the demographic and socioeconomic variables were not focused on causality. This would be difficult, especially since the data from both domains were collected from relatively the same time periods. Instead, analysis was focused on identifying if patterns existed between the variables. Association and correlation were measured through the use of two statistically tools. Spearman's rho was used to measure the association of the continuous standardized scores. A non-parametric measure of correlation on ranks between variables, rho ranges from -1 to +1, with 0 representing no association. Gamma was used to measure the association between variables when they were recoded into quartiles. Gamms also ranges from -1 to +1.