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Cultural Ecosystem Services of Agroecosystems Along the Wasatch Front, Utah

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CULTURAL ECOSYSTEM SERVICES OF AGROECOSYSTEMS ALONG THE WASATCH FRONT, UTAH

by

Tiffany K. Woods

A thesis submitted in partial
fulfillment of the requirements for the degree

of

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in

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ABSTRACT

Cultural ecosystem services of agroecosystems along the Wasatch Front, Utah

by

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Agroecosystems, including peri-urban systems, are important providers of a range of services. However, management of these systems has generally been based on the market value of crops, neglecting to capture the broader public goods that ecosystem services provide to stakeholders. While the ecosystem service framework (Millennium Ecosystem Assessment [MEA], 2005) has been adopted to measure the market and non-market values associated with these services, knowledge gaps persist, particularly with respect to the quantification and valuation of cultural ecosystem services (CES). In this paper, the determination of CES values assigned to agroecosystems by residents of two communities along the Wasatch Front, Utah are explored through a randomly administrated survey designed to characterize and quantify CES. Descriptive statistics indicate that participants are motivated to visit farmland or rangeland because of their associated CES values. A principal component analysis is used to categorize specific CES values into factors representing 'multifunctional' cultural amenities and 'traditional' rural amenities. The clustering of CES values corroborates findings from other studies

concerning multifunctional and traditional agricultural land-use preferences. OLS regression models subsequently reveal statistically significant relationships between multifunctional cultural amenities and religious affiliation and farming history. The regression models also uncover statistically significant relationships between traditional rural amenities and household income and community classification. Finally, our survey instrument demonstrates that while we are able to evaluate the range of commonly recognized CES categories, additional research is needed on lesser-studied CES (e.g. spiritual and inspirational values) and synergies among different CES (e.g. interconnected relationships between aesthetics and recreation) before their quantification can be standardized. However, this research demonstrates that CES values are ever-present in agroecosystems and can be integrated in peri-urban and agricultural land management and planning with existing CES knowledge.

(83 pages)

PUBLIC ABSTRACT

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Agroecosystems, including peri-urban systems, are important providers of a range of services. However, management of these systems has generally been based on the market value of crops, neglecting to capture the broader public goods that ecosystem services provide to stakeholders. While the ecosystem service framework (Millennium Ecosystem Assessment [MEA], 2005) has been adopted to measure the market and non-market values associated with these services, knowledge gaps persist, particularly with respect to the quantification and valuation of cultural ecosystem services (CES). In this paper, the determination of CES values assigned to agroecosystems by residents of two communities along the Wasatch Front, Utah are explored through a randomly administrated survey designed to characterize and quantify CES. Descriptive statistics indicate that participants are motivated to visit farmland or rangeland because of their associated CES values. A principal component analysis is used to categorize specific CES values into factors representing 'multifunctional' cultural amenities and 'traditional' rural amenities. The clustering of CES values corroborates findings from other studies concerning multifunctional and traditional agricultural land-use preferences. OLS regression models subsequently reveal statistically significant relationships between multifunctional cultural amenities and religious affiliation and farming history. The regression models also uncover statistically significant relationships between traditional rural amenities and household income and community classification. Finally, our survey

instrument demonstrates that while we are able to evaluate the range of commonly recognized CES categories, additional research is needed on lesser-studied CES (e.g. spiritual and inspirational values) and synergies among different CES (e.g. interconnected relationship between aesthetics and recreation) before their quantification can be standardized. However, this research demonstrates that CES values are ever-present in agroecosystems and can be integrated in peri-urban and agricultural land management and planning with existing CES knowledge.

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CHAPTER I

INTRODUCTION

Agroecosystems comprise nearly 45% of the United States' total land area (The World Bank, 2020). These systems continue to suffer increasing pressure as competition for land intensifies (Smith et al., 2010). While agricultural lands are at the highest risk of residential conversion, peri-urban landscapes (e.g. semi-agricultural landscapes) are of particular concern because they are undergoing rapid transformation due to suburbanization currently driven by amenity-related migration and low-cost housing (Ives and Kendal, 2013; Narducci et al., 2019). These landscapes are often recognized as cultural landscapes because they are directly and visibly shaped by human-nature interactions (Tengberg et al., 2012). Agroecosystems (including peri-urban systems) are chiefly managed for the provisioning of food, forage, and fiber, but are important providers of a range of ecosystem services (Power, 2010; Swinton et al., 2007), including the cultivation and maintenance of particular community identities and areas of cultural significance (Howley et al., 2012). To support sustainable rural planning and land management for these rapidly changing landscapes, it is critical to appropriately characterize the tangible and intangible services and benefits they provide.

The ecosystem service (ES) framework aims to identify and quantify the market and non-market values of environmental amenities (Seppelt et al., 2011), thus providing an opportunity to improve on the way agroecosystems are characterized and ultimately managed. The ES framework was first introduced by Daily and Ellison (2002) and formalized by the Millennium Ecosystem Assessment (MA, 2005). The MA (2005) sorts

ES into four primary categories: provisioning (e.g., production of food and fiber), supporting (e.g. nutrient cycling, habitats), regulating (e.g. water purification, climate regulation), and cultural services. The four MA ES categories are not equally represented in agricultural ES research, resulting in the identification and, often, enhancement of a select number of services and benefits, which, in turn, omits the importance of other ES categories (Plieninger et al., 2013). There is an abundance of research concerning agroecosystem provisioning services because mechanisms are already in place to measure crop and livestock productivity (Power, 2010; Rewitzer et al., 2017). Also, a growing body of scientific literature concerns the supporting and regulating services of agroecosystems (Kazemi et al., 2018; Mortimer et al., 2018; Swinton et al., 2007). However, cultural services are generally underrepresented, despite the inherent relationship between social and cultural values and agricultural food production and landscape management (Petway et al., 2020).

Cultural ecosystems services (CES) are widely recognized as the "non-material benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences" (MA, 2005, p. 40). These services emerge from the complex and dynamic relationships existing between people, their social and cultural practices, and the environmental spaces in which they occur (Bryce et al., 2016; Chan et al., 2012a; Fish et al., 2016; Plieninger et al., 2013). CES are culturally specific (Vieira et al., 2018), can be unique to individuals and/or communities (Nahuelhual et al., 2014; Willcock et al., 2017), and produce a range of benefits (e.g. physical, emotional, and mental) that support human well-being (MA, 2005; Raymond et al., 2014).

Although CES research has grown in recent years (Cheng et al., 2019), CES remain the least-studied of the four MA ES categories because they are difficult to quantify and value (Barrena et al., 2014; Cheng et al., 2019; Milcu et al., 2013; Vieira et al., 2018). Valuation methods are limited in their ability to measure CES because CES can be difficult to define or articulate in terms of measurable services, are rarely independent of other ES, are subjective, and may not be generalizable if their relevance is context-specific (Bryce et al., 2016; Gould et al., 2015; Infield et al., 2018; Petway et al., 2020; Satz et al., 2013; Vieira et al., 2018). In addition, CES quantification and valuation can prove problematic if values are perceived as incommensurable or are associated with sacred sites, which could result in stakeholder unwillingness to provide desired information (Klain and Chan, 2012; Satz et al., 2013). Yet there is a growing need to incorporate public valuation of CES in rural planning and the land management decision-making process, particularly in areas incurring high agricultural-to-residential conversion rates (Narducci et al., 2019). Drawing from the ES and CES literatures, we have identified three main justifications for including non-economic CES valuation in agroecosystem management.

First, incorporation of CES valuation could safeguard a range of associated ES from environmental degradation. Land-use and land-cover changes are the predominate drivers of ES alteration, with modifications to natural resource management in cultural landscapes adversely affecting the delivery of critical ES (Tengberg et al., 2012; Vieira et al., 2018). As we continue to untangle ES synergies (also referred to as ES bundles) and the geospatial extent of the transfer of ES benefits, decisions implemented at one scale or in one area may have unintended consequences at other scales or locations (Klain et al.,

2014; Power, 2010). However, CES are under the greatest threat because they are often irreplaceable (Plieninger et al., 2013). According to Plieninger et al. (2013), the fragmentation of larger properties (i.e. farms and rangeland) into residential parcels contributes directly to the diminishment or eradication of many CES. For example, agriculture creates a unique rural aesthetic character, and when developed, this characteristic vanishes (van Berkel and Verburg, 2014). Worse, the cutting of "cultural ties that bind people to ecosystems can lead to the loss of cultural identity and decreased opportunities for enjoying natural and cultural landscapes" (Vieira et al., 2018, p. 183).

Recognizing that agroecosystems are vital suppliers of CES, some researchers are recommending that these landscapes be viewed as public goods as well as a private economic resource (Howley et al., 2012), which in turn necessitates understanding public preferences. According to Howley et al. (2012), the protection and enhancement of the quality of agricultural and peri-urban landscapes is considered as important as food production and security in post-industrial societies. This can be attributed to increases in wealth commonly manifested by rising household incomes and/or gross domestic product, mobility associated with the proliferation of the automobile, which allowed individuals to live further distances between their places of residence and work, and rises in leisure times (Howley et al., 2012; Lopez et al., 1988). In addition, these landscapes may be easier to access by the urban and peri-urban public than other natural areas (e.g., national forests and parks), therefore allowing residents to benefit from ES that they may not otherwise be able to enjoy (Plieninger et al., 2015) and potentially increasing awareness of our dependence on nature (Bullock et al., 2018). To maintain CES levels that are desirable to society, decisions need to be based on public as well as private

preferences, and incentives need to be provided to agricultural land managers (Barrena et al., 2014; Swinton et al., 2007). CES valuation is essential to understanding preferences and informing incentive structures.

Second, CES demand, particularly for outdoor recreation, has increased over time in industrialized countries and is anticipated to continue increasing globally (Milcu et al., 2013). Advancements in provisioning efficiency and productivity and the creation of substitute supporting and regulating services could contribute to decreases in human reliance on these ES in comparison to CES (Guo et al., 2010). Examples include the use of levees for flood mitigation rather than maintaining undisturbed wetlands and the application of chemical fertilizers rather than using nitrogen fixing cover crops, though the sustainability of these types of substitute services are controversial (Fitter, 2013). Another explanation is that our collective understating of human well-being has expanded to include the tangible and intangible benefits of experiencing nature (Bryce et al., 2016; Russell et al., 2013). Nahuelhual et al. (2014) observed that in the Western world, CES are frequently ranked ahead of other ES. Although regularly overlooked due to their intangibility and the inherent difficulties associated with their measurement, CES are more accessible and intuitively appreciated by people than other agroecosystem ES (Plieninger et al., 2015; Willcock et al., 2017).

Finally, since CES are a product of individual and community value systems, they can motivate public engagement in the decision-making process and help reduce social conflict often associated with land management decisions. As witnessed in ES research, management of agroecosystems emphasizes the provisioning of marketable goods (Barrena et al., 2014; Power, 2010), even though these landscapes are widely perceived

as multifunctional systems which offer both commodity and non-commodity outputs (Howley, 2011; Ives and Kendal, 2013). The multifunctional attributes of agriculture, particularly the presence of CES, have been identified as an underlying cause of amenity-driven urban-rural migration and rural well-being (Bryce et al., 2016; Bullock et al., 2018; Plieninger et al., 2015). Therefore, CES has enormous potential for generating and maintaining public interest in land management and rural planning decisions (Vieira et al., 2018). Key motivators include the ability of CES to inspire deep attachment to areas (Fish et al., 2016) and bolster human-nature relationships, highlighting what people need and are capable of obtaining from the environment (Cheng et al., 2019).

Additionally, CES valuation can empower planners and policy-makers by allowing them to balance stakeholder demands to utilize material values with demands to maintain environmental amenities in agroecosystems (Infield et al., 2018), potentially ameliorating social and political tensions. CES identification, quantification, and valuation is an intensive process that requires attention to critical social impacts and dynamics (Gould et al., 2015). The measurement of other ES are possible without so much, if any, stakeholder or public participation, potentially overlooking diverse and meaningful perspectives regarding the contributions of ES to well-being and their role in land management (Plieninger et al., 2013; Vieira et al., 2018). For example, van Berkel and Verburg (2014) find that the promotion of tourism and recreation is a preferred rural development option. In their study, if land-use decisions had been based solely upon economic considerations, the preferred alternative would have been overlooked, and the implemented decision would have likely been insufficient in maximizing the community's net benefit from use of the land (Duguma and Hager, 2011). This highlights

the importance of incorporating CES measures and processes in agroecosystem management and planning, largely because agroecosystems have historically been so heavily characterized by production-based ES.

This paper reports on an empirical study designed to advance our understanding of the CES associated with agricultural and peri-urban landscapes, as well as to offer evidence towards the integration of CES quantification and valuation in agroecosystem management and planning. Our study location is in two peri-urban communities located along the Wasatch Front (greater Salt Lake City) in Utah. Our research has an applied aim but also makes a methodological contribution by testing the standardized measurement of agroecosystem CES. The primary objectives of this study are to: 1) Identify how CES associated with agroecosystems are perceived and valued by Utah residents; 2) Investigate the relationship between socio-demographic and socioeconomic factors and identified CES values; and 3) Evaluate the ability of a quantitative questionnaire to measure CES for use in the planning process.

CHAPTER II

MATERIALS AND METHODS

Study Sites

The greater Wasatch Front region is located in north-central Utah, home to 75% of Utah's population and the state's prime arable land (Kem C. Gardner Policy Institute [KCG], University of Utah, 2016). It is currently the third-fastest growing region in the nation (U.S. Census Bureau [USCB], 2019a) and is projected to double in population size by 2065 (Perlich et al., 2017). In anticipation of this unprecedented population growth, we examine use and perceptions of CES in peri-urban agroecosystems, as these represent the areas most often converted to residential and commercial development. We selected the cities of Spanish Fork and Layton, Utah as our study sites because both Wasatch Front municipalities have experienced high rates of population growth and land-use change since 2000, yet they retain large tracts of adjacent agricultural land. In addition, both are positioned near prominent natural features, Spanish Fork Canyon for Spanish Fork and the Great Salt Lake for Layton (see Appendix A for site selection criteria). Both communities were settled in the 1850s and have strong agricultural legacies, although the agricultural sector today only employs 0.5% of the population in Spanish Fork and 0.2% in Layton (USCB, 2019b, 2019c). Finally, these communities are spatially distinct, with Spanish Fork located in the south and Layton in the north of the Wasatch Front region (*Figure 1*).

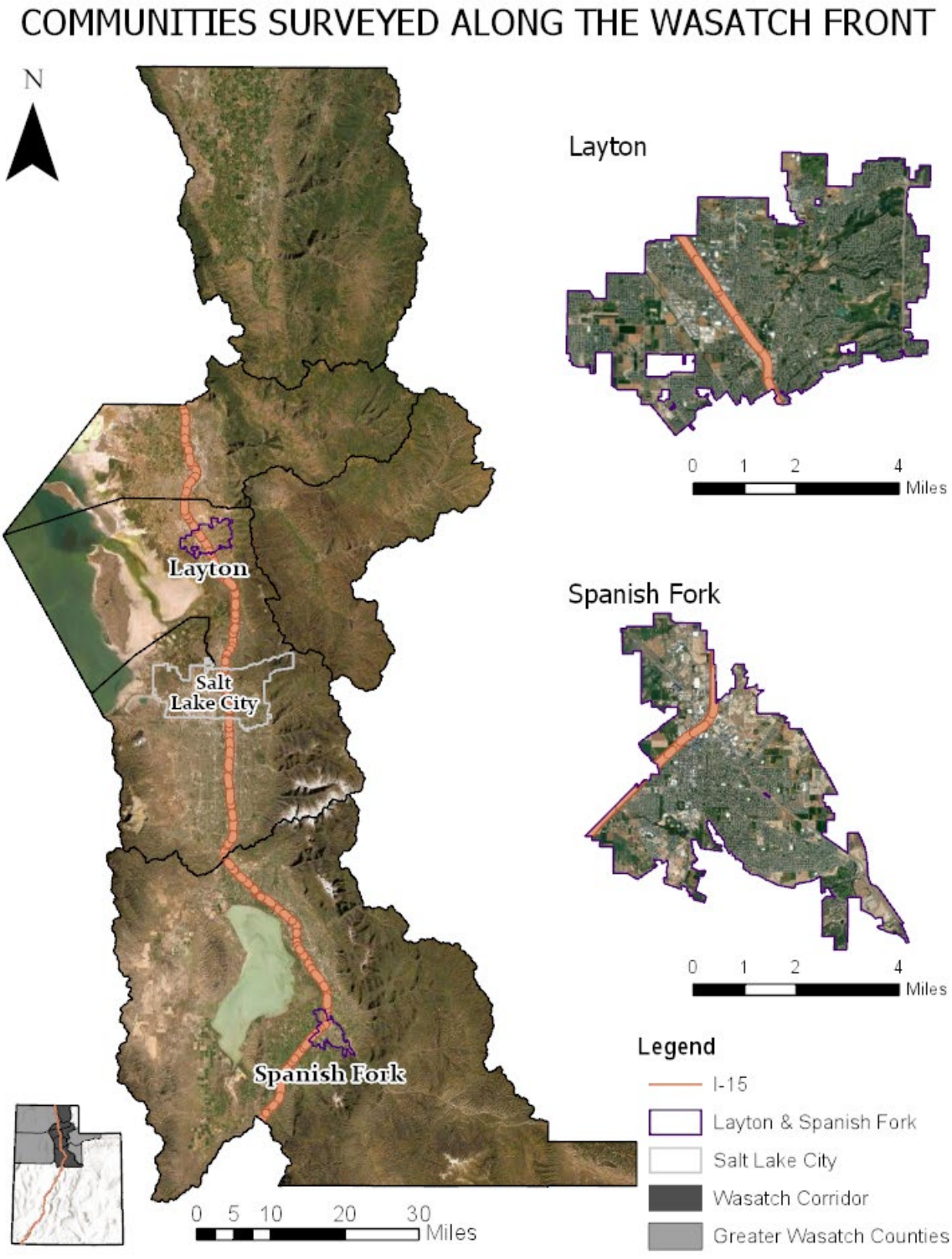

Figure 1. Communities surveyed. The map depicts Spanish Fork and Layton, as well as their positions within the greater Wasatch Front area and Utah.

Spanish Fork, located in Utah County, lies south of Salt Lake City and southeast of Utah Lake. It is the 20th largest city in Utah with a population of approximately 39,961 residents (USCB, 2019b). Between the 2000 and 2010 census reports, the percent change in Spanish Fork's population was 71.3 percent (USCB, 2019b). The city's population is expected to increase by another 80 percent by 2050. Agriculture production is still prominent in Spanish Fork and the surrounding area, as Utah County ranks second in the state for total agricultural products sold, accounting for 11 percent of the state's agricultural sales (NASS, 2017b).

Located north of Salt Lake City and east of the Great Salt Lake, Layton is the largest city in Davis County, with a population of 77,303 (USCB, 2019b). Between the 2000 and 2010 census reports, the percent change in population size was 15.1 percent (USCB, 2019b). The city's population is anticipated to increase by an additional 40 percent by 2050. Even though agriculture is no longer a dominant economic sector, Davis County ranks sixteenth in the state for total agricultural products sold, accounting for one-percent of the state's agricultural sales (National Agricultural Statistics Service [NASS], 2017b).

Between the 2012 and 2017 Census of Agriculture reports, both Davis and Utah Counties witnessed decreases in total farmland and rangeland acres and average parcel sizes: decreases ranging from 6 to 12 percent. These trends are expected to continue with population growth.

Survey Design

Stated preference surveying has been identified as a useful approach for gathering CES information because it is well-suited to the collection of structured data directly from respondents (Raymond et al., 2014; Willcock et al., 2017). The survey instrument developed for this study used a socio-cultural valuation approach to identify and better understand CESs in the cities of Spanish Fork and Layton. Infield et al. (2018) and Gould et al. (2015) have found socio-cultural valuation effective in measuring the importance of CES, although quantitative surveys may be unable to capture all CES values or nuanced perspectives and knowledge regarding these services and their benefits (Gould et al., 2015). To ensure that our survey design elicited a wide range of values associated with agroecosystem CES, we operationalized survey questions, had experts and stakeholders review and revise our survey, and pilot-tested our protocol instrument prior to administration.

Operationalization is an important component of survey design because it separates latent variables (e.g. concepts that cannot be measured directly) into subdomains that can be unpacked into measurable concepts (Dillman et al., 2014, p. 95). For this study, CES were separated into eight operationalization subsets. Six of the subsets were established by the MA (2005), including cultural identity, heritage values, spiritual and religious values, inspiration, aesthetics, and recreation. Educational opportunities and local productivity, as a representation of the relationship between cultural practices and the landscape, were also added, as they are recognized as emerging concepts within CES literature (Chan et al., 2012b; Fish et al., 2016). Following recommendations of Cheng et al. (2019) and Gould et al. (2015), our survey considers the

range of commonly recognized CES categories. CES questions were adapted from Schmidt et al. (2017), as they previously developed comprehensive CES scales that were tested in the European Union. Agricultural landscapes are predominately under private ownership in the U.S.; therefore, the adapted CES scales had to clarify that visiting farmland and rangeland could include time spent driving through agroecosystems or participating in activities adjacent to these landscapes (e.g. on the road).

The first scale, termed motivation scale, aimed to measure respondents' social and cultural motivations to visit agroecosystems. Motivation question statements included one indicator for each CES category. The second scale, termed frequency scale, intended to measure how many times per year each respondent participated in a CES activity in agroecosystems. Indicators (activities) for the frequency scale varied, based on the original scale design (Schmidt et al., 2017) and feedback provided by stakeholders. Answer stems included "more than once a week," "once a week," "once a month," "4-11 times a year," "1-3 times a year," and "never." The concept map in Figure 2 outlines our survey's CES concepts and operationalized question statements (indicators). Standardized demographic and socioeconomic questions, drawn from the U.S. Census American Community Survey (ACS), composed the final section of the survey, but for conciseness are not included in Figure 2 (see Appendix B for the survey instrument).

CES are often context-specific, so experts at Utah State University (USU) and stakeholders at Envision Utah, the Bear River Association of Governments, the Utah Rural Planning Group, and the Agricultural Land Preservation office at the Utah Department of Agriculture and Food reviewed our survey instrument for relevance and accuracy. Based upon feedback from individuals within these organizations, we added

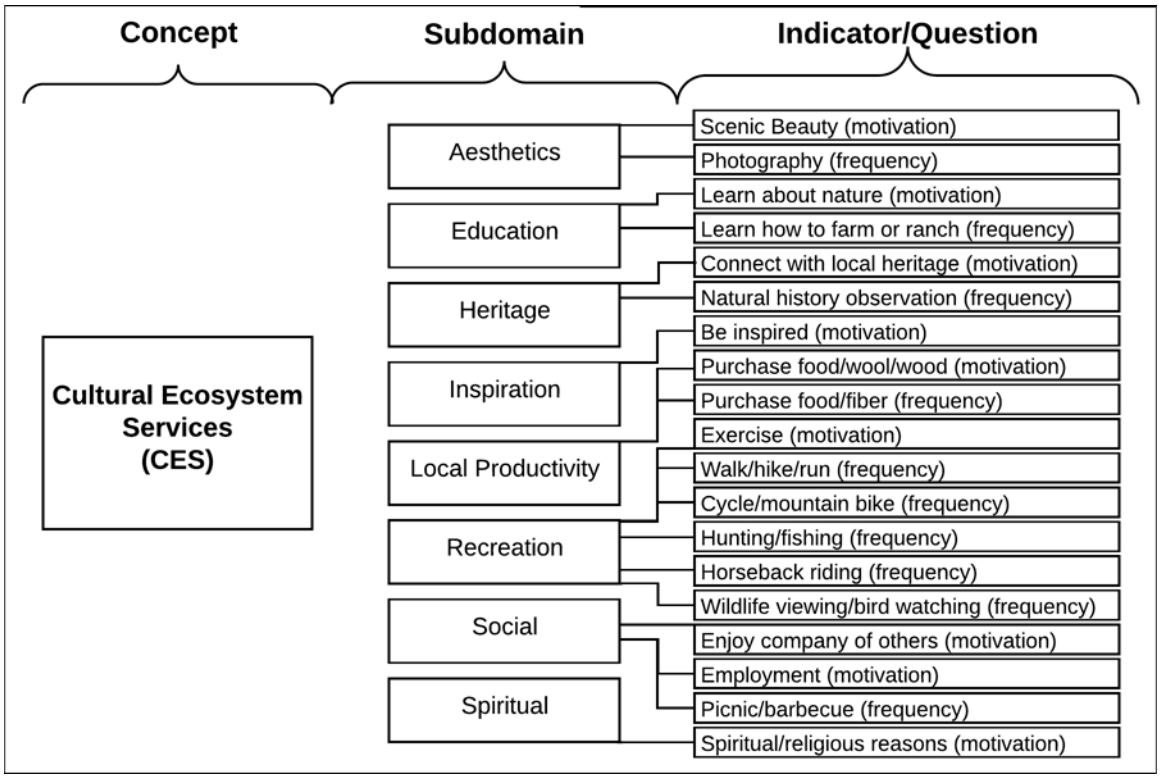

Figure 2. CES concept map. The study concept (CES) is separated into subdomains (CES categories) that are further unpacked into operationalized question stems (indicators) included in the survey instrument. The figure indicates whether the indicator was included in the motivation or frequency scale.

CES question stems associated with employment in the agricultural sector. We also refined our language to eliminate ES scientific jargon and superfluous questions and question stems. This is a useful step in survey development because ES language has been found to encourage respondents to think of these values in the context of provider-recipient relationships (Gould et al., 2015), and scientific jargon can discourage respondents from participating in a study (Dillman et al., 2014). Additionally, the removal of unneeded questions can minimize survey response bias because respondents are less likely to satisfice their responses (Dillman et al., 2014).

We piloted a web version of the survey instrument, created in Qualtrics, with graduate students and professors at USU. This round of testing was essential for flagging potential design flaws and informing any needed final revisions to the self-administered online survey.

Sampling Method and Administration

To systematically assess CES, multiple-user perspectives are required because relevant socio-cultural values identified solely by experts or stakeholders may differ from the general public (Narducci et al., 2019; Vieira et al., 2018). The survey was therefore administered to a random sample of residents in Spanish Fork and Layton. A simple random sample can facilitate the collection of the range of residents' perspectives, which may not be possible with a convenience sample. Sample frames were developed from residential address point data available through the Utah Automated Geographic Reference Center (AGRC) (2019). A total of 489 households were sampled in Spanish Fork, while 493 households were sampled in Layton. Our sample sizes were initially selected to obtain a precision level ±5% with a 95% confidence level and $p = 0.05$ (1992), but were increased by 25% to account for potentially low response rates (e.g. Grala et al., 2012).

A modified Dillman method (Dillman et al., 2014) was used to accommodate budgetary limitations. Selected households received three invitations to complete an online self-administered survey with the option of completing a print version. A financial incentive was offered in the form of a raffle for a gift voucher to increase response rates. We contacted sample participants between November 25, 2019 and January 3, 2020. Our recruitment materials included two letters, the initial and final mailings, and a reminder

postcard sent between letters. Households were assigned unique identification numbers, and using built-in functionality in Qualtrics, were limited to one submission per household. A total of 29 surveys were completed online from our Spanish Fork sample frame and 37 surveys completed from Layton, resulting in initial response rates of approximately 6% and 8%, respectively.

As a final measure, our study tested for non-response bias to ameliorate the selection bias that is often associated with web-based surveys in rural and peri-urban communities (Smyth et al., 2010). Even though 98.1% of residents in Layton and 97.9% of residents have access to wired broadband of 25 mpbs or faster (USCB, 2019b, 2019c), respondents must be computer-literate to participate in online surveys (Willcock et al., 2017). For this project, we only tested for non-response bias in Spanish Fork, due to resource limitations. Following Grala et al. (2012), we randomly sampled a subset of non-respondents, but instead of contacting households by phone, we distributed self-administered surveys using the drop-off pick-up method (DOPU) in early February 2020 (Trentelman et al., 2016). The DOPU method has been successful at garnering high response rates in Utah, though it can be cost-prohibitive for large geographic areas (Trentelman et al., 2016). Over two days, a team of 5 researchers were able to collect an additional 26 surveys, bringing our final response rate up to 11% for Spanish Fork.

Data Analysis

Collected responses were analyzed in SPSS version 26 and Microsoft Excel. We generated descriptive statistics and frequency tables for all socio-demographic, socioeconomic, and CES variables, then compared these with the ACS 5 year average published in 2018 (Manson et al., 2019) to determine if respondents were representative

of our study sites and general CES motivations and frequency. A Pearson's chi-square test and Mann-Whitney U test were first used to detect differences between respondents that submitted their survey online and those that submitted during the non-response DOPU testing phase in Spanish Fork. Later, the same tests were used to detect differences in responses between Spanish Fork and Layton. A Pearson's chi-square test was selected as the level of measurement for most close-ended questions that were nominal or ordinal. A Mann-Whitney U test analyzed age, a continuous variable, and ordinal variables.

A factor analysis using a Principal Component Analysis (PCA) with varimax rotation was then employed on statements designed to capture CES motivations and reveal underlying CES value structures. Underlying structures are represented by factors, which are created by transforming original observations into a new set of variables using the eigenvectors and eigenvalues calculated from a covariance matrix (Firmin, 2019). Resulting factors have a continuous level of measurement (Field, 2017). A PCA was suitable for our data, as our scale was composed of nine statements, and we obtained n=90 (Field, 2017). The number of factors were determined by an eigenvalue greater than 1 and confirmed with scree plots. The pairwise deletion function in SPSS was applied because our dataset had minimal missing values (missing n=2). The factor analysis resulted in two unique factors we identified as 'multifunctional' cultural amenities and 'traditional' rural amenities.

The two factor variables were standardized and examined in separate OLS regressions, with selected socio-demographic and socioeconomic variables entered as predictor variables (see Appendix C for regression suitability). All predictor variables

were categorical, therefore dummy variables were created for entry in the regression models. Dummy socio-demographic and socioeconomic variables specify participants' sex, age, religious affiliation, education attainment, and income. For the age variable, respondents were classified as under 55 or 55 and older. The age of 55 was determined as a suitable threshold because it lies between the average age of the American farmer (58) and the average age of beginning farmers (47). The majority of adult residents in Spanish Fork and Layton are affiliated with the Church of Jesus Christ Latter-day Saints (Church of Jesus Christ), therefore participants were classified as being affiliated with the Church of Jesus Christ or not. Higher education attainment and higher income classes have been found to determine environmental preferences (Howley, 2011; Ives and Kendal, 2013; van Zanten et al., 2016). As a result, respondents were classified as either not having a degree or having an Associates degree or higher. Two income variables were created to represent Utah's middle-class income earners (*IncomeA* = US$50,000-US$99,999) and higher income earners (*IncomeB* = US$100,000-higher), while respondents with an annual household income of less than $50,000 were the reference condition.

Following Howley (2011), the remaining predictor variables concerned respondents' farming histories and community classification. Respondents were classified as having a family history of farming or not. Respondents were able to self-identify their community type (rural, suburban, or urban), as both study sites have urban centers with peri-urban and rural areas on the outskirts. The reference condition was the rural community classification.

CHAPTER III

RESULTS

Our results suggest that CES of agroecosystems are valued in Spanish Fork and Layton. Respondents overwhelmingly indicated that a minimum of one CES category motivated them to visit farmland and rangeland, and they also nearly all participated in at least one CES activity in these landscapes on an annual basis. After identifying underlying CES structures, OLS regression models revealed that religious affiliation, household income, farming history, and community classification were predictors of CES value structures. Responses from an open-ended prompt in the contextually adapted motivation scale from the European Union indicates that existing CES knowledge can be integrated in peri-urban and agricultural land management and planning in post-industrial societies, even if CES knowledge gaps still exist.

Socio-demographic and socioeconomic characteristics of respondents

A Pearson's chi-square test indicated that there was no statistically significant difference between online and DOPU respondents in Spanish Fork in terms of gender ($\chi^2(1) = 0.121$, $p = 0.728$), education ($\chi^2(5) = 5.003$, $p = 0.416$), religious affiliation ($\chi^2(3) = 1.396$, $p = 0.706$), race/ethnicity ($\chi^2(3) = 2.038$, $p = 0.565$) or annual income ($\chi^2(4) = 7.431$, $p = 0.115$) (Table 1). A Mann-Whitney U test confirmed the Pearson's chi-square findings and also revealed that age for online respondents did not significantly differ from DOPU respondents, $U = 287.500$, $p = 0.265$ (Table 1). These results suggest that the null hypothesis of no relationship existing between survey-administration approach and survey responses cannot be rejected. Table 2, however, demonstrates that our DOPU

Table 1. Results from the Pearson's chi-square test and Mann-Whitney U test. Results indicate independence between survey administration method and site.

Grouping Variable	Variable	Level of Measurement	Pearson's Chi-square			Mann-Whitney U		
			Value	df	Sig.	U	Sig.	
Method	Gender	Nominal	0.121	1	0.728			
	Age	Continuous				287.500	0.265	
	Race/Ethnicity	Nominal	2.038	3	0.565			
	Religious Affiliation	Nominal	1.396	3	0.706			
	Housing Classification	Nominal	0.946	1	0.331			
	Education*	Ordinal	5.003	5	0.416	346.000	0.941	
	Annual Income	Ordinal	7.431	4	0.115	335.000	0.765	
Site	Gender	Nominal	3.717	1	0.054	**		
	Age	Continuous				823.000	0.196	
	Race/Ethnicity	Nominal	5.669	5	0.340			
	Religious Affiliation	Nominal	0.908	3	0.823			
	Housing Classification	Nominal	0.693	1	0.405			
	Education*	Ordinal	10.504	5	0.062	**632.000**	**0.003**	***
	Annual Income	Ordinal	5.716	5	0.335	738.000	0.091	

* Education could be nominal as we included answer stems "some college" and "post bachelors degree" which included a certificate.

** Approaching significance threshold ($p < 0.05$)

*** Reject Mann-Whitney U Null Hypothesis

respondents were slightly more representative of the target population regarding gender and age. Of respondents that completed the survey online, a total of 61% of respondents were female and 21% were 65 years and older. DOPU respondents were alternatively 56% female and only 8% were 65 years and older. Both groups of participants were within 3 percentage points of the target population's race/ethnicity (93% White/Caucasian) and earned a median household annual income of US$75,000. Greater differences were recorded for education, religious affiliation, and home ownership. More respondents had a bachelor's degree or higher than residents for both methods (46% and 44% versus 32%), though a lower percentage of DOPU respondents completed high school (83% versus 94%). Fewer respondents overall (79% and 79%, respectively) were

Table 2. Summary of sociodemographic and socioeconomic characteristics of Spanish Fork and Layton participants compared with the ACS 5-year average (Manson et al., 2019). Data for respondents that submitted their surveys online and during the DOPU testing phase in Spanish Fork are indicated accordingly.

	Spanish Fork			Layton	
	Online Survey	DOPU	ACS 2018	Online Survey	ACS 2018
Sex (n=28; n=25; n=37)					
Female	61%	56%	49%	38%	50%
Age (n=28; n=25; n=37)					
Persons 55 years and over	21%	8%	6%	30%	9%
Race (n=28, n=24; n=37)					
White	93%	92%	94%	95%	87%
Other	7%	8%	6%	5%	13%
Religion (n=28; n=24; n=37)					
Church of Jesus Christ	79%	79%	93%	76%	78%
Housing (n=28; n=26; n=37)					
Owner Occupied	96%	100%	76%	100%	72%
Education (n=28; n=25; n=37)					
High school grad or higher	97%	83%	94%	100%	94%
Bachelor's degree or higher	46%	44%	32%	78%	33%
Income (n=27; n=26; n=35)					
Median HH Income	$ 75,000	$ 75,000	$ 74,554	$ 125,000	$ 74,888

affiliated with the Church of Jesus Christ than the target population (93%), and a greater percentage of respondents (96% and 100%, respectively) owned their place of residence, whereas only 76% of Spanish Fork residents own their place of residence.

In contrast, there were fewer female respondents for Layton (38%) (Table 2). There were relatively more respondents 65 years or older (30%) and slightly higher percentages of White respondents (95%), homeowners (100%), and high school and college graduates (100% and 78%) than Layton residents. In addition, the average median household income of US$125,000 exceeded the target population median of US$74,888. Participants (76%) affiliated with the Church of Jesus Christ were anticipated.

All Spanish Fork participants (e.g. online and DOPU) were combined, then compared with Layton participants in a second Pearson's chi-square test (Table 1).

Results indicated that there was no statistically significant difference in regards to education ($\chi^2(5) = 10.504$, $p = 0.062$), religious affiliation ($\chi^2(3) = 0.908$, $p = 0.823$), race/ethnicity ($\chi^2(5) = 5.669$, $p = 0.340$), or annual income ($\chi^2(5) = 5.716$, $p = 0.335$). Though not statistically significant, gender did obtain a value close to the $p = 0.05$ threshold at $\chi^2(1) = 3.717$, $p = 0.054$. Results from a second Mann-Whitney U test indicated that age for Spanish Fork respondents did not significantly differ from Layton respondents, $U = 823.00$, $p = 0.196$ (Table 1). It also reaffirmed findings from the Pearson's chi-square test, that there was an overall lower level of educational attainment among the Spanish Fork respondents. Based on the Mann-Whitney U results, the null hypothesis would be rejected for education, as a statistically significant relationship was found between education attainment and site, $U = 632.00$, $p = 0.003$. However, as education was only found to have a statistically significant relationship with site in one of the two independent tests utilized, the dataset was not split by site for comparative purposes in the factor analysis and subsequent regressions. Results from the Pearson's chi-square and Mann-Whitney U test also revealed that observations did not need to be analyzed independently by survey administration method.

Social and cultural values of agroecosystems

The survey included two scales to measure CES motivations and frequency (Survey Design section 2.2). The motivation scale intended to determine which CES categories influenced respondents' interest in visiting agroecosystems. Only one respondent in Spanish Fork and one in Layton stated that CES were not motivators for them to visit farmland or rangeland. Another respondent in Layton marked unsure on all motivation question stems.

As shown in Figure 3, aesthetics (roughly 95% and 84% for Spanish Fork and Layton, respectively) were rated as the greatest motivator to visit farmland or rangeland, followed closely by inspiration (80% and 73%). For Spanish Fork, heritage and social opportunities (e.g. the enjoyment of the company of others) tied as the third most important motivator at 69%, followed by recreation (62%), local productivity (53%), educational opportunities (52%) and spiritual or religious values (32%) connected to

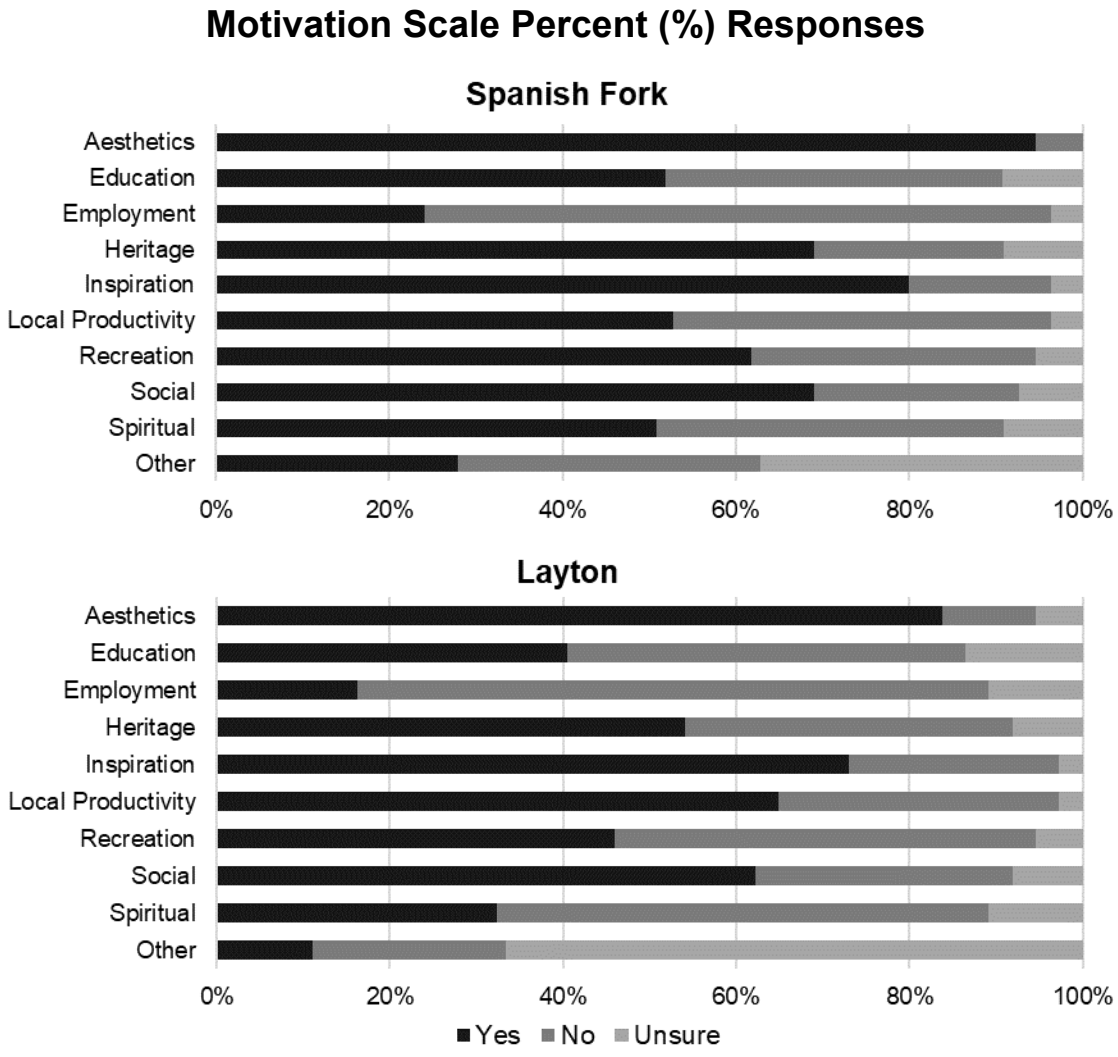

Figure 3. Percent responses by site and answer stem ("yes," "no," "unsure") for the motivation scale.

agroecosystems. Considerably more participants in Layton than in Spanish Fork ranked local productivity (the ability to purchase food, wool, and/or wood) as a motivator to visit farmland or rangeland.

A second scale, termed frequency, was employed to measure the extent to which respondents benefited from CES by providing them question stems to gauge how many times per year they visited farmland or rangeland to participate in CES activities (Figure 4). Only one respondent in Spanish Fork stated that they have never visited farmland or rangeland to participate in CES activities. Five respondents, with one located in Spanish Fork and four in Layton, selected only one CES activity with a frequency ranging from 1-11 times annually. Recreation in the form of walking, hiking, or running was the CES activity that respondents engaged in most frequently at both sites. Roughly 15% and 19% of Spanish Fork and Layton participants, respectively, indicated that they have never taken part in this activity. Wildlife viewing and natural history observation followed walking, hiking, or running as the CES activities participants benefitted from on a frequency of more than once per week. Respondents in Spanish Fork tended to participate in nearly all of the activities on a more regular basis, although respondents in Layton were found to purchase food and fiber from local agricultural lands and travel to these landscapes for natural history observation more regularly. Across sites, horseback riding, learning to farm or ranch, and cycling were the activities that respondents stated they participated in the least.

To ensure that we did not overlook highly valued CES in the survey, the motivation scale provided an “other option,” which, when selected, redirected respondents to a text box allowing them to list additional motivators for visiting farmland

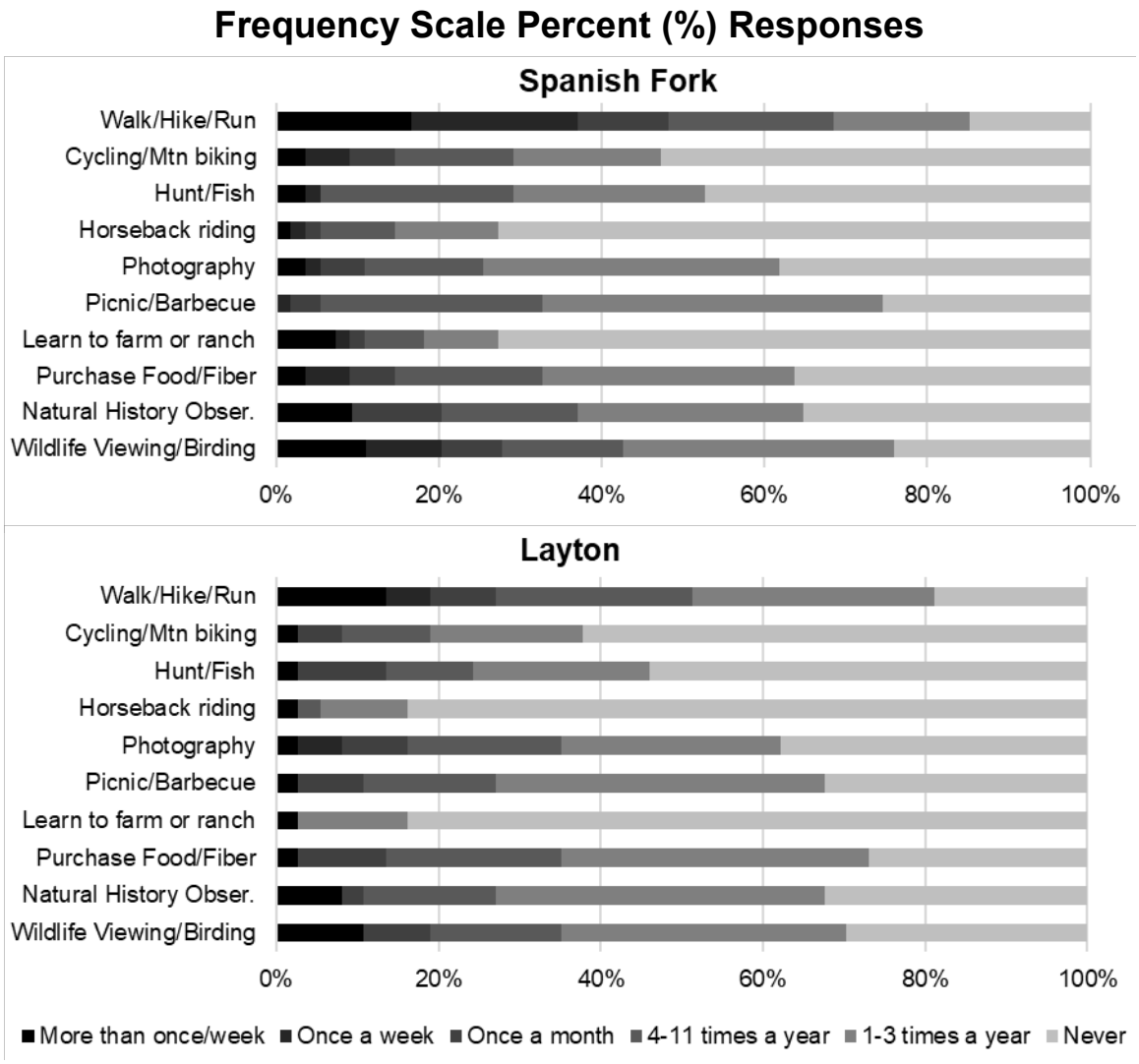

Figure 4. Percent responses by site and answer stem ("more than once a week", "once a week", "once a month", "4-11 times a year", "1-3 times a year", "never") for the frequency scale.

or rangeland. For those selecting the other option, we learned that respondents valued agroecosystems because they support seasonal functions and school field trips (e.g. Halloween mazes, pumpkin patches, etc.), grant access to water resources for recreation, provide mental health benefits (e.g. solace and calming effects), offer foraging for medicinal plants, allow observation or interaction with animals, provide open space, and

give rise to local food self-sufficiency, including the capacity to raise and feed livestock. School field trips and observation or interaction with animals could also be nestled under educational opportunities, as measured by ‘to learn about nature’ or ‘to learn how to farm or ranch’ statements.

Dimension reduction of the motivation scale

Results from the factor analysis of the CES motivation statements are presented in Table 3. The factor analysis resulted in two factors with an eigenvalue > 1, explaining roughly 46% of the variance combined. Aesthetics, inspirational values, social values, and recreation loaded highly with the first factor, termed multifunctional cultural amenities. These results are similar to those obtained by both Plieninger et al. (2019) and Howley (2011), wherein they characterized their first factors as cultural and multifunctional, respectively. Employment, local production, spiritual or religious values, educational opportunities, and heritage values loaded highly with the second factor, termed traditional rural amenities. According to Hellerstein et al. (2002), important rural amenities include the creation of employment opportunities, maintaining local agricultural production, and cultural heritage. Utah’s contextual setting could explain the nesting of the spiritual and educational statement items within the traditional factor; however, these results could differ considerably for regions or communities in the U.S. where land-use and religion are not tightly interwoven. The Wasatch Front has strong historical and cultural ties to the Church of Jesus Christ, as the region was originally settled by church members (Farmer, 2009). Land stewardship and education were, and still are, core values of the Church of Jesus Christ. Joseph Smith and Brigham Young, both important religious figures, promoted the binding of agricultural land-use with

Table 3. Factor loadings for the two CES factors ('multifunctional' cultural amenities and 'traditional' rural amenities). Values greater than 0.5 are bolded.

		Factor 1	Factor 2
CES Categoy	Statement Item	***Multifunctional***	***Traditional***
Aesthetics	To enjoy the scenery	**0.803**	0.047
Inspiration	To be inspired by nature	**0.783**	0.159
Social	To enjoy the company of others	**0.692**	0.059
Recreation	To get exercise	**0.488**	0.361
Employment	For work or employment	-0.011	**0.727**
Local Productivity	To purchase food, wool, wood or other materials	-0.020	**0.714**
Spiritual	For spiritual and/or religious reasons	0.347	**0.502**
Education	To learn about nature	0.377	**0.471**
Heritage	To connect with local heritage (traditions passed down through the landscape)	0.313	**0.456**
Eigenvalues		2.34	1.88
Variance		25.95%	20.90%

Extraction Method: Principal Component Analysis, Rotation method: Varimax with Anderson-Rubin normalization

religion and encouraged church members to learn how to farm (Farmer, 2009). In addition, Ives and Kendal (2013) found educational statements to load highly with multifunctional agroecosystems and food productivity.

Regression results

We examined the factor variables (multifunctional and traditional) derived from the factor analysis in separate OLS regression models to determine the extent to which social and economic considerations affect respondents' amenity preferences. The regression model is formulated as follows:

$$Y_i = b_0 + b_1\text{Sex} + b_2\text{Age} + b_3\text{Religion} + b_4\text{Education} + b_5\text{IncomeA} + b_6\text{IncomeB} + b_7\text{Farm} + b_8\text{Suburban} + b_9\text{Urban}$$

where Y_i represents factor variable i = multifunctional or traditional, *Age* indicates if respondents are 55 and older, *Education* indicates if respondents hold an Associates

degree or higher, *IncomeA* indicates if respondents earn a middle-class income for Utah (US$50,000 - US$99,999), *IncomeB* indicates if respondents earn more than the middle-class income in Utah, *Farm* indicates if respondents have a family history of farming, *Suburban* indicates if respondents identified their community as suburban/peri-urban, *Urban* indicates if respondents identified their community as urban, and *Sex* and *Religion* are as defined in Table 4.

Results for the OLS regressions are presented in Table 4. The results suggest that several socio-demographic and socioeconomic attributes are predictors of agroecosystem CES preferences, and that they vary across factor variables. Religious affiliation (b = -0.636, p = 0.017) and farming history (b = -0.539, p = 0.012) both exhibit negative, statistically significant relationships with the multifunctional factor. In contrast, the typical middle-class income participant exhibits a positive, statistically significant relationship with the traditional factor (b = 0.674, p = 0.031), and both community classification categories, suburban and urban, exhibit statistically significant negative relationships with the traditional factor (b = -0.84, p = 0.012 and b = -1.232, p = -0.011, respectively). Females and higher-income participants show positive and marginally statistically significant relationships with the traditional factor (b = 0.305, p = 0.151 and b = 0.5, p = 0.112, respectively). Lastly, age exhibits a negative and marginally statistically significant relationship with the multifunctional factor (b = -0.319, p = 0.136).

Table 4. OLS regression models exploring socio-demographic and socioeconomic factors influencing CES preferences.

	Multifunctional Model				Traditional Model			
	Coef.	**Std. Err.**	**p-value**		**Coef.**	**Std. Err.**	**p-value**	
Constant	0.459	0.414	0.271		0.343	0.421	0.418	
Sex (female is the reference category)								
Male	-0.116	0.206	0.577		0.305	0.210	0.151	
Age								
Age 55 and older	-0.319	0.212	0.136		0.038	0.216	0.860	
Religion (Church of Jesus Christ is the reference category)								
Other religious affiliation	**-0.636**	**0.262**	**0.017**	**	-0.266	0.266	0.321	
Education (Non-degree holder is the reference category)								
Associates degree and above	0.293	0.228	0.204		-0.131	0.233	0.574	
Income ($49,999 and below is the reference category)								
$50,000-$99,999	0.157	0.300	0.603		**0.674**	**0.306**	**0.031**	**
$100,000 or more	0.350	0.305	0.256		0.500	0.311	0.112	
Farming History (Farming history is the reference category)								
No farming background	**-0.539**	**0.210**	**0.012**	**	-0.169	0.214	0.433	
Community Classification (Rural is the reference category)								
Suburban/peri-urban	-0.362	0.320	0.260		**-0.840**	**0.326**	**0.012**	**
Urban	0.051	0.465	0.913		**-1.232**	**0.474**	**0.011**	**
R^2			0.23				0.200	

** Significant at the 5 percent level

CHAPTER IV

DISCUSSION

Perceptions of social and cultural values of agroecosystems

Our findings confirm that CES is ever-present in agroecosystems (e.g. Fish et al., 2016; Petway et al., 2020; Rewitzer et al., 2017; Schmidt et al., 2017; van Berkel and Verburg, 2014) and valued amongst residents in Spanish Fork and Layton. According to our results (Results section 3), aesthetics and inspiration were the most common motivators for respondents to visit farmland or rangeland in both Spanish Fork and Layton. Other motivational responses differed slightly between sites, suggesting that social and cultural values are contextually influenced, even if all CES are present in the landscape. For example, the ability to purchase locally produced food and fiber was the sixth most common motivator to visit farmland or rangeland in Spanish Fork, whereas it was the third highest motivational factor in Layton. In Utah County, where Spanish Fork is situated, only 9% of farmers sell directly to consumers, while 12% of farmers sell directly to consumers in Davis County (NASS, 2017a, 2017b), presenting Layton residents with more opportunities to purchase food and fiber from local farmers/producers and potentially augmenting their value of this service. In contrast, heritage values were the third most common motivator for Spanish Fork respondents, while they were sixth for Layton respondents. Layton is slightly more diverse in terms of race/ethnicity and religious affiliation than Spanish Fork (Table 2), possibly diminishing the importance of heritage values.

The frequency scale suggests that respondents at both sites walked, hiked, or ran more frequently in agroecosystems than derived value from the other CES; less than 16% of respondents, across both sites, stated that they never walk, hike, or run in agroecosystems. These results differ slightly from the responses provided in the motivation scale, as only 55% of respondents indicate that they were motivated to visit farmland or rangeland for recreation purposes. Proximity to farmland and rangeland could influence respondents' decisions to run, hike, or walk in these systems, as both Spanish Fork and Layton still retain, or are adjacent to, agricultural parcels.

Results for our aesthetic indicator in the frequency scale also varied with results from the motivation scale, as 38% of respondents indicate that they have never participated in the provided aesthetic activity, whereas 90% of respondents expressed that aesthetics motivated them to visit farmland or rangeland. Variance in results between the two scales could be attributed to the use of photography as the sole aesthetic indicator in the frequency scale (Figure 2). Respondents likely benefited from aesthetics when participating in other CES activities aside from photography. Synergies of perceived ES are prominent in CES, but our understanding of these synergies is limited (Plieninger et al., 2019). Though our study did not aim to untangle CES interactions, it is possible that the CES categories which motivated respondents to participate in CES activities differed from the category the CES activity was assigned in the frequency scale.

Based on observed variations in results between the motivation and frequency scale, we found that the use of multiple socio-cultural prompts (e.g. indicators/questions) is necessary to measure values associated with CES. As in our study, socio-cultural prompts could determine CES motivations or participation in CES activities, or they

could be designed to map and weight ES (e.g. Klain and Chan, 2012; Plieninger et al., 2013). As CES research continues, a wealth of CES measures are likely to be revealed, encompassing a multitude of perspectives. If our survey instrument simply measured the annual occurrence that residents participated in CES activities in agroecosystems, it would have failed to capture other, potentially more important, CES motivators or vice versa. In the case of aesthetics, the frequency scale alone would have underestimated the importance of this value because fewer respondents indicated that they benefited from the aesthetic indicator in the frequency scale than in the motivation scale. The inclusion of two CES specific scales also allowed us to identify potential respondent satisficing. For example, 2% of respondents indicated that CES did not motivate them to visit farmland or rangeland in the motivation scale. However, in the frequency scale, these respondents confirmed that they did benefit from CES by participating in CES activities, thereby leading us to believe that they were satisficing or participating in these activities due to convenience.

The inclusion of a PCA examining the CES motivation statements identified two underlying CES structures (e.g. multifunctional cultural amenities and traditional rural amenities). These structures facilitated an examination of the relationship between socio-demographic and socioeconomic variables. The grouping of statements (Table 3) supported findings from previously published studies (e.g. Hellerstein et al., 2002; Howley, 2011; Ives and Kendal, 2013; Plieninger et al., 2019). Still, we hypothesize that spiritual and educational opportunities will load heavier with multifunctional land-use preferences outside of Utah. This is because education and spiritual or religious values have historically been associated with agricultural land-uses throughout Utah (Farmer,

2009). Outside of Utah, spirituality or religious importance have been found to align with new-west agricultural values, in addition to aesthetics, inspiration, and recreation (Farrell, 2017). At the time of this study, we did not identify a PCA that included a spiritual or religious statement item in its analyses (Howley, 2011; Ives and Kendal, 2013; Plieninger et al., 2019), whereas educational opportunities have been found to load heavily with both multifunctional and food intensive agroecosystems (Howley, 2011; Ives and Kendal, 2013).

Influence of respondent characteristics on CES value structures

While some findings from our regression analysis were anticipated, we were surprised that sex, age, and education were not strong predictors of CES preferences, particularly the multifunctional cultural amenity factor. Previous studies have found that age, gender, and/or education positively influence aesthetic preferences for multifunctional agroecosystem land uses (Howley, 2011; Howley et al., 2012; Ives and Kendal, 2013; van Zanten et al., 2016). We find that when novel characteristics such as religious affiliation and farming history are included as predictors in study sites where these types of socio-demographics feature prominently in the social dynamic or population, the more traditional determinants of land-use preferences are weakened in terms of their explanatory power. In other words, we hypothesize religious affiliation and farming history are more likely predictors of underlying CES value structures and preferences.

As religious and heritage statement items loaded strongly with the traditional rural amenity factor, we anticipated that affiliation with the Church of Jesus Christ would exhibit a positive relationship with this factor. Instead, our study suggests the opposite;

members of the Church of Jesus Christ were instead more likely to obtain a higher multifunctional cultural amenity factor score than non-members. Several reasons could explain this finding. First, recreation is highly valued by Utahns, the majority of whom are members of the Church of Jesus Christ, and there has been an increase in recreational opportunities provided by private landowners, ranging from hunting and fishing to the development of motorized or non-motorized trail systems (Butkus, 2009). Second, agroecosystem aesthetics could directly represent Utah's heritage. Church of Jesus Christ settlers had a legacy of shaping their natural environment, creating cultural landscapes that reflected their values (Wheeler, 2011) with vestiges of their settlements still visible on the landscape today (Guth, 2009). Finally, a majority of Utah's agroecosystems are irrigated (an important landscape attribute dating back to European settlement), contributing to green and orderly landscapes, which have been found to predict aesthetic preferences regardless of religious affiliation (Ives and Kendal, 2013; Nassauer, 1995). Therefore, recreation and aesthetics could be more aligned with value structures of the Church of Jesus Christ than the traditional rural amenities identified by Hellerstein et al. (2002).

In addition to religious affiliation, respondents with a family history of farming were more likely to value multifunctional cultural amenities than respondents with no farming background. Respondents with a farming background may be more familiar with the intangible benefits of agroecosystems, as opposed to respondents without a familial farming history. Inwood et al. (2013) found that agricultural landowners emphasize the social noneconomic values of their properties when speaking with their descendants and community, even if economic motivations are the primary determinants of their land-use

decisions. Furthermore, multi-generational farmers with off-farm family members are more willing to diversify their farming operations in hopes of passing on a viable agricultural venture to the next generation (Inwood et al., 2013). The creation of recreation or other nature-oriented opportunities while retaining productivity activities were common diversification strategies, and as such, important characteristics of multifunctional agriculture (Howley, 2011; Inwood et al., 2013).

In contrast to findings from the OLS regression for the multifunctional cultural amenity factor, an annual middle-class income of US$50,000-US$99,999 predicted a higher traditional rural amenity factor score than lower and higher income groups. Previous studies that examined the influence of CES on land-use preferences were inconclusive as to the role of income in respondents' preferences. Howley (2011) found that social class, which considered profession and income, positively predicted preferences for natural landscapes and negatively predicted preferences for mixed agricultural landscapes, though a statistically significant relationship wasn't found between income and intensive or cultural agricultural landscapes. Other preference studies used education as a proxy for income because of respondents' unwillingness to provide income data (Ives and Kendal, 2013; Narducci et al., 2019; Zander et al., 2010). Therefore, further research on the effect of income on CES and agricultural land-use preferences is needed before an explanation can be provided on this finding.

Unlike the middle-class income variable, both community classification categories were revealed to have a negative relationship with the traditional rural amenity factor. Respondents that self-identified their communities as suburban and urban were more likely to obtain lower traditional factor scores than respondents that identified their

community as rural. Suburban and urban residents may be less familiar with opportunities to purchase food and fiber directly from local farmers or the heritage values associated with agroecosystems, whereas these values could be underlying motivators for individuals that live in these areas and identified their community as rural.

Quantitative measure of social and cultural values

According to Vieira et al. (2018), social survey-based evaluations of CES have disadvantages because they are: 1) often costly to design and implement; 2) lacking in standardization; and 3) geographically restricted. Our study finds that it is possible, even when facing resource limitations, to implement a survey designed to measure social and cultural values. Our initial response rates of 6% and 8% are comparable with the 6% response rate Ives and Kendal (2013) obtained by deploying two mailings with the inclusion of a raffle incentive. Studies that adhered to five mailings recommended in the Dillman method (Dillman et al., 2014) or that administered surveys using the DOPU technique tended to achieved higher response rates (e.g. Grala et al., 2012; Rewitzer et al., 2017; Trentelman et al., 2016). However, our data is robust because we have a near complete dataset (ranging from 88 – 92 respondents per question), and we tested for non-response bias to assess error associated with combining online and DOPU surveys (Ives and Kendal, 2013; Smyth et al., 2010).

Regarding standardization and geographical restrictions, the CES scales included in the survey are adapted from scales included in a comparable ES questionnaire administered in Scotland (Schmidt et al., 2017). Context-specific revisions were made to the original scales to better capture the spiritual and heritage values associated with the landscape, the direct purchase of food and fiber, and employment opportunities, as these

align with known, locally important values. While these revisions demonstrate that contextual considerations must be incorporated in CES protocol instruments, the use of scales intended for another region similarly demonstrate that existing questionnaires can be used to measure social and cultural values of agroecosystems if operationalized for a specific geographic location. Still, we recommend that the operationalization process be more nuanced when adapting existing scales to disparate regions, and a more concerted effort should be made in future studies to capture values from underrepresented populations. The inclusion of a text box intended for respondents to list additional motivations for visiting farmland or rangeland also demonstrates that our motivation scale was well-suited to measure the range of CES values, as only roughly 5% of respondents provided qualitative responses (some of which could be incorporated into existing CES motivation and frequency statement items). Our experience suggests that value-based standardized surveys are possible as CES research progresses and existing quantitative measures are tested in disparate regions globally.

Limitations

Although results from our Pearson's Chi-square and Mann-Whitney U tests confirmed that there is not a statistically significant difference in responses between online and DOPU participants, we caution the generalizability of our findings outside of Spanish Fork, Layton, and the Wasatch Front. We do, however, contend that results could be generalized to the Wasatch Front, with the exception of Salt Lake County, because the region is relatively homogeneous. Results from our second Pearson's Chi-square test also found no statistically significant difference between study sites, although the Mann-Whitney U test did suggest that education attainment was not independent from site. As

planners look to the future, they must acknowledge demographic shifts in the region. Net migration is anticipated to account for one-third of Utah's population increase in the future (Perlich et al., 2017), potentially diversifying the region's socio-demographic and socioeconomic composition. Generalizability to peri-urban landscapes located outside of the Wasatch Front is cautioned against because of the region's relationship with the Church of Jesus Christ. For example, we anticipated that educational opportunities would load higher with multifunctional agroecosystem land-use values, as found by Ives and Kendal (2013). Yet in our samples, they did not. Spiritual or religious statements could also load heavily with multifunctionality, although no studies we reviewed have included a spiritual statement item in a CES specific factor analysis.

Our survey design unintentionally overrepresented recreation in our frequency scale and could have been improved with the inclusion of inspirational and spiritual activity specific question stems. Recreation was overrepresented compared to other CES categories, as four recreation-related statements (e.g. walking/hiking/running, cycling/mountain biking, fishing/hunting, horseback riding, wildlife viewing/birding) were included, with an additional statement that could be interpreted as recreation (e.g. photography). Figure 2 demonstrates how many indicators were used to measure each CES category. A balanced scale would attempt to include an equal number of indicators for each category, or at a minimum include an indicator for each category in both the motivation and frequency scale. Photography was the only aesthetic-specific statement included in the CES frequency scale, but aesthetics (or other services) could be the underlying driver of a respondent's decision to recreate or participate in social functions taking place in agroecosystems. Recreation, tourism and aesthetics are currently

overrepresented in the CES literature (Petway et al., 2020), which could result in the enhancement of these services over other, equally important services. Consequently, we recommend that future research make a concerted effort to balance the quantification of CES through socio-cultural valuation methods. Survey operationalization has the potential to remedy this problem, but knowledge gaps still exist for lesser-studied CES categories, such as inspiration and spiritual or religious values associated with landscapes. As our understanding of CES advances, there is also a need for protocol instruments to measure interrelationships between CES services and benefits. Therefore, we recommend further exploration of underrepresented CES and synergies, which could allow us to delineate between primary and secondary benefits.

CHAPTER V

CONCLUSION

Agroecosystems should be managed for both the private and public goods they provide, as this could prevent ES degradation (Howley et al., 2012; Plieninger et al., 2013). In addition, preferences to manage agroecosystems as multifunctional landscapes could increase as people become more aware of both the tangible and intangible benefits provided by nature and their influence on human well-being (Milcu et al., 2013; Russell et al., 2013). Thus, incorporating CES measurement in land-management processes now could enhance the communication of public preferences in such processes (Vieira et al., 2018). Our study has found that agroecosystems are critical providers of a range of CES, and that these services are interrelated, making it difficult to measure CES independently. CES synergies suggest that changes to one service could adversely affect other CES, and thus potentially other ES. Yet CES interconnectedness should not be interpreted as a hinderance to their quantification; rather, it should encourage researchers, planners, etc. to include multiple indicators to measure preferences and values in socio-cultural valuation techniques. Although our study did not measure whether CES demand has indeed increased over time, we have discovered that roughly all of our respondents have participated in a minimum of one CES-related activity in agroecosystems, and that CES have motivated almost all of our respondents to visit farmland or rangeland. These findings reveal that CES demand in Spanish Fork and Layton is already high. Our findings can inform planning processes to better ensure that these landscape-derived contributions to well-being are not overlooked. Finally, the ability of respondents to

submit completed surveys demonstrates that they were intimately engaged in the process. In conclusion, agroecosystems should be managed for the range of social and cultural values they provide, and their incorporation in land-management and rural-planning processes is possible with existing protocol instruments that are contextually adapted.

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APPENDICES

APPENDIX A. AGRICULTURAL LAND-USE CONVERSION MAP AND STUDY SITE SELECTION CRITERIA

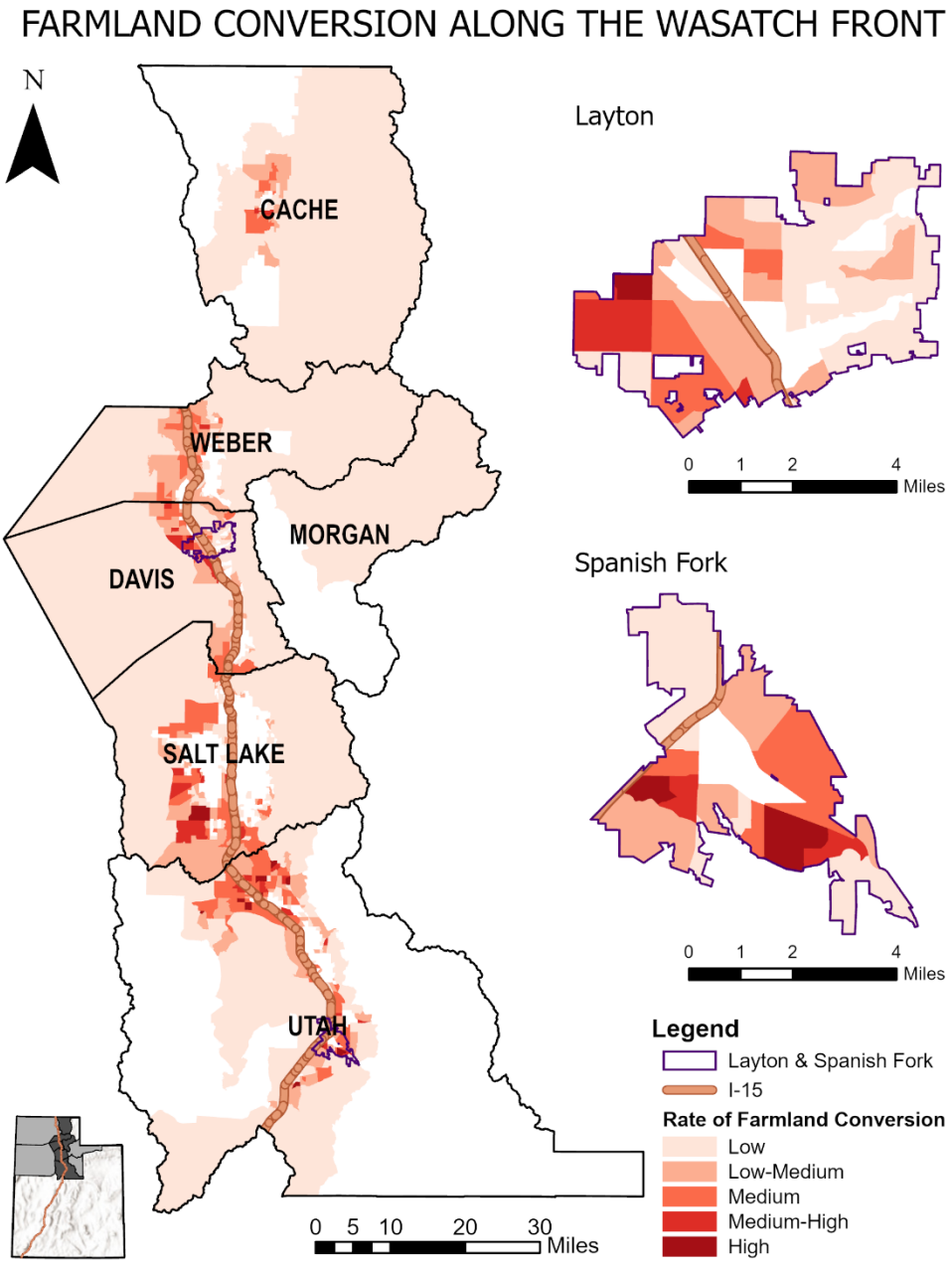


Figure 5. Farmland land-use change analysis between 2001 and 2010. Analysis completed at the census block group (CBG) level to identify areas that were developed from farmland along the Wasatch Front corridor. Areas that experienced no change were excluded. Sources: AGRC, NLCD

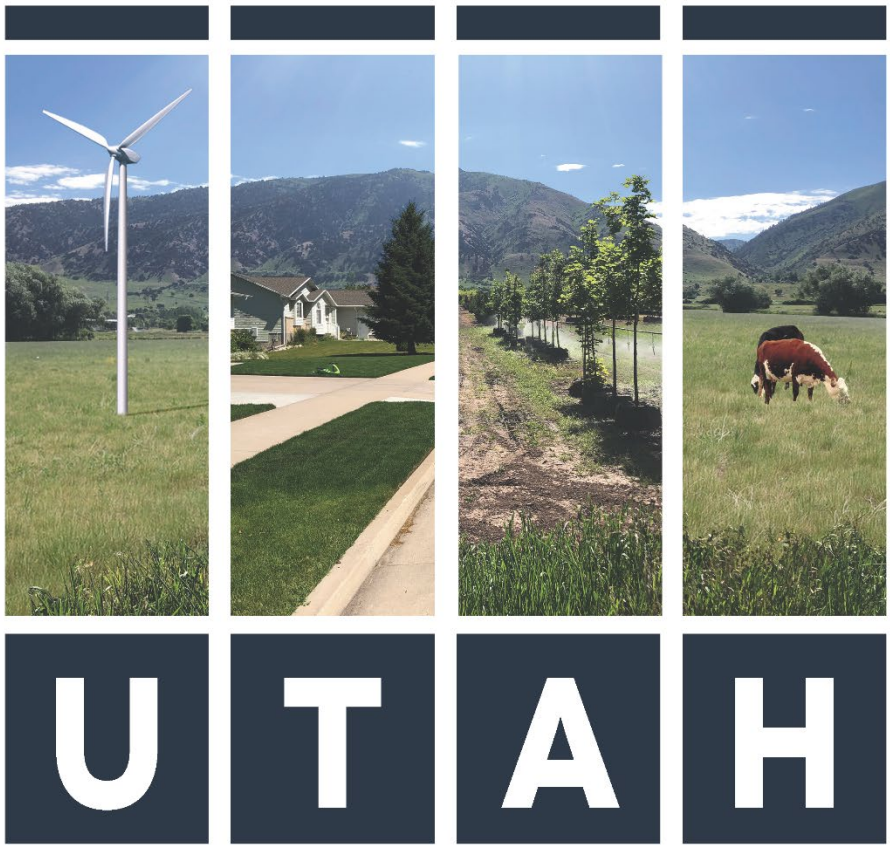
Table 5. Site Selection Criteria. Using the attribute table generated from Figure 5, census block groups with a rate of land-use change (farmland to developed) greater than 1.50% were considered. Other criteria included proximity to farmland and proximity to a natural feature (e.g. mountain, lake, creek). Only one site per county was selected. Selected sites are bolded and italicized.

Census Tract ID	Block Group ID	County	Municipality	Percent (%) Rate of Change	Urban / Suburban (Y/N)	Farmland Adjacent (Y/N)	Natural Feature Adjacent (Y/N)	County Duplicate (Y/N)
3300	3	Utah	Spanish Fork	2.24%	Y	N	N	N
10111	2	Utah	Lehi	2.22%	Y	N	N	N
204	1	Utah	Lehi	2.18%	Y	N	N	N
10404	1	Utah	Spanish Fork	2.12%	Y	N	Y (SF Canyon)	N
10112	1	Utah	Lehi	1.97%	Y	N	Y (Utah Lake)	N
113020	1	Salt Lake	South Jordan	1.96%	Y	N	N	N
3402	2	Utah	Payson	1.96%	Y	N	N	N
10220	2	Utah	Cedar Hills	1.95%	Y	N	Y (Mahogany Mountain)	N
10404	***2***	***Utah***	***Spanish Fork***	***1.84%***	***Y***	***Y***	***Y (SF Canyon)***	***N***
113019	1	Salt Lake	South Jordan	1.78%	Y	N	N	N
10218	1	Utah	Highland	1.68%	Y	N	Y (Dry Creek)	N
10104	2	Utah	Eagle Mountain	1.58%	Y	N	N	N
10208	1	Utah	Alpine	1.55%	Y	Y	Y (Dry Creek)	Y
10405	1	Utah	Spanish Fork	1.52%	Y	N	Y (SF Canyon)	N
10216	2	Utah	Lehi	1.52%	Y	N	Y (Dry Creek)	N
125405	***1***	***Davis***	***Layton***	***1.50%***	***N***	***Y***	***Y (Great Salt Lake)***	***N***

APPENDIX B. SURVEY INSTRUMENT

UTAH FARMLAND SURVEY

Perspectives on Utah's Farmland and Residents' Preservation and Development Preferences



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INTRODUCTION AND BACKGROUND

Investigators: This research project is led by Dr. Brent Chamberlain (Assistant Professor) and Tiffany Woods (Bioregional Planning Student) from the Department of Landscape Architecture and Environmental Planning at Utah State University. Questions can be directed to brent.chamberlain@usu.edu or tiffany.woods@aggiemail.usu.edu.

Introduction: The purpose of this research is to identify benefits provided by farmland along the Wasatch Front. We want to know how these benefits influence residents' perspectives and preferences for development and land use.

Procedures: Your participation will involve the completion of the following survey, which is expected to take 20-30 minutes to complete.

Confidentiality: : Responses will be kept ***strictly confidential*** through April 2020, after which any personally identifiable information (addresses) will be destroyed. Thereafter, all data will be maintained anonymously. Throughout the entire study data will be collected securely and stored on servers under Utah State University contracts, on the Investigators' password protected computers. Note that online activities always carry a risk of a data breach, but we will use systems and processes that minimize this.

Compensation: Upon completion of this survey, you may be entered in drawing for a $20 Visa gift card, we estimate that 20% of respondents will win. To enter the drawing, email ***tiffany.woods@aggiemail.usu.edu*** with the subject header ***USU Planning***. **Please include your contact information in the email** so that we can contact you if your email is drawn. Your contact info will be strictly confidential and will be stored separately from survey responses.

Study Findings: At the conclusion of this research project we will compile a fact sheet including aggregate results from all participants in the survey. If you would like to receive a copy of this fact sheet email ***tiffany.woods@aggiemail.usu.edu*** with the subject header ***USU Planning***.

IRB Review: This research has been approved by USU's Institutional Review Board (IRB) as proposal number #10363 for the protection of human research participants. If you have questions about the research study itself, please contact Dr. Brent Chamberlain or Tiffany Woods (details above). If you have questions about your rights or would simply like to speak with someone other than the research team about questions or concerns, please contact the IRB Director at (435) 797-0567 or irb@usu.edu.

Informed Consent: Your participation in this study is voluntary and not expected to have any risks beyond those in everyday life. You may refuse to participate or withdraw from this study at any time. By completing this survey, you agree to participate in this research project conducted by the investigators.

BENEFITS OF UTAH'S FARMLAND

Initially, we would like to learn about the benefits provided by Utah's farmland. Specifically, we are interested in benefits outside of farmland productivity. These include recreational and social opportunities, scenic beauty (views), etc.

Do you visit Utah's farmland for the following reasons...

This can include time spent driving through farmland or participating in activities adjacent to farmland (e.g. on the road). *Select one choice for each statement.*

	Yes	No	NA/Unsure
To get exercise	O	O	O
To learn about nature	O	O	O
To enjoy the scenery	O	O	O
To be inspired by nature	O	O	O
To connect with local heritage (traditions passed down through the landscape and land uses)	O	O	O
To enjoy the company of others	O	O	O
For spiritual and/or religious reasons	O	O	O
To purchase food, wool, wood, or other materials	O	O	O
For work or employment	O	O	O
Other (Please mark yes if other)	O	O	O

What are the other reasons you visit Utah's farmland?

Please list all reasons.

How frequently do you travel to farmland to participate in the following activities?

This can include time spent driving through farmland or participating in activities adjacent to farmland (e.g. on the road). *Select one choice for each statement.*

	Never	1-3 times a year	4-11 times a year	Once a month	Once a week	More than once a week
Walking/Hiking/Running	O	O	O	O	O	O
Cycling/Mountain biking	O	O	O	O	O	O
Hunting/Fishing	O	O	O	O	O	O
Horseback riding	O	O	O	O	O	O
Photography	O	O	O	O	O	O
Picnic/Barbecue	O	O	O	O	O	O
To learn how to farm or ranch	O	O	O	O	O	O
To purchase food and/or fiber	O	O	O	O	O	O
Natural history observation	O	O	O	O	O	O
Wildlife viewing/bird watching	O	O	O	O	O	O

The next few questions are designed to measure your familiarity with Spanish Fork, Utah County and your perspectives on potential conservation and renewable energy in the area.

Are you familiar with the area in Spanish Fork pictured below?

- Yes
- No
- Unsure

One way to preserve farmland in Spanish Fork is through new taxes. These taxes can leverage existing resources so farmland or development rights could be purchased. With either of these purchases, some or all existing farmland would be maintained as a farm or open space instead of housing or commercial development.

If preserving farmland in Spanish Fork required your taxes to increase, which type of tax would you prefer?

If you are unclear about how to respond, given the description above, please select "unsure".

- Property tax (tax on the value of property)
- Income tax (annual tax on personal income)
- Sales tax (tax on sales of consumption goods, such as restaurant services, groceries, gasoline, etc.)
- I support taxation for this purpose, but don't have a tax preference
- No tax (I am fundamentally opposed to using taxation for this purpose)
- Unsure

Would you support or oppose a solar farm on farmland near your home?

The solar array would not occupy more than 10% of the landscape allowing for continued farming practices or open space.

- Yes, I would support a solar farm near my home
- No, I would oppose a solar farm near my home
- Unsure

CHOICE EXPERIMENT - SPANISH FORK, UTAH

Development Alternatives

In the following section you will consider six (6) different sets of three (3) choices (A, B or C) for potential farmland use. Each choice includes a photograph of potential land uses and provides estimates on the percent of farmland preserved and annual taxation amounts. The type of tax is the tax preference you indicated in the previous question. If you selected "unsure", "no tax" or you don't have a tax preference, assume that the tax is happening through an increase in your property taxes.

Please note that Choice C in all sets represents the status quo. The status quo is based on historical conversion rates of farmland to single-family residential, which is being accelerated by Utah's rapid population growth (the Kem C. Gardner Institute anticipates that Utah's population will nearly double by 2065).

Select one choice for each set.

CHOICE SET ONE

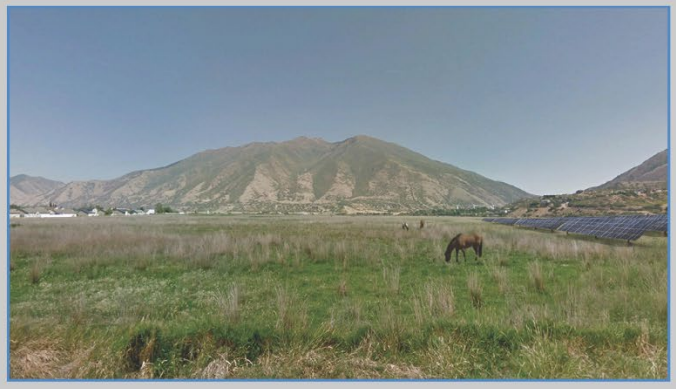
Choice A

$25 tax

100% farmland preserved

Horses grazing

Solar energy present



Choice B

$10 tax

50% farmland preserved

Cattle grazing

No renewable energy

Choice C

No tax

0% farmland preserved

5

CHOICE SET TWO

Choice A

$50 tax

100% farmland preserved

Orchard crop type

Solar energy present

Choice B

$10 tax

50% farmland preserved

Horses grazing

No renewable energy

Choice C

No tax

0% farmland preserved

6

CHOICE SET THREE

Choice A

$10 tax

50% farmland preserved

Alfalfa or hay crop type

No renewable energy

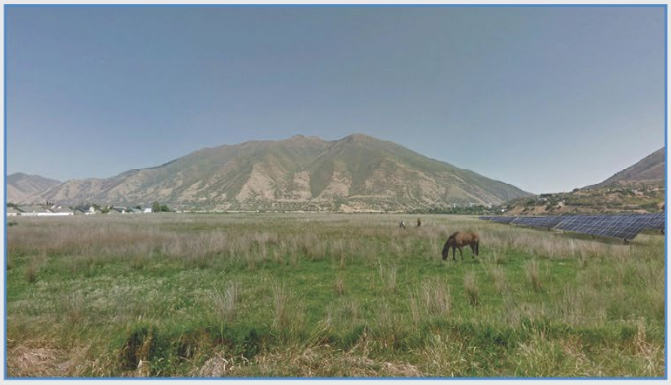
Choice B

$50 tax

100% farmland preserved

Horses grazing

Solar energy present



Choice C

No tax

0% farmland preserved

CHOICE SET FOUR

Choice A

$100 tax

100% farmland preserved

Orchard crop type

No renewable energy

Choice B

$25 tax

100% farmland preserved

Alfalfa or hay crop type

Solar energy present

Choice C

No tax

0% farmland preserved

8

CHOICE SET FIVE

Choice A

$25 tax

100% farmland preserved

Cattle grazing

Solar energy present

Choice B

$50 tax

50% farmland preserved

Orchard crop type

No renewable energy

Choice C

No tax

0% farmland preserved

CHOICE SET SIX

Choice A

$50 tax

50% farmland preserved

Alfalfa or hay crop type

No renewable energy

Choice B

$200 tax

100% farmland preserved

Orchard crop type

No renewable energy

Choice C

No tax

0% farmland preserved

10

FARMLAND PRESERVATION AND DEVELOPMENT PREFERENCES

Questions in this next section further explore your thoughts on farmland preservation and development throughout Utah and in your community.

Please mark your level of agreement with the following statements:

Select one choice for each statement.

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree	Unsure
There is enough farmland in Utah.	O	O	O	O	O	O
More farmland is needed for food production.	O	O	O	O	O	O
Utah should be self sufficient when it comes to producing food.	O	O	O	O	O	O
Purchasing locally produced food and/or fiber is beneficial to the environment.	O	O	O	O	O	O
Farmland should be used for future housing development.	O	O	O	O	O	O
Farmland preservation programs are beneficial for the local economy.	O	O	O	O	O	O
Farmland preservation is not that important to me.	O	O	O	O	O	O
My financial well-being conflicts with farmland preservation.	O	O	O	O	O	O

In general, how important is it to you to preserve farmland?

- O Very important
- O Important
- O Moderately important
- O Slightly important
- O Not at all important
- O Unsure

Do you agree or disagree with the following statement: Legislators are doing enough to preserve farmland.

- O Strongly disagree
- O Somewhat disagree
- O Neither agree nor disagree
- O Somewhat agree
- O Strongly agree
- O Unsure

Would you support or oppose higher density housing in your community if it resulted in more farmland preservation in your community?

- O Yes, I would support higher density housing
- O No, I would oppose higher density housing
- O Unsure

Briefly explain why you are unsure.

YOU AND YOUR COMMUNITY

Next, we have some questions about the current and previous communities you and your household have lived in, as well as your personal farming affiliations.

How many years has your household lived in the area?
Enter full years (round up to the nearest full year)

How would you describe the place you currently live?

- O On a farm
- O Rural area or small town
- O Suburban area
- O Urban area
- O Other

How would you describe the place you grew up?

- O On a farm
- O Rural area or small town
- O Suburban area
- O Urban area
- O Other

Does proximity to farmland have a positive or negative impact on your household's quality of life?

- O Extremely positive
- O Somewhat positive
- O Neither positive nor negative
- O Somewhat negative
- O Extremely negative
- O I don't live near farmland
- O Unsure

Is there a history of farming in your family?
This can include direct ownership of farmland or employment as a farmer.

- O Yes
- O No
- O Unsure

Do any of your family members (outside of your immediate family) currently live in your community?

- O Yes
- O No

Do you anticipate that any of your family members and/or friends will move to your community within the next 5 years?

- O Yes
- O No
- O Unsure

Does anyone in your household belong to an environmental club, group or organization?

- O Yes
- O No
- O Unsure

DEMOGRAPHICS

These final questions help us be sure that we have heard from the full range of perspective found in Utah. ***Your answers will be treated as confidential.***

What is your gender?

- O Male
- O Female
- O Other/Not listed

What year were you born?
Enter 4-digit year of birth (e.g. 1978) _____

What is the highest level of education you achieved?

- O Less than high school
- O High school graduate
- O Some college
- O Associates degree
- O Bachelors degree
- O Post Bachelors degree (for example Masters degree, Doctorate degree, professional degree or certification)

What category best describes your religious affiliation, if any?

- O Jewish
- O Latter-day Saint/Mormon
- O Muslim
- O Other Christian (e.g. Catholic, Protestant, etc.)
- O Other religion (please specify) _____
- O No religious affiliation

What category best describes your race or ethnicity?
Check all that apply.

- O Asian
- O American Indian or Alaska Native
- O Black / African American
- O Hispanic or Latino/Latina
- O Middle Eastern
- O Native Hawaiian or Other Pacific Islander
- O White / Caucasian
- O Other (please specify) _____

My current residence is...

- ○ Owned by you or someone in your household.
- ○ Rented.
- ○ Other (please specify): _____

Which of the following best describes your current employment status?

- ○ Employed for pay by a company/business/government
- ○ Self-employed
- ○ Unemployed
- ○ A student
- ○ A Homemaker
- ○ Retired
- ○ Other _____

Which category best represents your household's annual gross income, before taxes?

- ○ Less than $25,000
- ○ $25,000 - $49,999
- ○ $50,000 - $99,999
- ○ $100,000 - $199,999
- ○ $200,000 or more

We thank you for taking the time to complete this survey!

Your answers may help guide planning efforts by providing insights on how Utahns use and value farmland as well as their farmland preservation and development preferences.

To return your completed survey please place it in the provided envelope and hang it from your door in the provided baggie.

To receive a fact sheet including the aggregate results of this study please email Tiffany Woods (***tiffany.woods@aggiemail.usu.edu***) with the subject header ***USU Planning.***

If you would like to expand on any answers - or address issues we may have failed to ask about - feel free to comment below.

_____

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APPENDIX C. OLS REGRESSION SUITABILITY (ASSUMPTION CONFIRMATIONS)

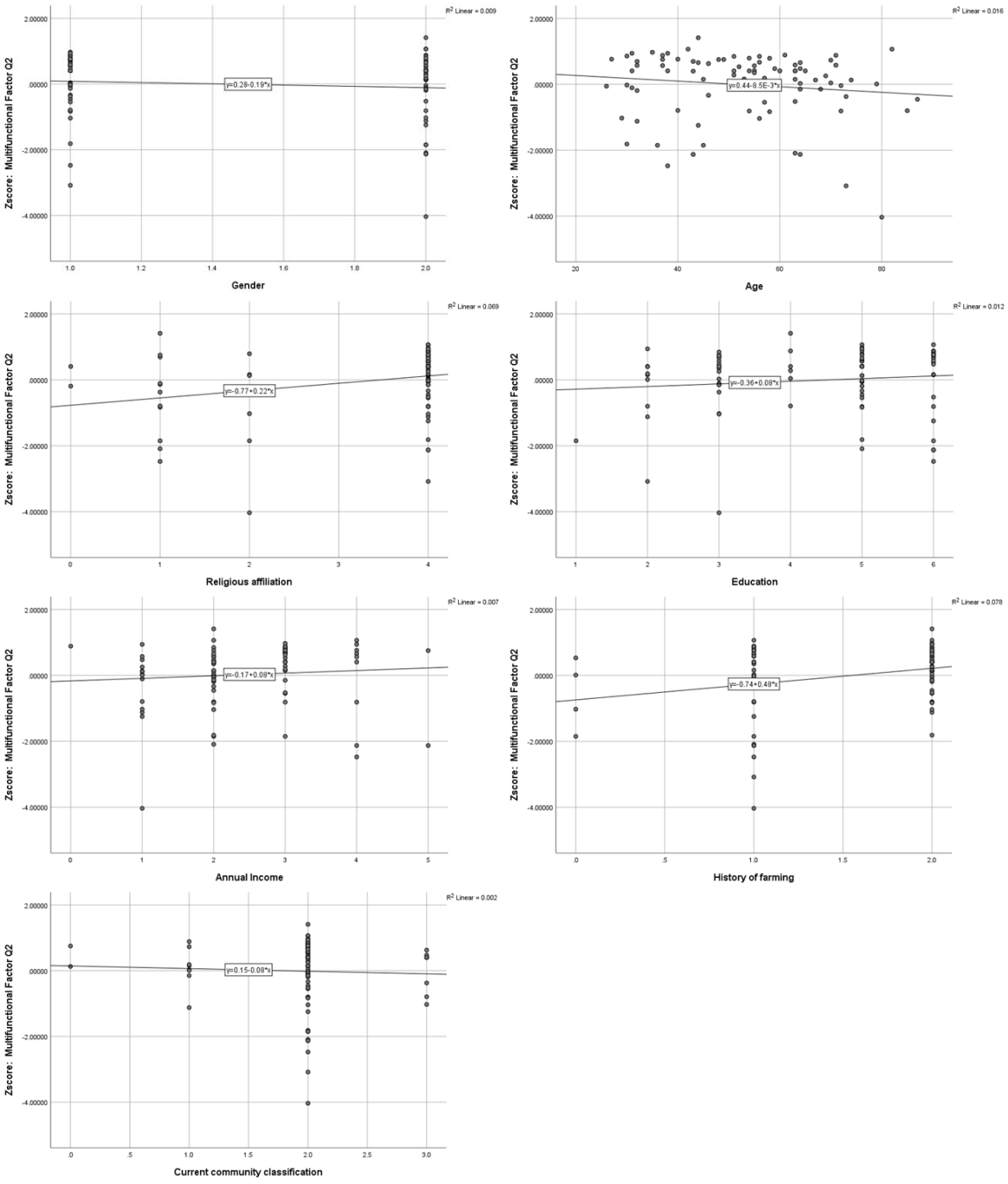

Figure 6. Regression assumption of linear relationship between the multifunctional factor and predictor variables. Predictor variables include gender, age, religious affiliation, education, annual income, history of farming, and community classification.

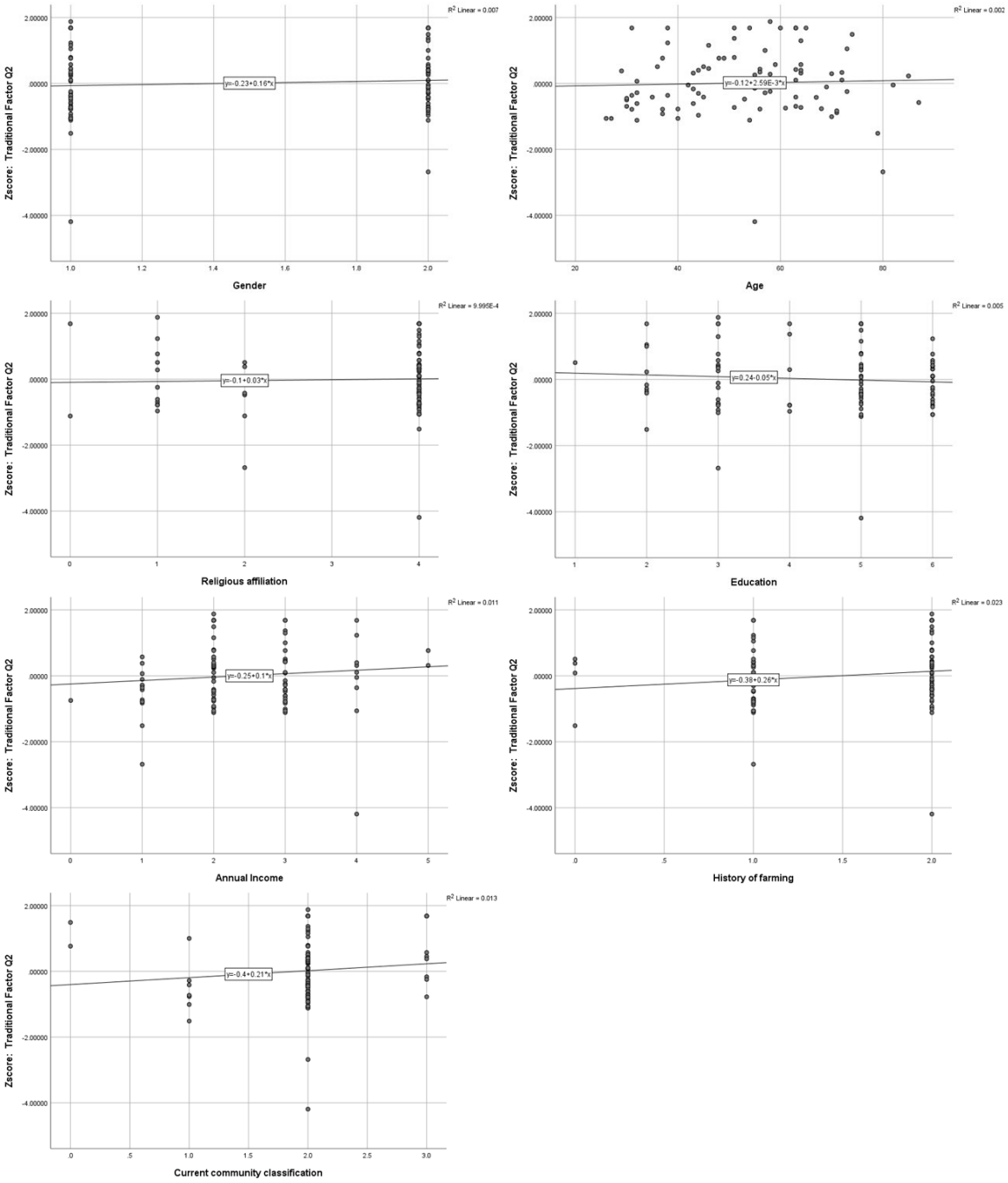

Figure 7. Regression assumption of linear relationship between the traditional factor and the predictor variables. Predictor variables include gender, age, religious affiliation, education, annual income, history of farming, and community classification. A relationship between all predictor variables and the outcome variable were revealed.

Table 6. Regression assumption of multicollinearity for the multifunctional factor (Factor 1). Correlations of more than 0.80 would indicate multicollinearity. As there are no correlations of 0.80 and higher, we can assume multicollinearity is not present in selected predictor variables and the outcome variable. Refer to Table 4 for list and definitions of predictor variables.

Correlations

		Factor 1	Sex	Age 55 and older	Other religion	Associates and above	Income $50,000-$99,999	Income $100,000 or more	No farming background	Suburban/ peri-urban	Urban
Pearson Correlation	Factor 1	1.000	-0.097	-0.094	-0.307	0.125	-0.028	0.157	-0.277	-0.065	0.032
	Sex	-0.097	1.000	0.067	0.048	-0.023	-0.033	-0.010	-0.045	0.131	0.037
	Age 55 and older	-0.094	0.067	1.000	-0.155	-0.117	0.051	-0.109	-0.135	-0.131	0.259
	Other reigious affiliation	-0.307	0.048	-0.155	1.000	-0.002	0.041	-0.180	0.134	-0.033	-0.181
	Associates and above	0.125	-0.023	-0.117	-0.002	1.000	-0.101	0.229	0.052	0.319	-0.304
	Income $50,000-$99,999	-0.028	-0.033	0.051	0.041	-0.101	1.000	-0.675	-0.158	-0.023	-0.110
	Income $100,000 or more	0.157	-0.010	-0.109	-0.180	0.229	-0.675	1.000	0.081	0.261	-0.147
	No farming background	-0.277	-0.045	-0.135	0.134	0.052	-0.158	0.081	1.000	0.046	0.015
	Suburban/peri-urban	-0.065	0.131	-0.131	-0.033	0.319	-0.023	0.261	0.046	1.000	-0.604
	Urban	0.032	0.037	0.259	-0.181	-0.304	-0.110	-0.147	0.015	-0.604	1.000
Sig. (1-tailed)	Factor 1		0.185	0.192	0.002	0.123	0.398	0.075	0.005	0.272	0.382
	Sex	0.185		0.266	0.328	0.413	0.382	0.463	0.337	0.109	0.364
	Age 55 and older	0.192	0.266		0.073	0.136	0.321	0.158	0.102	0.109	0.007
	Other reigious affiliation	0.002	0.328	0.073		0.493	0.354	0.049	0.105	0.381	0.045
	Associates and above	0.123	0.413	0.136	0.493		0.177	0.016	0.315	0.001	0.002
	Income $50,000-$99,999	0.398	0.382	0.321	0.354	0.177		0.000	0.072	0.415	0.155
	Income $100,000 or more	0.075	0.463	0.158	0.049	0.016	0.000		0.228	0.007	0.087
	No farming background	0.005	0.337	0.102	0.105	0.315	0.072	0.228		0.333	0.444
	Suburban/peri-urban	0.272	0.109	0.109	0.381	0.001	0.415	0.007	0.333		0.000
	Urban	0.382	0.364	0.007	0.045	0.002	0.155	0.087	0.444	0.000	

Table 7. Regression assumption of multicollinearity for the traditional factor (Factor 2). Correlations of more than 0.80 would indicate multicollinearity. As there are no correlations of 0.80 and higher, we can assume multicollinearity is not present in selected predictor variables and the outcome variable. Refer to Table 4 for list and definitions of predictor variables.

Correlations

		Factor 2	Sex	Age 55 and older	Other religion	Associates and above	Income $50,000-$99,999	Income $100,000 or more	No farming background	Suburban/ peri-urban	Urban
Pearson Correlation	Factor 2	1.000	0.081	0.006	-0.071	-0.049	0.220	-0.016	-0.165	-0.078	-0.180
	Sex	0.081	1.000	0.067	0.048	-0.023	-0.033	-0.010	-0.045	0.131	0.037
	Age 55 and older	0.006	0.067	1.000	-0.155	-0.117	0.051	-0.109	-0.135	-0.131	0.259
	Other reigious affiliation	-0.071	0.048	-0.155	1.000	-0.002	0.041	-0.180	0.134	-0.033	-0.181
	Associates and above	-0.049	-0.023	-0.117	-0.002	1.000	-0.101	0.229	0.052	0.319	-0.304
	Income $50,000-$99,999	0.220	-0.033	0.051	0.041	-0.101	1.000	-0.675	-0.158	-0.023	-0.110
	Income $100,000 or more	-0.016	-0.010	-0.109	-0.180	0.229	-0.675	1.000	0.081	0.261	-0.147
	No farming background	-0.165	-0.045	-0.135	0.134	0.052	-0.158	0.081	1.000	0.046	0.015
	Suburban/peri-urban	-0.078	0.131	-0.131	-0.033	0.319	-0.023	0.261	0.046	1.000	-0.604
	Urban	-0.180	0.037	0.259	-0.181	-0.304	-0.110	-0.147	0.015	-0.604	1.000
Sig. (1-tailed)	Factor 1		0.227	0.480	0.257	0.324	0.021	0.443	0.062	0.236	0.047
	Sex	0.227		0.266	0.328	0.413	0.382	0.463	0.337	0.109	0.364
	Age 55 and older	0.480	0.266		0.073	0.136	0.321	0.158	0.102	0.109	0.007
	Other reigious affiliation	0.257	0.328	0.073		0.493	0.354	0.049	0.105	0.381	0.045
	Associates and above	0.324	0.413	0.136	0.493		0.177	0.016	0.315	0.001	0.002
	Income $50,000-$99,999	0.021	0.382	0.321	0.354	0.177		0.000	0.072	0.415	0.155
	Income $100,000 or more	0.443	0.463	0.158	0.049	0.016	0.000		0.228	0.007	0.087
	No farming background	0.062	0.337	0.102	0.105	0.315	0.072	0.228		0.333	0.444
	Suburban/peri-urban	0.236	0.109	0.109	0.381	0.001	0.415	0.007	0.333		0.000
	Urban	0.047	0.364	0.007	0.045	0.002	0.155	0.087	0.444	0.000	

Table 8. Regression assumption of independent residuals for the multifunctional factor. As the Durbin-Watson value (1.703) is greater than 1 and less than 3, the assumption has been met.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.479[a]	0.230	0.139	0.928	1.699

a. Predictors: (Constant), Urban, Sex, No Farming Bacground, Income $100,000 or more, Other religion, Associates and above, Age 55 and older, Suburban/peri-urban, Income $50,000-
b. Dependent Variable: Multifunctional Factor

Table 9. Regression assumption of independent residuals for the traditional factor. As the Durbin-Watson value (1.851) is greater than 1 and less than 3, the assumption has been met.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.448[a]	0.200	0.106	0.946	1.896

a. Predictors: (Constant), Urban, Sex, No Farming Bacground, Income $100,000 or more, Other religion, Associates and above, Age 55 and older, Suburban/peri-urban, Income $50,000-
b. Dependent Variable: Traditional Factor

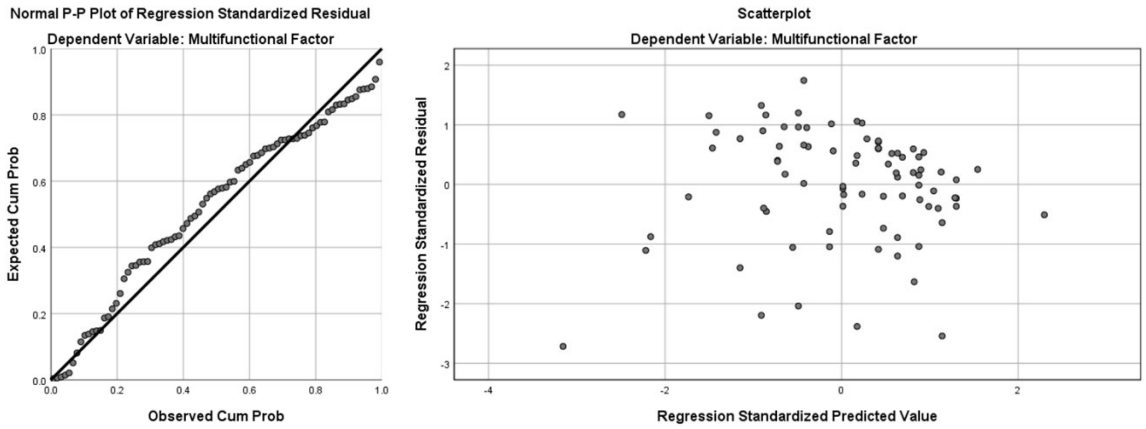

Figure 8. Regression assumption that the variance of the residuals is normally distributed and constant for the multifunctional factor. The residuals are somewhat normally distributed and constant.

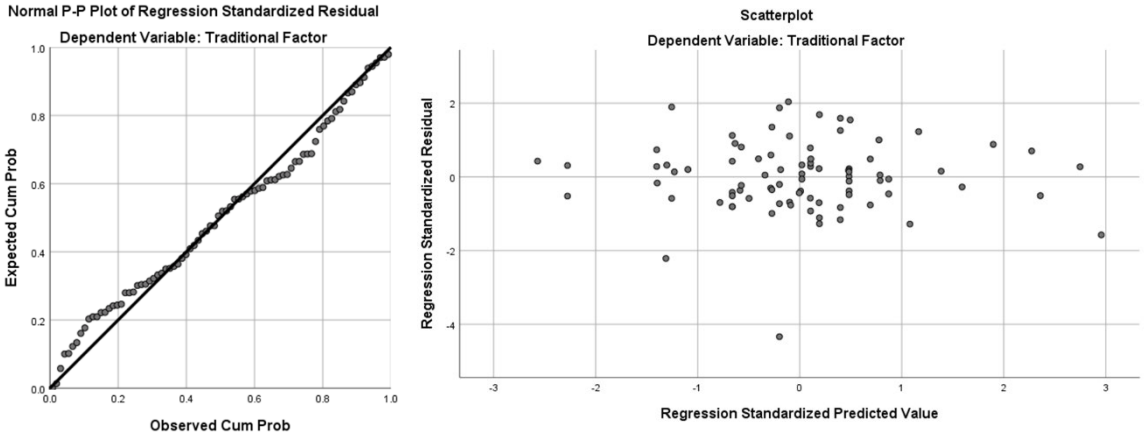

Figure 9. Regression assumption that the variance of the residuals is normally distributed and constant for the traditional factor. The residuals are normally distributed and constant.

Table 10. Regression assumption of influential cases for the multifunctional and traditional factor. The Cook's Distance values for both factors were all under 1, suggesting individual cases were not influencing the model.

Descriptive Statistics

	N	Minimum	Maximum
Cook's Distance- Multifunctional Factor	84	0.000002	0.172237
Cook's Distance - Traditional Factor	84	0.000002	0.153721