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The Farm-Community Nexus: Metrics for Social, Economic, and Environmental Sustainability of Agritourism and Direct Farm Sales in Vermont

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White Paper for the
UVM-ARS Center for Food Systems Research
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1. Summary of Approach and Results

Viable working landscapes, vibrant communities, and healthy ecosystems are the building blocks of sustainable food systems. Small and medium farms are connective tissue, creating a system that is greater than the sum of its parts by linking consumers to producers and promoting environmental stewardship. Our approach considers sustainability through connections between farms, their communities, and visitors within an agritourism framework, including on-farm experiences, direct sales of agricultural products, and farmer-consumer interactions at markets. The goal is to contribute to the understanding, operationalization, and integration of metrics built on the ideals that viable, sustainable, and resilient food systems must support social, economic and environmental goals.

The approach presented in this white paper:

1. Applied a sustainability framework to identify metrics relevant for social, economic, and environmental dimensions across farm, household, community, and statewide scales.
2. Identified existing data sets and current data gaps.
3. Identified linkages and impacts between social, economic and environmental dimensions of sustainability across scales and different frameworks.
4. Considered sustainability applied to direct sales and agritourism, with particular emphasis on the social floor required to promote individual, farmer, and community well-being, while protecting the environment by respecting our planetary boundaries.

We categorized priority metrics under primary sustainability dimensions:

Environmental – Open Space, Farm Products, Stewardship, and the Vermont Brand

Economic – Economic Impacts, Consumer Spending, Farm Profitability, Farm Labor, and Farmland

Social – Cultural Ecosystem Services, Labor Opportunities and Conditions, Social and Informational Infrastructure, Sense of Community, Demographic and Cultural Diversity, Good Governance, and Health, Safety, and Wellbeing

Based on our assessment of existing and needed metrics summarized in this white paper, key recommendations to the UVM-ARS Center include:

1. Catalyze and synergize efforts and resources in Vermont to holistically address sustainability.
2. Explore and identify ways the Vermont brand—an important component of the state’s social, ecological and economic identity and culture—supports sustainability.
3. Focus on informational and data needs that are central to understanding and ensuring sustainability in Vermont, including longitudinal producer and consumer surveys.
4. Support a deep convergence of social and natural sciences in addressing sustainability.

The goal is to provide an essential foundation for future research that will place the UVM-ARS Center for Food Systems Research at the forefront of this critical transdisciplinary area.

2. Background on Approach, Measures, and Indicators Chosen

Rural communities exemplify the challenges of sustainability. All three dimensions of sustainability (economic, social and environmental) are impacted as rural economies suffer out-migration and economic challenges. The disappearance of small and medium farms can negatively impact community identity, social networks and land stewardship, and lead to economic decline. On the other hand, many surviving farms have established strong community relationships through direct sales and agricultural experiences for the public on and off the farm. These farms are diverse and include dairy, maple, meat, vegetables, fruit, and valued-added products. These enterprises at the farm-community nexus allow producers to diversify their operations while preserving the working landscape, creating jobs, maintaining farming traditions, and sustaining cultural identities—synergizing and positively promoting the three dimensions of sustainability.

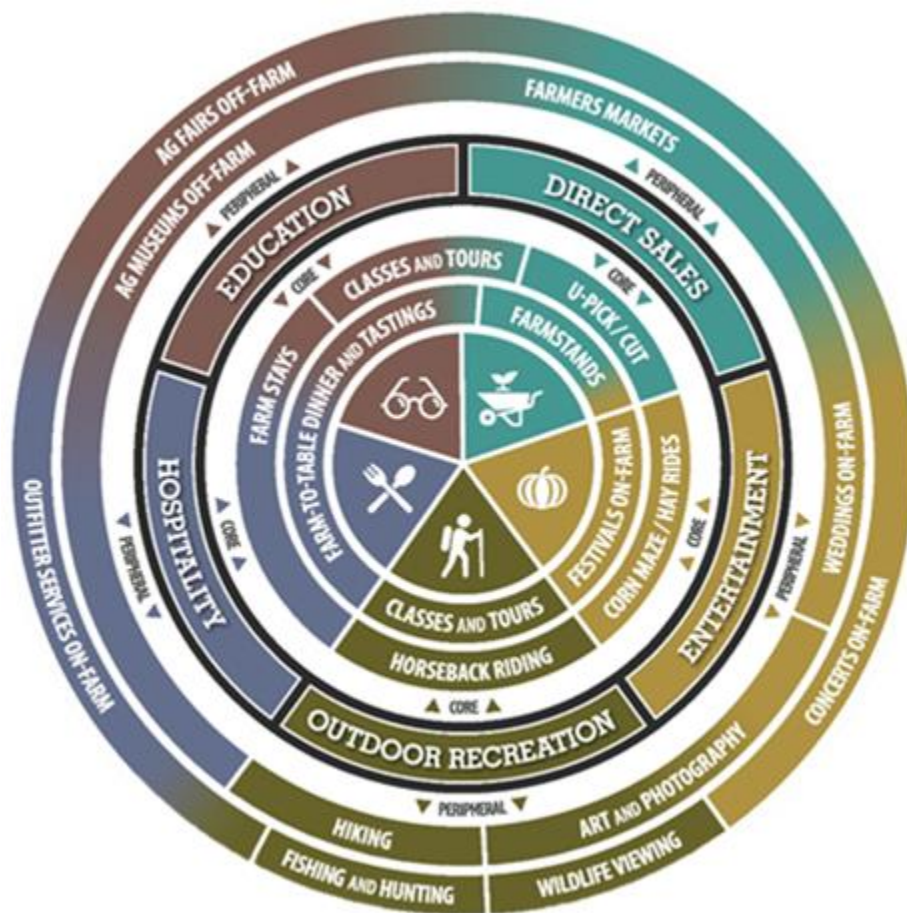


Figure 1. Five Categories of Agritourism with Core and Peripheral Tiers

The farm-community nexus encompasses a variety of activities, including direct-to-consumer sales of local food (e.g., farmstands, u-pick), agricultural education (e.g., school visits), hospitality (e.g., farm stays, tastings), recreation (e.g., hiking, horseback riding), and entertainment (e.g., hayrides, concerts) (Figure 1; Chase et al., 2018). While definitions of agritourism vary across different contexts, general agreement exists that at the core are *on-farm experiences focused on agriculture*. Relating to the French concept of *les produits du terroir* (which can also be considered “Taste of Place,”), Vermont farms and producers have a long history of developing and capitalizing on the Vermont brand, which engages with quality, place and methods of production, landscape aesthetics, and cultural geography, among other concepts and experiences. The broad definition of *terroir* and the Vermont brand are major forces driving agritourism in Vermont, and we consider their implications to the future of sustainable agritourism in Vermont (Trubek et al., 2010). This paper examines the farm-community nexus, incorporating all elements of the producer-consumer interface that defines agritourism, including product sales and activities on and off the farm for residents and visitors to Vermont. The benefits of agritourism are multi-faceted; supplementing farm income while also supporting the larger community and educating the public about agriculture (Chase & Grubinger, 2014). Although small and medium farms make up a large share of farms with direct sales and agritourism, the overall numbers are still relatively low (United States Department of Agriculture [USDA], 2019), leaving much room for growth.

Before the COVID-19 pandemic - an extreme event that has revealed many of the weaknesses in the dominant paradigm of our food systems - agritourism was rapidly increasing around the world, with two-fold growth in the global market projected from 2018 to 2025 (\$5.7 billion to \$12.9 billion, 12% annual growth; Peihong & Yali, 2019). On a national level, only 6.4% of U.S. farmers sold direct to consumers and the value of those sales was 0.7% (\$2.8 billion) of total farm sales in 2017. In Vermont, more than a quarter of farmers sell direct to consumers, accounting for 6.3% of sales. This translates to 1833 farms and \$50 million in Vermont (USDA, 2019). While the sector has enjoyed steady growth, there is preliminary evidence that suggests the COVID-19 pandemic is fueling a surge in direct sales as farms forgo restaurant and institutional sales and rapidly respond to increased demand from their community members (Kolodinsky et al., 2020). Although most metrics currently available will be based on pre-COVID knowledge, the pandemic presents a unique opportunity to track the sustainability of the changing food system through these morphing food enterprises. In addition to punctuating events like COVID or Tropical Storm Irene, Vermont agritourism sustainability must grapple with opportunities and risks related to climate change (Galford et al., 2014).

The purpose of this white paper is to develop a set of metrics that contribute to measuring and tracking strong social foundations and economies while promoting healthy environments. This approach is vital for several reasons. First, comprehensive measurements allow consideration of important factors, including traditional measures such as prices and farm income, and measures emerging as legitimate and important (e.g., ecosystem services that have yet to be measured or even considered; the social benefits of encouraging civic engagement; the economic benefits of agritourism to the broader community). Second, our approach captures

the interactions between the three dimensions of sustainability. These dimensions may be mutually reinforcing, or incur tradeoffs (e.g., increasing consumer demand may cause less environmentally-friendly production; high numbers of farm visitors could add carbon pollution, degrade environmental quality and/or goodwill among community members). Third, we propose a series of metrics that capture farm, household, community, county and statewide levels to better understand the effects of different agritourism and direct sales enterprises across scales. Without such metrics, development of programmatic, research, and policy supports for these enterprises, as well as rural economics and local food systems, will remain underdeveloped. Our approach is particularly useful as the farm-community nexus embraces complexity, bridging the divides between agriculture, environment, education, tourism, and community development.

To inform the development of metrics and indicators of sustainable agritourism operations, we evaluate recent evolutions in theory as it relates to understanding social, ecological, and economic sustainability in the farm-community nexus (see Appendix A: Theoretical Framework for greater detail). Efforts to acknowledge and comprehensively account for the various dimensions of sustainability were amplified by the United Nation's Brundtland Report (World Commission on Environment and Development [WCED], 1987), which provided a framework for sustainable development. Since then, scholars and practitioners have offered many frameworks and metrics that seek to operationalize sustainability. The breadth of these efforts indicates the complexity of the endeavor and suggest that no single framework alone is comprehensive or applicable to all contexts or situations. Agritourism is emblematic of the challenge in identifying a suitable theoretical framework approach to measuring sustainability across scales and for multiple stakeholders. We reviewed existing theoretical frameworks (e.g., Doughnut Economics, Sustainable Livelihoods, Community Capitals, and Ecosystem Services), finding strengths and weaknesses in each of them (Raworth, 2017; Flora et al., 2016; Nguyen, 2018). We integrated insights from each approach to guide the process of selecting and organizing metrics for agritourism as an example of a sustainable food system.

A basis for understanding our agritourism sustainability metrics is that society and economy are embedded within, and constrained by, the natural world (so called "planetary boundaries"). As Raworth (2017) posits in her framework "Doughnut Economics," justice and equity (economics and social) are situated within an ecological ceiling (Figure 2). This perspective shifts sustainability from a position of weak sustainability, whereby depletions of natural resources can be rectified through technological innovation (i.e., natural capital is substitutable with other forms of capital such as human), to one of strong sustainability which recognizes that social and economic wellbeing are nested within and dependent upon the natural world (i.e., natural capital is not substitutable). Useful as the Doughnut Economics model is, its focus has primarily focused at global and national levels and has only recently begun to consider its application at smaller scales (i.e., cities, Doughnut Economics Action Lab [DEAL], 2020). In Vermont, our focus on agritourism enterprises and their linkages with their communities and counties means that our efforts are even more localized, leading us to identify additional frameworks adept at capturing small-scale dynamics.



Figure 2. Doughnut Economics Model

Throughout the 1990s the concept of livelihoods gained traction among development scholars and consensus grew around the idea that asset bases were filled with different kinds of capitals (natural, social, financial, built, and human) (Bebbington, 1999; Scoones, 1998). Sustainable Livelihoods (SL) became widely known and applied by scholars and development organizations alike (Moser, 2008). From the perspective of SL, livelihood strategies – what people do – is dependent on the access to, and configuration of, different capitals (Scoones, 1998). Similar to SL, the Community Capitals (CC) framework (Flora et al., 2016) utilized various capitals to characterize the various stocks of resources present at the community level. At its most basic, the idea was that sustainable community development rested on the ability of a community to generate a common pool of these resources that were accessible among community members equitably. We see benefit in merging the CC and SL frameworks to allow for the examination of the capitals’ availability and accessibility across scales, which is beneficial in two main ways. First, an integration provides the ability to assess the interactions of the capitals within and across scales. The former allows for the examination of the stocks of resources that exist in a particular geographic space, while the latter provides insight into the resources to which agritourism enterprises (in the case of this white paper) have access and how those are converted into activities that allow individuals to pursue their personal and commercial goals.

The Ecosystem Services (ES) framework (Sukhdev et al., 2010) provides useful language to characterize the natural world in which societies and economies are embedded. While ecosystem services are akin to natural capital in that they are considered as the benefits that humans derive from nature, supporting services underlie those direct benefits, removed from human use and thus not natural capital. Characterizing the natural world through an ES framework provides possibility to view the environment in more nuanced ways than only through a human lens based in self-interest, and more closely adheres to a core tenet of strong sustainability that human actions and potential are constrained by an ecological ceiling (Raworth, 2017). Natural capital serves as the link between the human constructed world and the natural world, but an ES approach to the environment allows for the kind of multidimensional depictions of the natural world as the capitals frameworks provide for the social world (for a more in-depth discussion of theoretical frameworks see Appendix A). Together, CC, SL, and ES frameworks allow for multidimensional, multi-scalar analyses of sustainability generally and how agritourism enterprises contribute (or not) to sustainability. In the sections that follow we use the synthesis of these theoretical frameworks as the foundation for considering methods, metrics, and indicators that will effectively measure social, ecological, and economic sustainability at the farm-community nexus in agritourism operations.

3. Methods

The first step of our approach focused on theoretical frameworks that identify components of a strong social foundation and prosperous economy (minimum, inner ring) that can exist within planetary boundaries (maximum, outer ring) (Raworth, 2017, Figure 2). We utilized these models to consider social, economic, and environmental aspects of the farm-community nexus, allowing for a categorization of different types of experiences and an accounting for the dimensions of sustainability and their interactions. These models and methods are outcomes of a multidisciplinary research team composed of individuals with expertise in food systems, community well-being, ecosystem ecology, rural sociology, applied economics, consumer behavior, and conservation of crop genetic diversity. Healthy discussion and debate among team members from these different disciplines regarding the theoretical framework, methodological approach, and unit of analysis support the metrics and results presented in this white paper.

The second step of the approach examined existing and needed sources of data, assessed their relevance to the conceptual framework developed in step one, and assessed their completeness with attention to scale (e.g., household, zip code, county, etc.). The result of this process is a table of suggested indicators, both existing and needed, believed to be key sustainability metrics for agritourism in Vermont and beyond (Appendix D).

The third step incorporated stakeholder input on priority metrics. The project team solicited stakeholder input via a one-hour webinar on December 4, 2020. Twenty-five participants

joined the webinar representing a range of interests and organizations including: Senator Patrick Leahy’s office, St. Michael’s College, Vermont Farm to Plate Network, Vermont Agency of Agriculture, Vermont Fresh Network, University of Maine, Fort Ticonderoga, Local Maverick, Shelburne Farms, Vermont farmers/producers, and faculty and students representing a range of UVM departments and disciplines. Throughout the webinar, online polls collected participant feedback on key metrics related to sustainability dimensions of the farm-community nexus. Poll questions sought to assess the aspects of environmental, economic, and social sustainability that stakeholders perceive as most important to agritourism businesses, and to the people and communities where agritourism businesses are located. Participants were asked to select their top three answers for each question and to share additional answers and ideas via the webinar chat feature. Poll results are included in Appendix B.

The fourth step synthesized the stakeholder input with the theoretical framework and prior research on key sustainability metrics. Table 1 below summarizes the key sustainable food systems metrics. These metrics are presented in more detail in *Section 4. Results & Implications*. The expanded sustainable food systems metrics table is included in Appendix D.

Table 1. Summary of Key Sustainability Metrics for Vermont Agritourism

Primary Sustainability Dimension	Metrics
Environmental	Open Space
	Farm Products
	Stewardship
	The Vermont Brand (Including <i>Terroir</i>)
Economic	Economic Impacts
	Consumer Spending
	Farm Profitability
	Farm Labor
	Farmland
Social	Cultural Ecosystem Services
	Labor Opportunities and Conditions
	Social and Informational Infrastructure
	Sense of Community, Community Networks, and Civic Engagement
	Demographic and Cultural Diversity
	Good Governance
	Health, Safety, and Wellbeing

4. Results and Implications

a. What Metrics/Measurements

Through this process, we have identified metrics that can: 1) capture a particular dimension of sustainability (e.g., environment), 2) address multiple dimensions of sustainability (e.g., social and economic) and/or 3) provide insight into interactions or trade-offs between the dimensions (e.g., environmental degradation from visitor use versus increased income from direct sales).

Environmental Sustainability

Metrics for the environment have become increasingly intertwined with the benefits nature provides to people (ecosystems services), or natural capital. The results of our stakeholder session indicate that open space and working lands are important to agritourism and Vermont (Table 1). Sales of farm products that contribute to working lands, such as maple syrup or apples, were also highly rated by stakeholders considering economic measures. Stewardship of forests was also well supported. An additional comment was added to include consideration of soil health (e.g., carbon sequestration, erosion control).

1. Open Space

The metric of Open Space associated with the agritourism enterprise is a proxy for many environmental services and goods. That is, open space is a rapid way to measure the relative status of the land and its services. Here, we consider the term “open space” to be inclusive of “natural” environments (e.g., forests) as well as working landscapes (e.g., pastures, row crops, orchards). In Vermont, the distinction between open space and working landscapes is a continuum, where a forest parcel may function for maple sugaring operations, selective timber harvest or other uses, and pastures may be grazed with varying intensity. We define open space to consist of the non-built environment (e.g., fields, forest), explicitly excluding the built environment (e.g., parking lots, buildings).

Environmental services inferred from open space include the lands’ ecological, social and economic functions. Ecologically, open space has many benefits to humans as it represents more “natural” cycles of water (e.g., water retention, filtration), energy (e.g., no urban heat island), nutrients (e.g., erosion control, phosphorous retention) and carbon (e.g., soil health, climate mitigation) compared to the built environment. Socially, open space generates cultural ecosystem services (see Social Sustainability section in this section) by providing access to recreation (e.g., hiking), social activities (e.g., gathering), and cultural activities (e.g., maple sugaring, yoga). Economic benefits include the direct flow of consumer funds to individual farms as well as associated spending in the community (e.g., buying gas or maple syrup after hiking). Environmental goods represented by open space could include food, fiber, and fuel.

2. Farm Products

In an ecosystem services perspective, the act of providing farm goods (e.g., primary productivity that produces food) is in the environment dimension. While these goods are largely valued

economically (e.g., price of a gallon of maple syrup) rather than for their contributions to ecosystem services, we specifically list this metric both the environment dimension and provide more details in the economic dimension.

3. *Stewardship*

Agritourism enterprises demonstrate their commitment to land stewardship in different ways. One way is in maintaining open space (see above). Specifically, stakeholders said they valued forest stewardship, so it is important to capture this specific land use (forest cover) within the metrics. Additionally, stewardship can be demonstrated by measurements of biodiversity or commitments to particular practices (often through certification, e.g., pollinator friendly habitat, delayed haying for bobolink nesting).

4. *The Vermont Brand and Terroir*

This is perhaps the most pervasive and well-known metric as well as the most difficult to define. Identifying aspects of our environment and culture that contribute to the perception of the “Vermont brand” would take further social science study as well as biological study, although some imagery connotes the iconic aspects—forested hills, lakes, open space, rustic, small farms, environmental stewardship ethic, etc. Some aspects of the Vermont brand can be captured by understanding the *terroir* of our place. *Terroir*, in wine or other foods, arises from an interaction of the genetic background of the crop grown (the grape variety, for example) with the environment and organism in it (the climate, the soils, microbes, pests). We outline some of the research needs to better understand what contributes to Vermont *terroir* briefly in the research needs section below, and at greater length in Appendix C.

Economic Sustainability

Metrics regarding economic sustainability overlap substantially with environmental and social sustainability metrics. This integration of metrics is a key aspect of the white paper process and outcomes. The economic sustainability dimension includes both the demand (consumer/visitor) and supply (farmer/producer) sides. Economic impact metrics encompass the full range of monetary benefits including the farm and consumer sides for a specified geographic scale ranging from a community, county, state, or larger region. To get a better understanding of priority metrics at the consumer and farm level, we also discuss consumer spending and farm profitability, along with critical inputs: farm labor and farmland.

1. *Economic Impacts*

Economic impact is measured at three levels: direct, indirect and induced. An economic impact study measures the changes in spending in a specified geographic area due to a hypothetical change in economic activity. It is typically measured at a national, state, regional, or community level. The **direct effect** results from dollars spent on agritourism products and services by a “final” consumer or visitor. The **indirect effect** results from the agritourism proprietors purchasing goods and services to run their business and hiring workers. The **induced effect** results from the effects of the changes in household income due to the

economic activity from the direct and indirect effects. For example, farm employees spend their paycheck buying food at the grocery store or paying the mortgage on their house. The total effect is the combination of direct, indirect, and induced effects.

2. Consumer Spending

Consumer spending is a necessary input for measuring economic impacts. Five overlapping categories of agritourism include: direct sales of farm products, entertainment, outdoor recreation, hospitality, and education. These activities and market channels can occur either on the farm, in the community in which the farm is located, or through online or mail order sales. Examples of each activity, broken down into core and peripheral activities, can be found in Figure 1 of this paper. Data is needed at the specific level of each activity and/or market channel. The estimated income attributed to agritourism in Vermont in 2017 was \$51.7 million, with 97% of that revenue coming from direct sales of food (USDA, 2019), suggesting that consumer spending on recreation, education, hospitality, and entertainment on farms is much lower. However, as will be discussed in section 4e, agritourism revenue other than direct sales may be underreported. Further, visitors to agritourism farms often spend money in the surrounding community, seeking other sources of food, lodging, entertainment, education, and hospitality.

3. Farm Profitability

At the farm level, profitability is a measure of a business's ability to produce a return on an investment based on its resources. Simply put, revenue minus expenses equals profit. The contributions of agritourism to overall farm profitability vary from farm to farm. For some farms, agritourism is responsible for relatively little of the farm's overall income, while for others it can be the primary source of revenue (Schilling et al., 2012). Economic benefits can extend beyond short-term profitability, including diversification of revenue, which is viewed as improving income stability (Tew & Barbieri, 2011), and the potential for longer term economic benefits arising from public engagement via agritourism (Schilling et al., 2012). Profitability and revenue generation are often complemented by farm goals related to social and environmental sustainability dimensions (Quella et al., in press).

4. Farm Labor

Labor is frequently identified as a major concern for agricultural enterprises (Chase and Grubinger, 2014). Agritourism creates an opportunity for farms to hire additional staff, often requiring skills different than those necessary for food production, such as customer service, marketing, and hospitality. The additional employees hired on to assist with agritourism activities may be part-time or seasonal (Veeck et al., 2016), due to the seasonal nature of common agritourism activities such as corn mazes, Christmas events, and pick your own orchard visits. In addition to hired workers, agritourism allows family farms to pay more family members who might otherwise not be paid a regular salary (Schilling et al., 2012) and allow farmers (who often don't pay themselves a salary) to have more income. These employees in turn can spend their income at other local businesses, improving the local economy. See the section on labor opportunities and conditions, under social sustainability, for a longer

explanation of the benefits that come from farm labor. In 2019, the hourly farm wage (\$13.99) was equal to 60 percent of the nonfarm wage (\$23.51) (USDA Economic Research Service [USDA ERS], 2020b).

5. Farmland

Access to land is the top challenge identified by young and beginning farmers (Ackoff et al., 2017). The price per acre of farmland is a measure of accessibility of financial resources in order to operate an agritourism business. It is estimated that 70% of US farmland will change hands in the next two decades (Cargill, n.d.). Insecure tenure undermines environmental stewardship, investment, and community-building -- encompassing all three dimensions of sustainability. Agritourism is impacted by the availability of affordable farmland, but also provides an opportunity for land conservation by allowing visitors to connect to rural amenities and food production, which can improve the public's view of farming and provide support for conservation of agricultural land (Schilling et al., 2012). Increased revenue from agritourism and public awareness of agricultural amenities could help reduce development pressure placed on farmland, keeping more land available for agriculture over the long term. Economic benefits also come from the environmental services that open space and agricultural land can provide, as discussed previously in the environmental sustainability section.

Social Sustainability

Though identified as one of the core dimensions of sustainable development for over three decades, social sustainability has not received the same attention as environmental and economic sustainability, although Vermont has been the focus of some research (e.g., Chase et al., 2013). In part, this is due to the expansiveness of social sustainability, leading to haziness in both theory and measurement. As Boström et al. (2015) note, "social sustainability refers to a variety of aspects such as quality of life, inter- and intra-generational justice, local populations' access to natural resources, citizens' access to green urban spaces, cultural diversity, gender issues, workers' right, broad stakeholder participation, and development of social capital." Given the breadth of considerations, many conceptualizations exist in how to categorize the concept, though many converge in substance if not language. We have drawn from these various frameworks, and specifically Amartya Sen's body of work, settling on four dimensions of social sustainability: quality of life, social cohesion, equity and diversity, and democratic governance.

- **Quality of life (QOL)** refers to meeting material and non-material needs to lead a 'good life'¹ for all members in society.

¹ We recognize that defining the 'good life' is full of cultural, social, and political assumptions. This is unavoidable – Saunders et al. (2020) reminds us that the project of sustainable development is political – which priorities get set, by whom, and the degree to which they are invested are questions of how power is distributed and used in society. For the purposes of this white paper, we adhere to the work of Sen and others, which, while being culturally appropriate to the Vermont context, must also be culturally situated and not assumed relevant or appropriate for other geographic and cultural contexts.

- **Social cohesion (SC)** refers to the quality and strength of social bonds, such that they foster belonging, trust, and the capacity to act collectively.
- **Equity and diversity (ED)** focus on the promotion of diversity and the achievement of equitable opportunities and outcomes.
- **Democratic governance (DC)** promotes open and inclusive processes of the making and enacting of formal and informal rules.

We then relied on an extensive literature review, coupled with feedback from our stakeholder meeting, to select seven metrics that collectively account for considerations of social sustainability relevant to agritourism. Below we present these metrics, indicating the dimension(s) of social sustainability each reflects. Although our metrics are important to for Vermont’s agritourism, they do not capture the entirety of social sustainability.

1. *Cultural Ecosystem Services (Dimensions: QOL, SC)*

Cultural Ecosystem Services (CES) focuses on the people-community-environment nexus, describing the non-material benefits people obtain from ecosystems (Millennium Ecosystem Assessment [MA], 2005; Sukhdev et al., 2010). As a link between humans and their natural environment, CES helps explain why people may have a sense of being “at home” in a landscape (Schaich et al., 2010). Providing insight into the underlying values motivating people to interact with their environments in particular ways (Chan et al., 2016), CES assesses recreation and ecotourism, sense of place, aesthetic, cultural heritage, education, inspiration, social relations, cultural diversity, and spiritualism and religion (MA, 2005). A wide range of indicators have been used to measure CES, including number and type of recreation facilities (i.e., hunting, fishing, boating), park visitation, forested land, water quality, as well as indicators of social values, cultural scores, recreational potential, and willingness to pay (La Rosa et al., 2016).

A dimension of CES of particular interest to agritourism is sense of place, which encompasses attachment to place and place as a center of meaning. In general, place attachment can be understood as the strength of emotional and symbolic bonds that individuals, groups, or communities feel to a place, which is distinct from the goods and services provided by that place (Williams, Stewart, & Kruger, 2013). Place meaning refers to how place shapes, and is shaped by, individuals' cognition and beliefs (Stedman, 2008). Within agritourism, CES generally and sense of place specifically help explain the connections producers and consumers make with and to a particular place, helping to give rise to regional identity, as well as opportunities for cultural branding and touristic experiences oriented around that identity (see discussion of Vermont brand and *terroir* above). These connections may be to a particular location or to a “generic” place (e.g., seascape, lake, farm) (Scannell & Gifford, 2014). Agritourism can benefit from fulfilling a desire to connect with the rural ideal (farmscapes), providing additional revenue generation for farmers as well as rural experiences for consumers (Harrington, 2018). In the Vermont context, sense of place is also important to the state’s brand and regional *terroir*, which helps entice some visitors from nearby urban centers in Massachusetts, New

York, and Quebec. Leveraging the bonds that people have with Vermont's imagery and identity is a promising pathway for agritourism to maximize its potential for sustainability.

2. Labor Opportunities and Conditions (Dimensions: QOL, ED)

Labor has been central to debates over the justness and sustainability of capitalism since its onset. Increasingly, empirical evidence on exploitative labor practices across the food system, including migrant workers (Mares, 2019), food processing (Miraftab, 2016), and restaurant workers (Jayaraman, 2012), has highlighted the deficiencies in the social sustainability of the food system. Strohlic et al. (2008) summarize the myriad benefits that farm enterprises reap from creating just labor conditions, including enhanced farm viability and worker satisfaction and retention. Van Rijn et al. (2019) conceptualize labor conditions on farms to consist of labor standards (wages and salaries; in-kind benefits; job security; standard of living), working conditions (health; workplace safety; dialogue and trust), and participation and identity (workers' organization, sense of ownership and control; career potential). These considerations exist alongside the economics of farm labor (see discussion above) to ensure that the employment that is available is just and fair.

3. Social and Informational Infrastructure (Dimensions: QOL, SC)

Given that humans are embedded in and interdependent on community and the wider world, farm and agritourism operations must be able to access necessary social supports and technical information to succeed. Agritourism requires resources and information such as access to agriculture extension services and other technical support, farm insurance, succession planning, seed and livestock supply, climatic information, emergency weather broadcasts, and disaster relief, as well as relationships that provide emotional support, help maintain mental health, and contribute to overall well-being. However, not only must these services be available, but they also need be accessible. To be fully inclusive, social and informational resources need to be equitably accessible across diverse contexts, a challenge, given that it requires attention to such considerations as developing outreach materials and that are culturally appropriate, social mores which may discourage certain populations from accessing social services, gender bias, and ensuring that resources and services are physically and economically accessible. Farms that can tap into social and informational supports are more resilient and adaptable in the long term (Meuwissen et al., 2019). Broad, inclusive access to these resources helps to increase farm viability, social cohesion, and quality of life within agritourism operations but can also radiate out into the larger community as a generator of equity and diversity.

4. Sense of Community, Community Networks, and Civic Engagement (Dimensions: SC, DC)

The concept of "sense of community" (SoC) encompasses feelings of belonging, support, worth, and commitment that members of a community hold for one another. SoC has four dimensions: membership, shared emotional connection, needs' fulfilment, and influence (McMillan & Chavis, 1986). Strong SoC is correlated with healthier communities, collective efficacy, local development, higher life satisfaction, personal health, and trust (Schellenberg, 2016). Active civic, social, and political participation is associated with a stronger sense of community (Talò et

al., 2014) and trust (Miranti & Evans, 2019). Social networks within and across communities and community engagement have long been an indicator of societal health. Agritourism holds important potential to foster social sustainability through building and strengthening networks between and among producers and consumers (Che, Veeck, & Veeck, 2005). Kinship, friendship, and acquaintanceship networks are important in fostering social cohesion among community residents (Browning et al., 2004). Trust, reciprocity, information sharing, and collaboration within social networks builds social capital, which allows communities to be able to engage in capacity-enhancing, community-building, and economic opportunities (McGehee, 2010). Putnam (2000) used various measures of social involvement to indicate the social capital (which he defines as the trust, norms, and networks that encourage collective action for shared benefit) of a given place. Lyson and Guptill (2004) tied ideas of civic participation with agriculture, arguing that the emergence of local food systems, indicated by direct-to-consumer marketing, fostered opportunity for both economic and community development.

5. Demographic and Cultural Diversity (Dimensions: ED)

Systems with greater diversity tend to be more adaptable and durable to shocks both anticipated and unforeseen, and this applies to both ecological and social systems. Demographic and cultural diversity in agritourism can offer a variety of solutions to specific sustainability challenges relevant to a particular farm operation (Meuwissen et al., 2019). The culture of a workplace affects how inclusive or exclusive it is to diverse demographics (e.g., race, socio-economic status, physical ability, place of residence, or other distinctions). Creating a workplace and public-facing agritourism business that is welcoming to all demonstrates to the larger community the benefits of equity and opportunity for all creating more trust and social cohesion through inclusion. This demographic and cultural inclusion operates at multiple levels, including at the level of ownership, within the workforce, and at the farm-public interface as an agritourism operation. At the farm-public interface, an important question is whether the operation reaches out broadly to invite all demographics to participate in agritourism, inclusive across age, ancestry/ethnicity, physical ability, etc., and creates welcoming and inclusive experiences for those who decide to participate. The ability and capacity to do so is also influenced by the context; the diversity of the population that resides in the area where the agritourism enterprise operates is informative to that business's level of engagement with diverse communities. Striving for inclusivity benefits social cohesion, but also affects economic sustainability as it may shift or expand the target market/audience of the business. Additionally, agritourism operations that utilize traditional, regional, or culturally specific methods or planting material help to showcase a diversity of ways to work with the land and celebrate traditional knowledge as an alternative to industrialized agriculture which is often disassociated from local cultural, historical, and social values and knowledge.

6. Good Governance (Dimensions: DG, SC, ED, QOL)

Governance focuses on the processes of making, implementing, and enforcing decisions, rules, and policies. It has received increasing focus within social sustainability, as it has become well established that how sustainable development is pursued should be given equal weight to what sustainable development is about (Boström et al., 2015). Although definitions of good

governance vary, core elements are consistent across most definitions: effectiveness, transparency, accountability, participation, inclusivity, and equity (Wilde et al., 2015). Good governance has been found to foster trust (da Cruz et al., 2016) and enhance quality of life (Cárcaba et al., 2017). In the context of agritourism, good governance is critical to consider both in terms of the policy context in which agritourism enterprises operate as well as the conditions experienced by workers of these enterprises. The rules governing how resources are distributed in society, and who gets to make those rules, reveal the power structures that underlie questions of justice and equity. Given the challenges that land access presents to beginning farmers (see Farmland above), particular interest relates to the governance of and access to land.

7. Health, Safety, and Wellbeing (Dimensions: QOL, ED)

Processes of sustainable development seek to generate beneficial outcomes and conditions for individuals and communities that can be maintained over time. Conventionally, measures of health, safety, and wellbeing have focused on conditions critical to having a baseline of security and opportunity: food security, nutrition security, health status, educational attainment, housing conditions, etc. Other, often non-material, dimensions are increasingly being recognized as necessary to account (i.e, happiness, mental health, psychological safety, benefits from cultural ecosystem services, etc.). All these considerations are critical to monitor not just for benchmarking purposes but also to examine the contextual conditions that are best suited to support successful agritourism enterprises (i.e., are places that have certain education levels more likely to support and retain agritourism enterprises?).

b. What Data are Necessary?

Environmental Sustainability

1. Open Space

Open space can be assessed at multiple scales and is a land-based measure. A universal data set for the state could be developed as a GIS activity. This would merge existing data on land cover types (e.g., pasture, crops, built environment) with property data (e.g., grand list) and identification of agritourism enterprises. Alternatively, individual farms may choose to report their open space. Economic metrics of income, wages, and consumer spending can be overlaid. Socially, open space may relate to senses of community and place and civic engagement.

2. Farm Products

See Economic Sustainability (profitability, consumer goods). Socially, farm products may also relate place and community attachment and employment opportunities.

3. Stewardship

Forest stewardship and biodiversity can be assessed with geospatial data sets on land cover. Forest cover, as well as the matrix of land uses, are proxies for forest stewardship and biodiversity. Additionally, the State of Vermont has habitat data for many species through the

geospatial BioFinder data set available online in a webmap format. Alternatively, more local information could be collected, such as survey-based data on practices and commitments/certifications that relate to stewardship and biodiversity.

4. *The Vermont Brand and Terroir*

We have noted that current knowledge is limited regarding what aspects of our socio-cultural context and natural environment (our climate, microorganisms specific to our climate, etc.) contribute to local flavors or aspects of the Vermont brand and *terroir*. *Terroir*, in wine or other foods, arises from an interaction of a crop's genetic background (i.e. the grape variety) with the local environment (e.g., climate, geology and soils, microbes, pests). Biologically, there has been very limited research to date on Vermont *terroir*. We would benefit from more information on crop varieties and livestock breeds that may be unique to this region, an area for future investigation as described in our appendix. Similarly, information on microbial diversity (in soils, on fruit), an underappreciated contributor to *terroir*, is needed. The emergent unique Vermont *terroir* relates to cultural and economic components of the Vermont brand of agritourism. We elaborate on research directions in Appendix C.

Economic Sustainability

Limited data are available to address some of the five metrics discussed below, primarily through past UVM research and the USDA National Agricultural Statistics Service. However, substantial data gaps exist for all five metrics. Many of the gaps could be at least partially filled through annual farmer and consumer surveys. Consumers should include not only Vermont residents but also visitors from out-of-state.

1. *Economic Impacts*

Economic impact studies are conducted using input-output (IO) and Social Accounting Matrix (SAM) models. IO Analysis examines the movements of products and services between industries, households, and governments. The SAM model adds non-industrial financial flows (taxes, dividends, interest, investments, borrowing, social security, unemployment compensation, etc.) to the typical IO elements noted above. The software package and database, IMPLAN (IMpact analysis for PLANing), is commonly used to conduct economic impact studies. Data for the IMPLAN database are supplied by the US Department of Commerce, US Department of Labor Statistics, US Department of Agriculture, and other federal and state government agencies. These data can be adjusted to reflect the specific situation of a community. This requires an understanding of the specific situation of a community or region that may not be reflected adequately or appropriately by data already contained in the SAMs included with IMPLAN software.

2. *Consumer Spending*

Data on consumer spending is needed as an input for economic impacts studies, as well as for market research and developing profiles of different types of consumers of agritourism activities. These data can be obtained by surveying consumers (farm visitors) both in Vermont and outside of Vermont. In Vermont, the UVM Center for Rural Studies conducts an annual

Vermont Poll that could contain questions about consumer spending on direct sales of local food and experiences on farms. Past Vermont Poll questions of interest include: direct local food purchases in the past year, purchase of local food products from retail stores in the past year, change in purchase of local food from farm stands and farmers' markets year to year, purchase of maple syrup from farmers and farm stands in the past year, willingness to pay more for "Made in Vermont" food products including maple syrup, sausage, and cheddar. Indeed, value of the Vermont brand has been revealed only in the economic realm, through willingness to pay for Vermont products. Data from Vermont visitors can be captured in a variety of ways:

- 1) Surveying visitors while they are in Vermont through intercept or online surveys at welcome centers, and tourism attractions including farms, and lodging establishments;
- 2) Contacting past visitors by email or phone using contact information potentially supplied by the Vermont Department of Tourism and Marketing, tourism attractions including farms, and the newly forming Vermont Lodging Association;
- 3) Purchasing data from national tourism surveys through companies such as Longwoods International. However, these data from national surveys frequently have a limited sample of Vermont visitors and tend to focus on general tourism expenses without the specificity needed for agritourism research.

3. Farm Profitability

To understand the impact of agritourism on revenue, the following measures should be collected: revenue and expenses from all farm and non-farm-related sources, revenue and expenses from agritourism enterprises, sales per day of operation, percentage of total sales from agritourism and recreational services, percentage of sales from direct marketing, and consumer spending on farm products, entertainment, recreation, education, and hospitality. To understand the off-farm impacts, revenues from restaurants, hotels, and other businesses near agritourism farms can be collected to see how they are related to and may increase due to agritourism events. Farm expenditures can be examined to see how agritourism revenue is spent on supplies from backward-linked industries.

4. Farm Labor

The U.S. agricultural workforce has long consisted of a mixture of two groups of workers: (1) self-employed farm operators and their family members, and (2) hired workers. In 2019, the farm wage (\$13.99) was equal to 60 percent of the nonfarm wage (\$23.51) (USDA ERS, 2020b). Measures that can be used to understand the impacts of agritourism on labor include: number of full-time staff, number of part-time and seasonal staff, family vs. non-family staff time, wages, benefits, total hours of employment, and the days of operation per year.

5. Farmland

To understand the economic impacts of agritourism on farmland, the following metrics could be used: average cost per acre of farmland, land availability and location (size and continuity of parcels), rent/mortgages paid, availability of financing/capital, number and types of policies

tied to land access, opportunity cost of not developing agricultural land, amount of farmland used for food production and for agritourism, and the amount of farmland that is protected.

Social Sustainability

Given that social sustainability has not received its due attention, large data gaps exist, meaning that primary data collection will be necessary. There are some existing data that help provide contextual information on the social conditions at a particular geographic scale, primarily the county level, and allow for examination of how these broader conditions help support (or not) the vibrancy of the agritourism also existing there. However, our recommendation is that a dedicated effort to data collection at the household/individual level will be necessary to account for the social dimension of sustainability.

1. Cultural Ecosystem Services

In a review of current methods for assessing CES, Hirons et al. (2016) suggests using a combination of methods to assess CES, preferably including participatory and deliberative methods. However, they acknowledge that the choice of method is constrained by practical, political, and ideological considerations, barring the development of a single metric for assessing CES. A review of CES indicators by Hernández-Morcillo et al. (2013) suggests that spatially explicit measures, such as mapping tools, improves the quality of CES indicators, such as used by Plieninger et al. (2013) and Schaich et al. (2010). La Rosa et al. (2016) offers a review of indicators (see table, p 79) used in 63 CES studies, which can be used in selecting place-specific metrics. Gould et al. (2018) provides an interview protocol to elucidate CES values in a community that aims to provide contextual and place-based data focused on human well-being. A UVM professor, Gould provides expertise on CES and would be an excellent source to identify potential indicators that currently exist in secondary datasets. For research specifically on sense of place, we recommend basing efforts in the five-dimensional model of place attachment developed by Raymond et al. (2010) that included place identity, place dependence, nature bonding, family bonding and friend bonding. It should be noted that CES, as with most of these metrics for social sustainability, are complex and nuanced. Quantifying CES, sense of place, and other social metrics through survey research captures a partial perspective that would benefit from qualitative research to further examine how people experience landscapes. For qualitative studies on sense of place, expertise exists at UVM with Dr. Cheryl Morse of the Geography department.

2. Labor Opportunities and Conditions

At the county level, the U.S. Bureau of Labor Statistics, the US Census, and the Vermont Department of Labor provide publicly available data on aspects of labor and employment. Aspects of the informal economy are also important to consider, especially in the context of agriculture in which informal labor is common. Although existing data are less readily available, Alderslade et al. (2006) provide methodological options for providing information about labor in the informal economy. For household/individual levels, the Department of Labor's National Agricultural Workers Survey is a comprehensive instrument that could be considered together

with the standards for Food Justice Certification, a third-party certification that audits for just labor practices and Fair Trade standards.

3. Social and Informational Infrastructure

Data for social and informational infrastructure can be obtained from a combination of county level demographic data combined with farm and community-level survey of demographics and practices, particularly focusing on what types of social infrastructure and information are available *and* accessible, including those directly related to farming such as extension services, as well as geographic proximity to resources and infrastructure such as access to high-speed internet. While assessment of these aspects of social sustainability have been lacking in North American agricultural research, European scholars have been exploring and developing sets of indicators and composite indices (Herrera et al., 2016) which can help guide selection of indicators and data needed.

4. Sense of Community, Community Networks and Civic Engagement

At the county level, the Social Capital Project of the Joint Economics Committee of the US Congress has put together a comprehensive index, with accompanying publicly available data, of social capital at the county-level (Social Capital Project, 2018). Penn State University also provides publicly available data used to build its county-level social capital index (Penn State, n.d.). The National Research Council published a book on measures of social capital that provides a two-page table of measurable elements, including voting records, volunteering, memberships, frequency of interactions, confidence in institutions, access to education, and income inequality, as well as where to find measures within current major US surveys (Prewitt et al., 2018). Indicators for civic agriculture, NOFA VT provides data on CSAs, farmers' markets, and farm stands/pick your owns) by county. Lyson et al. (2001) provide a model that incorporates county-level (agricultural) census data to examine connections between agricultural production, civic engagement, and community welfare.

At the individual level, sense of community is most commonly measured using the Sense of Community Index (SCI), a 12-item true-false survey that has proven to be reliable across many community settings. The SCI tool was updated in 2008 to a 25-item Likert response scale (Chavis et al., 2008). Schellenberg et al. (2018) found that a single self-assessment question for sense of community belonging was an adequate measure of a broad range of correlates of community belonging (socioeconomic and demographic characteristics, neighborhood characteristics, rootedness, and social capital). In addition, relevant to both agritourism operators/employees and customers, surveys measuring civic engagement (e.g., Civic Engagement Scale [Doolittle and Faul, 2013] and community trust [e.g., Di Napoli et al., 2019] would provide insight into people's general orientations towards their communities. Extensive survey research has also been conducted over the last several decades on consumer preferences for and behaviors towards local food (see Feldmann & Hamm, 2015 for a literature review).

5. Demographic and Cultural Diversity

Data for demographic and cultural diversity can be obtained from a combination of county level demographic data (e.g. American Community Survey of the Census Bureau) combined with farm-level surveys and self-assessment of demographics and practices, including rates of farmers/employees that are women or underrepresented populations, physical accessibility for employees and community participants (i.e. customers), usage of culturally traditional crops/methods, and presence of cultural diversity awareness/celebration programming. Research suggests measuring engagement across diverse groups within a region in democratic activities such as elections, and using existing data such as participation on voluntary civic and community organizations (Axelsson et al., 2013).

6. Inclusive and Transparent Governance

Many measures of good governance exist at national levels (e.g., World Bank's World Governance Indicators), although efforts are being made to establish measures of good governance at sub-national and local scales. Multiple methodological approaches can be utilized to assess local governance (including content analysis of policy documents, surveys, interviews, and existing secondary data) (Wilde et al., 2015), which would need to be adapted and tailored to the agritourism sector in Vermont to evaluate the policy context in which agritourism enterprises operate. Sornkaew (2009) provides recommendations for specific data to use to indicate aspects of good governance and although many of the indicators are not relevant (i.e., military in politics), others are relevant and already exist (i.e., percentage of people who voted in national and local elections) or are relatively easily obtainable through survey research (i.e., percentage of people who believe budget allocation meets local needs). Pomeranz and Stedman (2020) have recently piloted a survey instrument that measures eight dimensions of good governance for assessing local programs (deer management in their case) that could be adapted to the agritourism sector.

7. Health, Safety, and Wellbeing

To assess the social conditions at the county and state levels, useful secondary data exist and are available from national and state agencies for food security (e.g., USDA ERS) health (e.g. Vermont Department of Health; Centers for Disease Control and Prevention [CDC]; County Health Rankings & Roadmaps Program), mental health (CDC), education (e.g. Vermont Agency of Education; US Census Bureau), crime rates (Federal Bureau of Investigation), and housing (US Census Bureau) (see Appendix D for website URLs). Happiness, a sustainability metric first implemented by Bhutan and subsequently taken up by the United Nations through their annual world happiness report, has also been measured by the Center for Rural Studies. Ongoing farm-level measures of these wellbeing metrics would also be useful to track connections between contextual (county-level) conditions, type of agritourism enterprise, and sustainable outcomes.

c. How to Store/Document and Track Data

Environmental sustainability metrics can be archived and made publicly available through the UVM Forest Ecosystem Monitoring Cooperative (FEMC, n.d.). The FEMC is a DataOne node so they assign DOIs to datasets, follow strict metadata standards, publish data online, and provide secure back-up systems. Existing data sets may already be hosted by the State (e.g., BioFinder [Agency of Natural Resources (ANR), 2020a], VT ANR Atlas [ANR, 2020b]) and could be linked off a central ARS Center Website.

Economic and social sustainability data collected through surveys can be stored at UVM and managed through the UVM-ARS Center in conjunction with the Center for Rural Studies (CRS). CRS has 30+ years of experience developing and implementing surveys of a wide variety of constituents, including consumers and farmers. CRS can develop, deliver, manage data, store data, and conduct analyses for both qualitative and quantitative surveys using in-person, web, email, and telephone-based technologies. UVM has recently purchased the Qualtrics package of survey tools, which could be used for both consumer and farmer surveys.

d. How Could These Metrics Be Measured and Replicated

Environmental Sustainability

Environmental sustainability metrics have some existing data for metrics, require new analysis of existing data or need new data—much of it with spatial and or temporal dimensions. The State of Vermont has habitat data for many species through its geospatial BioFinder data set available online in a webmap format (ANR, 2020a). Information on open space exist in publicly available, state-wide database of land cover types.

Spatial analysis and modeling with current data sets can address questions like the role of open space in agritourism and ecosystem services such as water retention (Watson et al. 2016), pollination (Koh et al., 2016) and forest productivity and fragmentation (Adams et al. 2018, 2020). Economic metrics of recreation (e.g., Sonter et al., 2016), and education could also be used to value this category. Alternatively, more local information could be collected, such as survey-based data on practices and commitments/certifications that relate to stewardship and biodiversity.

New research is needed to understand Vermont *terroir*. Ecologically, there has been limited research to date on crops and crop varieties and conditions that may be unique to this region—also an area for future investigation.

Economic and Social Sustainability

Primary and secondary data collection are required to measure metrics. Specifically, regular surveys of producers and consumers could provide data needed for longitudinal analysis. Consumers include Vermont residents as well as visitors from outside Vermont. Given that many of our recommendations for primary data collection revolve around surveys, assuring

that any instruments utilized are valid and reliable is critical for methodological soundness. Because extensive data gaps exist for both economic and social sustainability, enacting longitudinal farm and consumer surveys presents an important opportunity to benchmark and monitor changes to sustainability. The Center for Rural Studies has the ability to lead this data collection and could look to established efforts of longitudinal data collection at the household level such as the World Bank's Living Standards Measurement Survey and USAID's Demographic and Health Survey's for methodological guidance. CRS's annual Vermonter Poll is an example of a UVM survey that could be part of this coordinated effort moving forward.

For Vermont-specific data collection efforts outside of UVM, the Vermont Agency of Agriculture conducted an annual producer survey between 2017 and 2020. However, the response rate has been low for the past few years, with less than 100 producers responding to the most recent survey in 2020 (A. Matthews, personal communication, January 12, 2021). For 2021, the Agency is considering working with UVM researchers on the annual survey instead of conducting it themselves. Focused on Vermont visitors from out-of-state, the Vermont Department of Tourism and Marketing conducts a benchmark survey every two years, and there could be potential for collaboration with that survey effort.

Secondary data sources include the US Census Bureau and the USDA National Agricultural Statistics Service (NASS). These agencies collect data that can be used to track metrics of economic sustainability, although limitations exist and data will need to be supplemented from primary sources. For example, the NASS direct marketing variable is limited to food and is separated from the agritourism variable in the USDA NASS Census of Agriculture. Both variables must be used when evaluating agritourism revenue using the broad definition set in this paper. For data from existing datasets, opportunity exists to write statistical code and make it publicly available. Expertise on this front exists within CALSX with Dr. Meredith Niles and Dr. Travis Reynolds. Input-output and Social Accounting Matrix models can be used to conduct economic impact studies, as described in the previous section. As for many of the metrics, a combination of primary and secondary data is needed for accurate, reliable measurements.

e. Anticipated Challenges

- 1) Coordination of surveys: Currently, UVM researchers frequently send farmers and consumer surveys without coordination and communication. This has resulted in survey fatigue and low response rates as well as inefficiencies and additional expenses at UVM. While coordination will have benefits, developing a culture of collaboration around surveying at UVM will be challenging.
- 2) Consistent funding and staffing will be required to maintain the annual surveys.
- 3) Addressing the many interests of UVM researchers may result in surveys that are too long.
- 4) For economic impact studies, data at the community level must be adjusted (a research project in itself).

- a. Some farmers do not label agritourism revenue generating activities as agritourism (Schilling et al., 2012).
 - b. The National Agricultural Statistics Service separates direct marketing revenue for agritourism revenue in its data collection, so farmers who do not label education, recreation, entertainment, and hospitality as agritourism revenue will not have their revenue accurately categorized. Further, data on direct sales may include sales that occur off farm.
 - c. While the Census of Agriculture can provide a high level, state-wide picture of agritourism within the larger direct to consumer sales data, a farmer survey is likely needed to collect specific data about agritourism businesses (and other types of farm sales).
- 5) New environmental analysis, e.g., *terroir*, may require coordination for funding through other sources such as competitive federal grants.
 - 6) Supervision and coordination of analysts with a wide range of specializations (e.g., spatial analysis, social surveys) will require a broad leadership for sustainability.

f. Other Metrics for Consideration

Another consideration for the economic viability of agritourism is off-farm income supporting the operations. Off-farm work serves as the primary source of income for over half of farm operators in the United States (Veeck et al. 2016), suggesting that farm income is supplemented by other income for many agritourism farm operators. Farm revenue should therefore be evaluated for its sustainability based on if it helps farm households to meet financial objectives, not just on the amount of revenue alone.

Vermont is pursuing work, led by researchers at the Gund Institute for Environment, on Payment for Ecosystem Services (PES). These PES ideas would pay farmers to reduce phosphorus loading from their farms. Metrics for sustainability may be natural links with the ARS Center.

5. Future Implications

This paper identifies and integrates a set of common metrics describing the sustainability impacts of direct sales and agritourism enterprises for subsequent analysis of how farms, households, communities, and counties can leverage these opportunities while mitigating tradeoffs and negative externalities. In developing this paper, we sought sustainability metrics in four major steps:

- 1) Using the conceptual framework, we described the types of metrics necessary to understanding sustainability dimensions of the farm-community nexus;

- 2) We examined existing sources of data to assess their relevance and completeness relative to step 1, and identify data needs through our working knowledge of Vermont data sets, literature review, and other relevant sources;
- 3) We prioritized metrics based on stakeholder input;
- 4) We considered synergies and unintended consequences between the dimensions of sustainability, and identified cross-over metrics that address both the social floor and planetary boundaries.

The outcome of this effort is a better understanding of the interaction between the dimensions of sustainability and their impacts on each other. Through this process, we have identified metrics that can: 1) capture a particular dimension of sustainability (e.g., nutrient management/environment), 2) address multiple dimensions of sustainability (e.g., livelihood/socioeconomic) and/or 3) provide insight into interactions or trade-offs between the dimensions (e.g., environmental degradation from visitor use).

Recommendations

By integrating frameworks to measure the range of benefits and tradeoffs provided by direct interactions between farmers, visitors, and consumers, we can aggregate information over time, location, and enterprise type. Based on our assessment of existing and needed metrics summarized in this white paper, our key recommendations to the ARS Center include:

- 1) The UVM-ARS Center can catalyze and synergize existing efforts and resources in Vermont to holistically address sustainability. Potential key partners include the Center for Rural Studies, Gund Institute for Environment, and Vermont Tourism Research Center to name a few. Specific opportunities include:
 - a. Create and implement an agritourism longitudinal consumer survey for Vermonters and tourists. Agritourism has different segments and sub-markets (e.g., overnight farmstays, outdoor recreation, educational tours, farm to plate, and various direct marketing channels). We need to clearly understand these different sub-markets and their role and impact in the overall sustainability of agritourism. Survey research should include values and beliefs, not just spending. This effort might begin with a community level survey that draws on CRS's Gross National Happiness survey of Vermont and the Vermonter poll. Two separate surveys for consumers are needed: one for Vermonters and another for visitors.
 - b. Create and implement a longitudinal farmer survey. This survey would focus on all types of farms in Vermont, including non-profit and community farms as well as privately owned farms of all sizes. CRS has the capability to conduct this survey, and coordination is needed with the Vermont Agency of Agriculture and others conducting producer surveys.

- c. Utilize collaborations with scholars and projects on the environment, including the Gund Institute of Environment and Rubenstein School of Environment and Natural Resources.
 - d. In developing future scopes of work, include both qualitative and quantitative studies at micro/household scales. Data at the micro/household level, if and where it exists, is not easily available or accessible. Effort, however, should be made to identify and organize existing relevant datasets among UVM and other Vermont researchers.
- 2) The Vermont brand is a key component of the state's social, ecological and economic identity and culture that should be embraced by the UVM-ARS Center. Many aspects of the Vermont brand need further exploration to identify and support sustainability:
- a. Aspects of the Vermont brand important to producers, decision makers, and tourists (in state, out of state). Currently, willingness to pay is the economic metric that measures the value of the Vermont brand. Data collected through consumer choice experiments with both Vermont residents and tourists/potential tourists can provide information on consumer preference structures that contribute to both the meaning of and social/cultural and environmental contributions of the Vermont brand.
 - b. Spatial and natural components of the Vermont brand (viewsheds, tree species, open space, working lands).
 - c. *Terroir* components of the Vermont brand. Which aspects are important to Vermonters? Tourists? What properties are important for *terroir* (e.g., waters, soils, geology)? Sensory evaluations of Vermont products versus non-Vermont products could provide a measure of *terroir*. We caution not to divide Vermont into regions with separate "tastes," as we are too small a state to compete within our borders, except, perhaps as part of a coordinated taste of Vermont trail.
- 3) Informational and data needs are central to understanding and ensuring sustainability in Vermont. We recommend that:
- a. Longitudinal producer and consumer surveys are conducted in collaboration with UVM researchers and Vermont agencies.
 - b. Support personnel focused on data is essential for the Center.
 - c. Analytical expertise must include both qualitative and quantitative methods.
 - d. Analytical expertise should include econometrics, spatial analysis, behavioral economics, demography, ethnographic research, and others. We cannot collect a full suite of metrics spanning social, economic and environmental without expertise in methods spanning all three domains.
- 4) Addressing sustainability requires deep convergence of social and natural sciences. Given that the three sustainability dimensions can encompass all aspects of the human experience, theoretical frameworks are essential to both define and span boundaries, as

well as conceptualize the interactions within and across sustainability domains. To this end, we suggest the UVM-ARS Center utilize clear frameworks for defining, approaching and supporting sustainability for the success of sustainability metrics. The ARS should carefully consider and articulate the sustainability framework that motivates the Center's work. In this white paper, we have identified several relevant frameworks that hold relevance not just to agritourism but to sustainable agriculture and food systems generally. We note that the frameworks we cover are not exhaustive and many compelling options exist to frame UVM-ARS Center initiatives.

6. References

- Ackoff, S., Bahrenburg, A., & Shute, L.L. (2017). *Building a future with farmers II: Results and recommendations from the national young farmer survey*. National Young Farmers Coalition. https://www.youngfarmers.org/wp-content/uploads/2019/03/NYFC-Report-2017_LoRes_Revised.pdf
- Adams, A.B., Pontius, J., Galford, G.L., Merrill, S.C., & Gudex-Cross D. (2018). Modeling carbon storage across a heterogeneous mixed temperate forest: The influence of forest type specificity on regional-scale carbon storage estimates. *Landscape Ecology*, 33, 641-658. <https://doi.org/10.1007/s10980-018-0625-0>
- Adams, A.B., Pontius, J., Galford, G.L., Merrill, S.C., & Gudex-Cross D. (2020). Simulating forest cover change in the northeastern U.S.: Decreasing forest area and increasing fragmentation. *Landscape Ecology*. <https://doi.org/10.1007/s10980-019-00896-7>
- Agency of Natural Resources. (2020a). *Maps and mapping: BioFinder*. State of Vermont. <https://anr.vermont.gov/maps/biofinder>
- Agency of Natural Resources. (2020b). *Maps and mapping: Natural resources atlas*. State of Vermont. <https://anr.vermont.gov/maps/nr-atlas>
- Alderslade, J., Talmage, J., & Freeman, Y. (2006). *Measuring the informal economy – One neighborhood at a time*. The Brookings Institute Metropolitan Policy Program. https://www.brookings.edu/wp-content/uploads/2016/06/20060905_informaleconomy.pdf
- Audubon Vermont. (n.d.). *Audubon Vermont*. <https://vt.audubon.org/>
- Axelsson, R., Angelstam, P., Degerman, E., Teitelbaum, S., Andersson, K., Elbakidze, M., & Drotz, M.K. (2013). Social and cultural sustainability: Criteria, indicators, verifier variables for measurement and maps for visualization to support planning. *AMBIO*, 42, 215–228. <https://doi.org/10.1007/s13280-012-0376-0>
- Bebbington, A. (1999). Capitals and capabilities: A framework for analyzing peasant viability, rural livelihoods, and poverty. *World Development*, 27(12), 2021-2044. [https://doi.org/10.1016/S0305-750X\(99\)00104-7](https://doi.org/10.1016/S0305-750X(99)00104-7)
- Boström, M., Vifell, Å.C., Klintman, M., Soneryd, L., Hallström, K.T., & Thedvall, R. (2015). Social sustainability requires social sustainability: Procedural prerequisites for reaching substantive goals. *Nature and Culture*, 10(2), 131-156. <https://doi.org/10.3167/nc.2015.100201>

- Bourdieu, P. (1986). The forms of capital. In J. G. Richardson (Ed.), *Handbook of theory and research for the sociology of education* (pp. 241-258). Greenwood Press.
- Browning, C.R., Feinberg, S.L., & Dietz, R. (2004). The paradox of social organization: Networks, collective efficacy, and violent crime in urban neighborhoods. *Social Forces*, 83(2), 503-534. <https://doi.org/10.1353/sof.2005.0006>
- Cárcaba, A., González, E., Ventura, J., & Arrondo, R. (2017). How does good governance relate to quality of life? *Sustainability*, 9(4), 631. <https://doi.org/10.3390/su9040631>
- Cargill, C. (n.d.). *Gaining ground for farmers* [PowerPoint slides]. Land for Good. https://extension.unh.edu/resources/files/Resource005985_Rep8408.pdf
- Centers for Disease Control and Prevention. (n.d.). *Behavioral risk factor surveillance system: Survey data and documentation*. https://www.cdc.gov/brfss/data_documentation/index.htm
- Chan, K. M. A., Balvanera, P., Benessaiah, K., Chapman, M., Díaz, S., Gómez-Baggethun, E., Gould, R., Hannahs, N., Jax, K., Klain, S., Luck, G. W., Martín-López, B., Muraca, B., Norton, B., Ott, K., Pascual, U., Satterfield, T., Tadaki, M., Taggart, J., & Turner, N. (2016). Opinion: Why protect nature? Rethinking values and the environment. *Proceedings of the National Academy of Sciences*, 113(6), 1462–1465. <https://doi.org/10.1073/pnas.1525002113>
- Chase, L.C., Amsden, B., & Kuehn D. (2013). Measuring quality of life: A case study of agritourism in the Northeast. *Journal of Extension*, 51(1). <http://www.joe.org/joe/2013february/a3.php>
- Chase, L.C. & Grubinger, V. (2014). *Food, farms, and community: Exploring food systems*. University of New Hampshire Press.
- Chase, L.C., Stewart, M., Schilling, B., Smith, R., & Walk, M. (2018). Agritourism: A conceptual framework for industry analysis. *Journal of Agriculture, Food Systems and Community Development*, 8(1), 13-19. <https://doi.org/10.5304/jafscd.2018.081.016>
- Chavis, D.M., Lee, K.S., & Acosta J.D. (2008). *The sense of community index (SCI) revised: The reliability and validity of the SCI-2*. Paper presented at the 2nd International Community Psychology Conference, Lisboa, Portugal. <http://dl.icdst.org/pdfs/files/f458f0f15016819295377e5a979b1893.pdf>
- Che, D., Veeck, A., & Veeck, G. (2005). Sustaining production and strengthening the agritourism product: Linkages among Michigan agritourism destinations. *Agriculture and Human Values*, 22(2), 225–234. <https://doi.org/10.1007/s10460-004-8282-0>

- County Health Rankings & Roadmaps Program. (n.d.). *2020 county health rankings: State reports*. University of Wisconsin Population Health Institute.
<https://www.countyhealthrankings.org/>
- da Cruz, N. F., & Marques, R. C. (2016). Structuring composite local governance indicators. *Policy Studies*, 38(2), 109–129. <https://doi.org/10.1080/01442872.2016.1210117>
- Di Napoli, I., Dolce, P., & Arcidiacono, C. (2019). Community trust: A social indicator related to community engagement. *Social Indicators Research*, 145(2), 551–579.
<https://doi.org/10.1007/s11205-019-02114-y>
- Doolittle, A., & Faul, A. C. (2013). Civic engagement scale: A validation study. *SAGE Open*, 3(3), 1-7. <https://doi.org/10.1177/2158244013495542>
- Doughnut Economics Action Lab (DEAL). (2020). *Creating city portraits: A methodological guide from the thriving cities initiative* [pdf]. KR Foundation. Retrieved December 15, 2020 from <https://doughnuteconomics.org/tools-and-stories/14>
- Ellis, F. (2000). The determinants of rural livelihood diversification in developing countries. *Journal of Agricultural Economics*, 51(2), 289-302. <https://doi.org/10.1111/j.1477-9552.2000.tb01229.x>
- Emery, M., Fey, S., & Flora, C. (2006). Using community capitals to develop assets for positive community change. *Community Development Practice*, 13, 1-19.
- Federal Bureau of Investigation (FBI). (n.d.). *Uniform crime reporting program*.
<https://www.fbi.gov/services/cjis/ucr>
- Feldmann, C., & Hamm, U. (2015). Consumers' perceptions and preferences for local food: A review. *Food Quality and Preference*, 40, 152–164.
<https://doi.org/10.1016/j.foodqual.2014.09.014>
- Flora, C.B., Flora, J.L., & Gasteyer, S.P. (2016). *Rural communities: Legacy and change* (5th edition). Routledge.
- Forest Ecosystem Monitoring Cooperative (FEMC). (n.d.). *The forest ecosystem monitoring cooperative: Products, data, cooperative*. <https://www.uvm.edu/femc>
- Galford, G.L., Hoogenboom, A., Carlson, S., Ford, S., Nash, J., Palchak, E., Pears, S., Underwood, K., & Baker, D.V. (2014). *Considering Vermont's future in a changing climate: The first Vermont climate assessment*. Gund Institute for Ecological Economics.
http://dev.vtclimate.org/wp-content/uploads/2014/04/VCA2014_FullReport.pdf

- Gould, R. K., Klain, S. C., Ardoin, N. M., Satterfield, T., Woodside, U., Hannahs, N., Daily, G. C., & Chan, K. M. (2015). A protocol for eliciting nonmaterial values through a cultural ecosystem services frame. *Conservation Biology*, 29(2), 575–586.
<https://doi.org/10.1111/cobi.12407>
- Gourevitch, J. D., Singh, N. K., Minot, J., Raub, K. B., Rizzo, D. M., Wemple, B. C., & Ricketts, T. H. (2020). Spatial targeting of floodplain restoration to equitably mitigate flood risk. *Global Environmental Change*, 61, 102050. <https://doi.org/10.1016/j.gloenvcha.2020.102050>
- Guerry, A. D., Polasky, S., Lubchenco, J., Chaplin-Kramer, R., Daily, G. C., Griffin, R., Ruckelshaus, M., Bateman, I. J., Duraiappah, A., Elmqvist, T., Feldman, M. W., Folke, C., Hoekstra, J., Kareiva, P. M., Keeler, B. L., Li, S., McKenzie, E., Ouyang, Z., Reyers, B., ... Vira, B. (2015). Natural capital and ecosystem services informing decisions: From promise to practice. *Proceedings of the National Academy of Sciences*, 112(24), 7348–7355.
<https://doi.org/10.1073/pnas.1503751112>
- Harrington, L. M. B. (2018). Alternative and virtual rurality: Agriculture and the countryside as embodied in American imagination. *Geographical Review*, 108(2), 250–273.
<https://doi.org/10.1111/gere.12245>
- Harriss, J. & Renzio, P. D. (1997). Policy arena: ‘Missing link’ or analytically missing? The concept of social capital. *Journal of International Development*, 9(7), 919–937.
[https://doi.org/10.1002/\(SICI\)1099-1328\(199711\)9:7<919::AID-JID496>3.0.CO;2-9](https://doi.org/10.1002/(SICI)1099-1328(199711)9:7<919::AID-JID496>3.0.CO;2-9)
- Hernández-Morcillo, M., Plieninger, T., & Bieling, C. (2013). An empirical review of cultural ecosystem service indicators. *Ecological Indicators*, 29, 434–444.
<https://doi.org/10.1016/j.ecolind.2013.01.013>
- Herrera, B., Gerster-Bentaya, M., & Knierim, A. (2016). *Social indicators of farm-level sustainability*. Farm Level Indicators for New Topics in Policy Evaluation (FLINT) Project.
<https://www.flint-fp7.eu/downloads/reports/D5.2e.pdf>
- Hirons, M., Comberti, C., & Dunford, R. (2016). Valuing cultural ecosystem services. *Annual Review of Environment and Resources*, 41(1), 545–574.
<https://doi.org/10.1146/annurev-environ-110615-085831>
- Jayaraman, S. (2013). *Behind the kitchen door*. Cornell University Press.

- Koh, I., Lonsdorf, E. V., Williams, N. M., Brittain, C., Isaacs, R., Gibbs, J., & Ricketts, T. H. (2016). Modeling the status, trends, and impacts of wild bee abundance in the United States. *Proceedings of the National Academy of Sciences*, *113*(1), 140–145. <https://doi.org/10.1073/pnas.1517685113>
- Kolodinsky, J., Sitaker, M., Chase, L., Smith, D., & Wang, W. (2020). Food systems disruptions: Turning a threat into an opportunity for local food systems. *Journal of Agriculture, Food Systems, and Community Development*, *9*(3), 5-8. <https://doi.org/10.5304/jafscd.2020.093.013>
- La Rosa, D., Spyra, M., & Inostroza, L. (2016). Indicators of cultural ecosystem services for urban planning: A review. *Ecological Indicators*, *61*, 74–89. <https://doi.org/10.1016/j.ecolind.2015.04.028>
- Long, N. (2001). *Development sociology: Actor perspectives*. Routledge.
- Lyson, T. A. & Guptill, A. (2004). Commodity agriculture, civic agriculture and the future of U.S. farming. *Rural Sociology*, *69*(3), 370–385. <https://doi.org/10.1526/0036011041730464>
- Lyson, T., Torres, R., & Welsh, R. (2001). Scale of agricultural production, civic engagement, and community welfare. *Social Forces*, *80*, 311–327. <https://doi.org/10.1353/sof.2001.0079>
- Mares, T.M. (2019). *Life on the other border: Farm workers and food justice in Vermont*. University of California Press.
- McGehee, N. G., Lee, S., O'Bannon, T. L., & Perdue, R. R. (2010). Tourism-related social capital and its relationship with other forms of capital: An exploratory study. *Journal of Travel Research*, *49*(4), 486–500. <https://doi.org/10.1177/0047287509349271>
- McMillan, D., & Chavis, D. (1986). Sense of community: A definition and theory. *Journal of Community Psychology*, *14*, 6–23.
- Meuwissen, M. P. M., Feindt, P. H., Spiegel, A., Termeer, C., Mathijs, E., de May, Y., Finger, R., Balmann, A., Wauthers, E., Urquhart, J., Hansson, H., Paas, W., Slijper, T., Coopmans, I., Vroege, W., Ciechomska, A., Accatino, F., Kopainsky, B., Poortvliet, P.M., ... Reidsma, P. (2019). A framework to assess the resilience of farming systems. *Agricultural Systems*, *176*, 102656. <https://doi.org/10.1016/j.agsy.2019.102656>.
- Millennium Ecosystem Assessment Program (MA). (2005). *Ecosystems and human well-being: Synthesis*. Island Press.
- Miraftab, F. (2016). *Global heartland: Displaced labor, transnational lives, and local placemaking*. Indiana University Press.

- Miranti, R., & Evans, M. (2019). Trust, sense of community, and civic engagement: Lessons from Australia. *Journal of Community Psychology*, 47(2), 254–271. <https://doi.org/10.1002/jcop.22119>
- Morse, J. W., Gladkikh, T. M., Hackenburg, D. M., & Gould, R. K. (2020). COVID-19 and human-nature relationships: Vermonters' activities in nature and associated nonmaterial values during the pandemic. *PLoS ONE*, 15(12): e0243697. <https://doi.org/10.1371/journal.pone.0243697>
- Moser, C. (2008). Assets and livelihoods: A framework for asset-based social policy. In C. Moser & A. A. Dani (Eds.), *Assets, livelihoods, and social policy* (pp. 43-81). The International Bank for Reconstruction and Development / The World Bank.
- National Science Foundation. (n.d.) *Ten big ideas for future NSF investment* [video]. Retrieved January 12, 2021 from https://www.nsf.gov/news/special_reports/big_ideas/life.jsp
- Nguyen, H. (2018). *Sustainable food systems: Concept and framework*. Food and Agriculture Organization of the United Nations. <https://www.oneplanetnetwork.org/sites/default/files/ca2079en.pdf>
- Nicholson, C. C., Koh, I., Richardson, L. L., Beauchemin, A., & Ricketts, T. H. (2017). Farm and landscape factors interact to affect the supply of pollination services. *Agriculture, Ecosystems & Environment*, 250, 113–122. <https://doi.org/10.1016/j.agee.2017.08.030>
- Northeast Organic Farmers Association of Vermont (NOFA-VT). (n.d.). *Programs*. <https://nofavt.org/programs>
- Peet, R., & Hartwick, E. (2009). *Theories of development: Contentions, arguments, alternatives* (2nd edition). The Guilford Press.
- Peihong, Z. & Yali, Z. (2019). *Global agritourism market report, history and forecast 2014-2025, breakdown data by companies, key regions, types and applications*. QY Research Group.
- Penn State College of Agricultural Sciences. (n.d.). *Social capital variables for 2014* [excel spreadsheet]. Retrieved January 8, 2021 from <https://aese.psu.edu/nercrd/community/social-capital-resources/social-capital-variables-for-2014>
- Perry, E., Manning, R., Xiao, X., Valliere, W., & Reigner, N. (2018). Social climate change: The advancing extirpation of snowmobilers in Vermont. *The Journal of Park and Recreation Administration*, 36(2), 31–51. <https://doi.org/10.18666/JPra-2018-V36-I2-8307>

- Plieninger, T., Dijks, S., Oteros-Rozas, E., & Bieling, C. (2013). Assessing, mapping, and quantifying cultural ecosystem services at community level. *Land Use Policy*, 33, 118–129. <https://doi.org/10.1016/j.landusepol.2012.12.013>
- Pomeranz, E.F. & Stedman, R.C. (2020). Measuring good governance: Piloting an instrument for evaluating good governance principles. *Journal of Environmental Policy & Planning*, (22)3, 428-440. <https://doi.org/10.1080/1523908X.2020.1753181>
- Portes, A., & Landolt, P. (2000). Social capital: Promise and pitfalls of its role in development. *Journal of Latin American Studies*, 32(2), 529–547. <https://doi.org/10.1017/S0022216X00005836>
- Pretty, J. (2008). Agricultural sustainability: Concepts, principles, and evidence. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 363, 447–465. <https://doi.org/10.1098/rstb.2007.2163>
- Prewitt, K., Mackie, C.D., & Habermann, H. (Eds.). (2014). *Civic engagement and social cohesion: Measuring dimensions of social capital to inform policy*. The National Academies Press.
- Putnam, Robert D. (2000). *Bowling alone: The collapse and revival of American community*. Simon & Schuster.
- Quella, L., Chase, L., Conner, D., Reynolds, T., Wang, W., & Singh-Knights, D. (in press). Visitors and values: A qualitative analysis of agritourism operator motivations across the US. *Journal of Agriculture, Food Systems, and Community Development*.
- Raworth, K. (2017). *Doughnut economics: Seven ways to think like a 21st century economist*. Chelsea Green Publishing.
- Raymond, C. M., Brown, G., & Weber, D. (2010). The measurement of place attachment: Personal, community, and environmental connections. *Journal of Environmental Psychology*, 30(4), 422–434. <https://doi.org/10.1016/j.jenvp.2010.08.002>
- Saunders, F., Gilek, M., Ikauniece, A., Tafon, R. V., Gee, K., & Zaucha, J. (2020). Theorizing social sustainability and justice in marine spatial planning: Democracy, diversity, and equity. *Sustainability*, 12(6), 2560. <https://doi.org/10.3390/su12062560>
- Scannell, L. & Gifford, R. (2014). Comparing the theories of interpersonal and place attachment. In L. Manzo & P. Devine-Wright (Eds.), *Place attachment: Advances in theory, methods and applications* (pp. 23–36). Routledge.
- Schaich, H., Bieling, C., & Plieninger, T. (2010). Linking ecosystem services with cultural landscape research. *Gaia*, 19(4), 269–277.

- Schellenberg, G., Lu, C., Schimmele, C., & Hou, F. (2018). The correlates of self-assessed community belonging in Canada: Social capital, neighbourhood characteristics, and rootedness. *Social Indicators Research*, 140(2), 597–618. <https://doi.org/10.1007/s11205-017-1783-1>
- Schilling, B.J., Sullivan, K.P., & Komar, S.J. (2012). Examining the economic benefits of agritourism: The case of New Jersey. *Journal of Agriculture, Food Systems, and Community Development*, 3(1), 199-214. <https://doi.org/10.5304/jafscd.2012.031.011>
- Scoones, I. (1998). *Sustainable rural livelihoods: A framework for analysis* (Working Paper 72). Institute of Development Studies (IDS). <http://www.ids.ac.uk/files/Wp72.pdf>.
- Scoones, I. (2009). Livelihoods perspectives and rural development. *The Journal of Peasant Studies*, 36(1), 171–196. <https://doi.org/10.1080/03066150902820503>
- Sen A. (1981). *Poverty and famines: An essay on entitlement and deprivation*. Clarendon Press.
- Sen, A. (1997). Editorial: Human capital and human capability. *World Development*, 25(12), 1959-1961. [https://doi.org/10.1016/S0305-750X\(97\)10014-6](https://doi.org/10.1016/S0305-750X(97)10014-6)
- Sen, A. (1999). *Development as freedom*. Anchor Books.
- Social Capital Project. (2018). *The geography of social capital in America* (SCP Report No. 1-18). United States Congress Joint Economic Committee - Republicans. <https://www.lee.senate.gov/public/index.cfm/scp-index>
- Sonter, L.J., Watson, K.B., Wood, S.A., & Ricketts, T.H. (2016). Spatial and temporal dynamics and value of nature-based recreation, estimated via social media. *PLOS ONE* 11(9): e0162372. <https://doi.org/10.1371/journal.pone.0162372>
- Sornkaew, T. (2009). A method for estimating local and national good governance indices. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.3067194>
- Stedman, R.C. (2008). What do we “mean” by place meanings? Implications of place meanings for managers and practitioners. In L.E. Kruger, T.E. Hall, & M.C. Stiefel (Eds.), *Understanding concepts of place in recreation research and management* (pp. 61-81). USDA Forest Service.
- Strochlic, R., Wirth, C., Besada, A. F., & Getz, C. (2008). *Farm labor conditions on organic farms in California*. California Institute for Rural Studies. <https://www.cirsinc.org/publications/farm-labor>

- Sukhdev, P., Wittmer, H., Schröter-Schlaack, C., Nesshöver, C., Bishop, J., ten Brink, P., Gundimeda, H., Kumar, P., & Simmons, B. (2010). *Mainstreaming the economics of nature: A synthesis of the approach, conclusions and recommendations of TEEB*. The Economics of Ecosystems and Biodiversity (TEEB). <http://teebweb.org/publications/teeb-for/synthesis/>
- Talò, C., Mannarini, T., & Rochira, A. (2014). Sense of community and community participation: A meta-analytic review. *Social Indicators Research*, 117(1), 1–28. <https://doi.org/10.1007/s11205-013-0347-2>
- Tew, C., & Barbieri, C. (2011). The perceived benefits of agritourism: The provider's perspective. *Tourism Management*, 33(1), 215-224. <https://doi.org/10.1016/j.tourman.2011.02.005>
- Trubek, A.B., Lemasson, J., & Jordan, H. L. (2010). Produits du terrior: Similarities and differences between France, Québec and Vermont. *Opportunities for Agriculture Working Paper Series*, 1(2). Center for Rural Studies/Food Systems Research Collaborative, University of Vermont. <https://scholarworks.uvm.edu/fsagriculture/2/>
- United States Bureau of Labor Statistics (2019). *Quarterly census of employment and wages: Databases*. Retrieved January 14, 2021 from <https://www.bls.gov/cew/data.htm>
- United States Census Bureau. (n.d.). *American community survey (ACS)*. <https://www.census.gov/programs-surveys/acs>
- United States Department of Agriculture Economic Research Service. (2020a). *Farm economy: Farm household well-being*. Retrieved January 14, 2021 from <https://www.ers.usda.gov/topics/farm-economy/farm-household-well-being/>
- United States Department of Agriculture Economic Research Service. (2020b). *Farm labor: Wages*. Retrieved January 8, 2021 from <https://www.ers.usda.gov/topics/farm-economy/farm-labor/#wages>
- United States Department of Agriculture Economic Research Service. (2020c). *Land use, land value, & tenure: Farmland value*. Retrieved January 14, 2021 from <https://www.ers.usda.gov/topics/farm-economy/land-use-land-value-tenure/farmland-value/>
- United States Department of Agriculture Economic Research Service. (2021). *Food security in the US*. Retrieved January 8, 2021 from <https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us/>

- United States Department of Agriculture National Agricultural Statistics Service. (2019). *2017 Census of agriculture: State and county data*.
<https://www.nass.usda.gov/Publications/AgCensus/2017/index.php>
- University of Vermont. (n.d.). *Tourism research center: Agritourism research*. Retrieved January 14, 2021 from <https://www.uvm.edu/vtrc/agritourism-research>
- Van Rijn, F., Fort, R., Ruben, R., Koster, T., & Beekman, G. (2020). Does certification improve hired labour conditions and wageworker conditions at banana plantations? *Agriculture and Human Values*, 37(2), 353–370. <https://doi.org/10.1007/s10460-019-09990-7>
- Veeck, G., Hallett IV, L., Che, D., & Veeck, A. (2016). The economic contributions of agricultural tourism in Michigan. *Geographical Review*, 106(3), 421-440.
<https://doi.org/10.1111/j.1931-0846.2016.12161.x>
- Vermont Agency of Education. (n.d.). *Data and reporting*. <https://education.vermont.gov/data-and-reporting>
- Vermont Department of Health. (n.d.). *How healthy are we? Public health data*.
<https://www.healthvermont.gov/stats/data>
- Vermont Department of Labor. (n.d.). *Economic and labor market information*. Retrieved January 14, 2021 from <http://www.vtlni.info/>
- Watson, K.B., Ricketts, T.H., Galford, G., Polasky, S., & O’Neil-Dunne J. (2016). Avoided flood damages on the Otter Creek, VT: Impacts of intact wetland complexes. *Ecological Economics*, 130, 16-24. <https://doi.org/10.1016/j.ecolecon.2016.05.015>
- Watson, K.B, Galford, G.L., Sonter, L., Koh, I., & Ricketts, T. (2019). The effect of accounting for beneficiary demand in prioritizing conservation actions to meet biodiversity and ecosystem service goals. *Conservation Biology*, 33(4), 942-952.
<https://doi.org/10.1111/cobi.13276>
- Watson, K.B, Galford, G.L., Sonter, L., & Ricketts, T. (2020). Conserving ecosystem services and biodiversity: Measuring the tradeoffs involved in splitting conservation budgets. *Ecosystem Services* 42, 101063. <https://doi.org/10.1016/j.ecoser.2020.101063>
- Wilde, A., Narang, S., Laberg, M., Moretto, L., & Nachem, J. (Ed.). (2015). *A users guide to measuring local governance*. United Nations Development Programme (UNDP).
<https://www.undp.org/>
- Williams, W.P., Stewart, D.R., & Kruger, L.E. (Eds.). (2013). *Place-based conservation: Perspectives from the social sciences*. Springer.

World Commission on Environment and Development (WCED). (1987). *Our common future*.
Oxford University Press.
<https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf>

7. Appendices

A. Theoretical Framework

Efforts to acknowledge and comprehensively account for the various dimensions of sustainability were amplified by the United Nation's Brundtland Report (WCED, 1987), which provided a framework for sustainable development. The inclusion of environmental and social dimensions was a welcome departure from the singular focus on economic indicators that had been the basis of development measures prior. Through this report, explicit recognition was given to the reality that environmental, social, and economic aspects of society influence one another, sometimes beneficially and sometimes detrimentally. However, this awareness does not specifically conceptualize how the various dimensions of sustainability interact with one another, a consideration to which our team dedicated extensive attention to theorize how environmental, social, and economic aspects of agritourism might mutually reinforce one another or cause tradeoffs.

Agritourism is emblematic of the challenge in identifying a suitable theoretical framework approach to measuring sustainability across scales and for multiple stakeholders. We reviewed existing theoretical frameworks (e.g., Doughnut Economics, livelihoods, capitals), finding strengths and weaknesses existing in each of them. We integrated insights from several to guide the process of selecting and organizing sustainability metrics for agritourism. In this section, we outline and summarize the various salient components of frameworks from which we drew guidance before offering a conceptual model integrating several models that anchored our approach.

A base assumption for our agritourism sustainability metrics is that society and economy are embedded within, and constrained by, the natural world (so called "planetary boundaries"). As Raworth (2017) posits in her framework "Doughnut Economics," justice and equity (economics and social) are situated below an ecological ceiling (Figure 2, page 7). This perspective shifts sustainability from a position of weak sustainability, whereby depletions of natural resources can be rectified through technological innovation (i.e., natural capital is substitutable with other forms of capital such as human), to one of strong sustainability which recognizes that social and economic wellbeing are nested within and dependent upon the natural world (i.e., natural capital is not substitutable). Useful as the Doughnut Economics model is, its focus has primarily focused at global and national levels and has only recently begun to consider its application at smaller scales (i.e., cities, DEAL, 2020). In Vermont, our focus on agritourism enterprises and their linkages with their communities and counties means that our efforts are primarily focused are even more localized, scales leading us to identify other frameworks that have been adept at capturing small-scale dynamics.

In the early 1990s, development scholars began coalescing around the idea that flexible frameworks were required to understand a diversity of livelihoods and recognizing the multiple kinds of resources that people use to pursue desirable livelihood outcomes (e.g., income

security, food security, etc.). Based in Sen's (1981, 1997, 1999) capabilities approach, which understands development to depend on the institutional contexts that structure individuals' ability to make choices and lead lives that they value, the concept of livelihoods emerged as:

"... the capabilities, assets (stores, resources, claims, and access) and activities required for a means of living: a livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capacities and assets, and provide sustainable livelihood opportunities for the next generation." (p. 6)

Throughout the 1990s the concept of livelihood gained traction among development scholars and consensus grew around the idea that asset bases were filled with different kinds of capitals (natural, social, financial, built, and human) (Bebbington, 1999; Scoones, 1998). Sustainable Livelihoods (SL) became widely known and applied by scholars and development organizations alike (Moser, 2008). From the perspective of SL, livelihood strategies – what people do – is dependent on the access to, and configuration of, different capitals (Scoones, 1998). Livelihood options are shaped by broader structural factors, including institutional rules and norms (e.g., market practices, land tenure), organizational presence (e.g., NGOs, government agencies), social relations and cultural customs (e.g., gender, class), ecosystems characteristics (e.g., climate, soils), environmental stresses (e.g., drought, flood), and other macro trends (e.g., population, migration, technological advancements) (Ellis, 2000). Within this SL context, development efforts must seek to understand people's assets and their use to achieve desirable outcomes (Ellis, 2000; Moser, 2008; Scoones, 1998) (Figure 3).

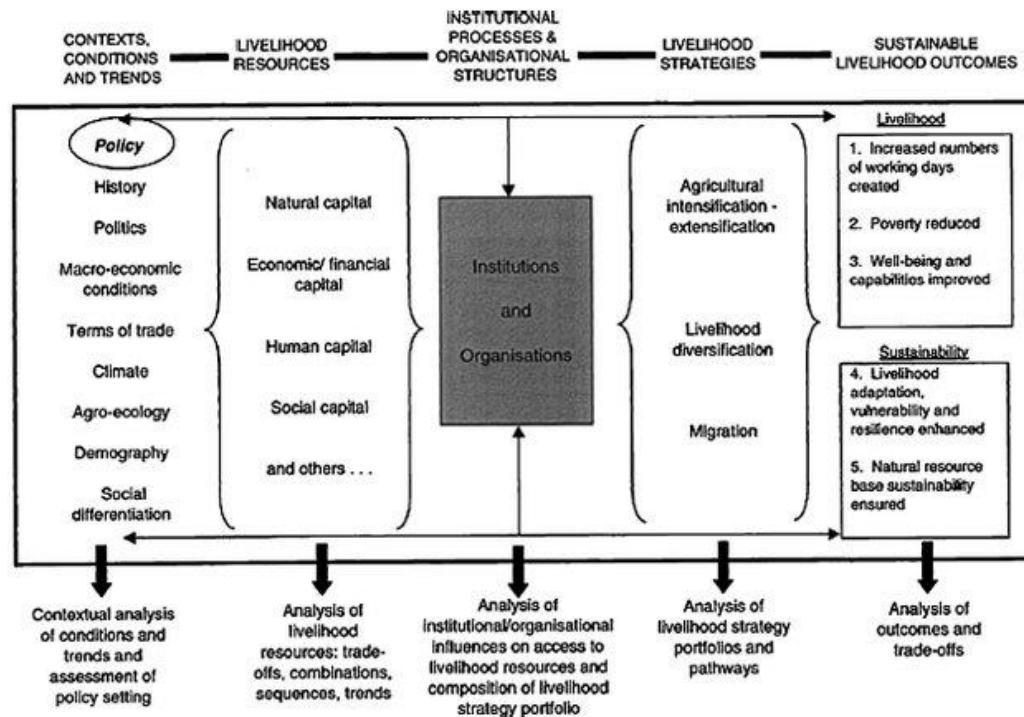


Figure 3. Sustainable Livelihoods Framework: a checklist (Scoones 1998.)

Though the SL framework exploded in the 1990s and early 2000s, it has since suffered in decline, not least because it struggled to adequately depict how broader socio-ecological contexts influenced livelihoods (Moser, 2008). Simply, the SL framework proved difficult to utilize in ways that accounted for multiple scales simultaneously (Scoones, 2009).

As the SL framework gained popularity to conduct household analyses in international rural development, similar models were being developed to guide approaches to community development. Similar to SL, the Community Capitals (CC) framework (Flora et al., 2016) utilized various capitals to characterize the various stocks of resources present at the community level. At its most basic, the idea was that sustainable community development rested on the ability of a community to generate a common pool of these resources that were accessible among community members equitably. The CC framework identifies seven essential capitals,¹ which provide the basis of our conceptual approach and definitions of capitals in this white paper (Flora et al., 2016):

- Natural capital underlies all other capitals (Flora et al., 2016) and “refers to the living and nonliving components of ecosystems—other than people and what they manufacture—that contribute to the generation of goods and services of value for people” (Guerry et al., 2015: 7349).
- Cultural capital describes existing worldviews and their associated values (Flora et al., 2016). What is valued at the community level informs the value of cultural capital that individuals possess, which helps determine positions in social hierarchies (Bourdieu, 1986).
- Human capital is constituted by knowledge, skills, capacities, and potential. At the community level, the stock of human capital informs the employment opportunities available, health and social wellbeing, what and how something is valued (Flora et al., 2016). At the individual level, accumulated human capital enhances the ability to pursue self-determination (Sen, 1997).
- Social capital has been theorized at the community level as social relationships and networks and the norms of trust and reciprocity that exist within them (Putnam, 2000). The social capital that exists within social networks may be generated by either altruistic or instrumental motivations (Portes & Landolt, 2000). At the individual level, one way to understand social capital is as the potential to access available resources within a network that can be converted into other forms of capital (Bourdieu, 1986).
- Political capital is about power, who holds it, and how it gets wielded to institutionalize rules and regulations (Flora et al., 2016).
- Financial capital is the financial assets possessed and has historically been the capital that has received disproportionate attention and emphasis in development rhetoric and practice (Flora et al., 2016; Peet & Hartwick, 2009).
- Built capital is constituted by all the facets of the material infrastructure of society (Flora et al., 2016).

According to Flora et al. (2016), the stocks and qualities of the seven capitals together determine a community's ability to identify and collectively act to leverage common interests and mitigate mutual threats. Figure 4 visualizes the CC framework.

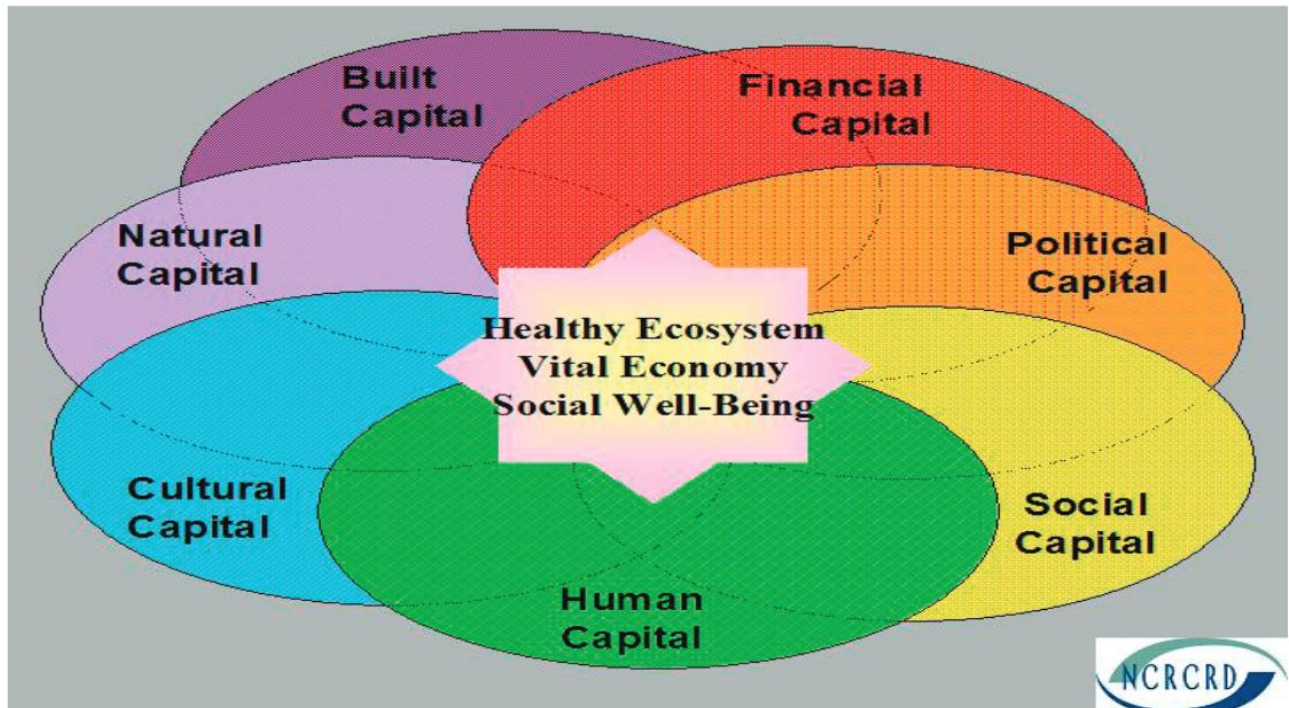


Figure 4. The Community Capitals Framework (Emery et al., 2006).

We suggest merging the CC and SL frameworks to allow for the examination of the capitals' availability and accessibility across scales, which is beneficial in two main ways. First, an integration provides the ability to assess the interactions of the capitals within and across scales. The former allows for the examination of the stocks of resources that exist in a particular geographic space, while the latter provides insight into the resources to which agritourism enterprises (in the case of this white paper) have access and how those are converted into activities that allow individuals to pursue their personal and commercial goals. Thus, in addition to the definitions of the capitals, two more definitions that can operate, like the capitals, at both enterprise and community levels.

- Livelihood activities are how the available resources are converted into productive labor and reproductive work while navigating changes in context and circumstance in the pursuit of consumption and economic necessities and lives that are meaningful and fulfilling (Long, 2001; Sen, 1999). At the enterprise level, agritourism operations utilize their various capitals to engage in business activities, natural resource management, social networks, and political affairs.
- Livelihood outcomes are the consequences of livelihood activities. What is defined as a desirable outcome is contextual, value-oriented, and normative (Long, 2001; Scoones,

2009). Within the current sustainability paradigm, desirable outcomes are articulated by the Sustainable Development Goals.

Although integrating the two frameworks is promising for conducting cross-scalar analysis on sustainability, there are a few important caveats to note. First, characterizing the social and natural world according to a series of capitals risks reductionism and instrumentalism (Scoones, 2009), assumptions that all capitals are fungible (Pretty, 2008), and false assumptions that the accumulation of capitals is uniformly positive (Long, 2001; Portes & Landolt, 2000). Care must be taken to not reduce capitals to a crude set of proxies that fail to reflect reality and its complexities (Harriss, 1997). Relatedly, a capitals framework must be situated culturally. Neither the vocabulary nor concepts have been easy to translate into other languages and more importantly, these frameworks always carry embedded assumptions, values, and normative framings (Scoones, 2009). Finally, since a capital is a resource that humans utilize for their own benefit, then a capitals framework is de facto anthropocentric. This holds true for natural capital as well. As Guerry et al. (2015) explicitly indicate (see above in our definition of natural capital), natural capital is a resource that used by humans to generate value for people.

This last point is important for how environmental sustainability is considered in this white paper. As indicated at the beginning of this section, our position is that society and economy are embedded within environmental limits (Raworth, 2017). Environmental capacity has implications for humans both directly (i.e., availability of natural capital) as well as indirectly, (i.e., healthy, functioning ecological, biological, climatic, etc. systems). The Ecosystem Services (ES) framework provides useful language to characterize the natural world in which societies and economics are embedded. While ecosystem services are akin to natural capital in that they are considered as the benefits that humans derive from nature, supporting services underlie those direct benefits, removed from human use and thus not natural capital. Characterizing the natural world through an ES framework provides possibility to view the environment in more nuanced ways than only through a human lens based in self-interest, and more closely adheres to a core tenet of strong sustainability that human actions and potential are constrained by an ecological ceiling (Raworth, 2017). Natural capital serves as the link between the human constructed world and the natural world, but an ES approach to the environment allows for the kind of multidimensional depictions of the natural world as the capitals frameworks provide for the social world.

Together, CC, SL, and ES frameworks allow for multidimensional, multi-scalar analyses of sustainability generally and how agritourism enterprises contribute (or not) to sustainability. Though we believe integrating these frameworks is useful to guide analyses, it is important to again return to the potential risks it contains. As indicated above, a common and valid critique of capitals frameworks are that they are liable to oversimplification and reductionism (Scoones, 2009). Ensuring that it is not only crude measures of various capitals is critical to buffering against this tendency. Those who apply this framework must recognize the tendency for normative valuations of community contexts and livelihood strategies, thus requiring explicit acknowledgement and engagement among researchers, practitioners, and citizens (Scoones,

2009). The 'capitals' language also makes it easy for an assumption to arise that the more capital, the better. However, theoretical and methodological work has demonstrated that the actual dynamics of the capitals are much more complex than being uniformly positive. Their qualities, distributions, and accessibility may produce undesirable outcomes including exclusion, inequality, conflict, and punitiveness (Bourdieu, 1986; Flora et al., 2016; Portes & Landolt, 2000). Although existing datasets and quantitative data collection are highlighted in the metrics we offer in this White Paper, mixed methods approaches - with particular, but not exclusive attention to qualitative methods - are critical to ensure that the nuances, wrinkles, and complexities of reality are depicted as accurately as possible. In addition, although our conceptual model captures the social and environmental dynamics at different scales, it is not focused on broader scales, a weakness that has been identified in the application of capitals frameworks (Scoones, 2009). Thus, though beyond the scope of this white paper, monitoring and analyzing long-term trends, environmental changes at macro scales, and institutional conditions, and making those data available and usable to investigations being conducted at local scales will avoid myopic and partial explanations. We again emphasize multiple methods: big datasets are essential for considerations such as climate change, as are approaches such as content analysis to document policy shifts.

B. Stakeholder Input

As described in the Methods section of the paper, the project team sought stakeholder input on priority metrics. Stakeholder input was solicited via a one-hour webinar on December 4, 2020. Twenty-five participants joined the webinar representing a range of interests and organizations including: Senator Patrick Leahy’s office, St. Michael’s College, Vermont Farm to Plate Network, Vermont Agency of Agriculture, Vermont Fresh Network, University of Maine, Fort Ticonderoga, Local Maverick, Shelburne Farms, Vermont farmers/producers, and faculty and students representing a range of UVM departments and disciplines.

Throughout the webinar, online polls collected participant feedback on key metrics related to sustainability dimensions of the farm-community nexus. Poll questions were designed to assess the aspects of environmental, economic, and social sustainability that stakeholders perceive as most important to agritourism businesses, and to the people and communities where agritourism businesses are located. For each dimension (environmental, economic, social) participants were asked to respond to 2-4 specific questions, and to provide their top 3 answers for each individual question. Stakeholders were also encouraged to share additional answers and ideas via the webinar chat feature. Tables 2-4 summarize poll results.

Table 2. Stakeholder Poll: Environmental Sustainability Responses

What aspects of environmental sustainability are most important to an agritourism business? <i>[Answer options: Working/productive lands, Open space (recreation, scenery), Farm products, Forest stewardship, Certifications/standards (e.g., pollinator habitat, wildlife friendly), Water quality, Erosion control & nutrient management, Carbon sequestration, Something missing? (type in chat)]</i>	Percent
Working/productive lands	69
Open space (recreation/scenery)	63
Farm products	56
Forest stewardship	38
Others: tourism's contribution to carbon emissions	
What aspects of environmental sustainability do you think are strong in Vermont agritourism overall? <i>[Answer options: same as above]</i>	
Open space (recreation/scenery)	82
Farm products	82
Working/productive lands	76
Forest stewardship	29

Table 3. Stakeholder Poll: Economic Sustainability Responses

What aspects of economic sustainability are most important to an agritourism business? <i>[Answer options: Profitability, Affordable labor, Affordable farmland, Job security, Healthcare, Stable markets, Something missing? (type in chat)]</i>	Percent
Profitability	100

Affordable farmland	65
Affordable labor	59
Stable markets	53
What aspects of economic sustainability are most important to the well-being of people living in the same community as the agritourism business?	
<i>[Answer options: Direct sales of farm products, Education on the farm, Recreation on the farm, Acres of Cropland, Acres of Pasture, Acres of Woodland, Something missing? (type in chat)]</i>	
Direct sales of farm products	94
Recreation on the farm	69
Education on the farm	38
Acres of woodland	38
Acres of cropland	31
Others: Land use planning, maintaining iconic/authentic landscapes	
What aspects of economic sustainability are most important to the well-being of the greater community where the agritourism business is located?	
<i>[Answer options: % Employed in service occupations, % Employed in agriculture, forestry, fishing and hunting, and mining, % Employed in natural resources occupations, % Employed in arts; entertainment; recreation; accommodation & food services, % Households with broadband connection, Median housing value, Housing occupancy rate, Median monthly gross rent, Owner-occupied housing, Something missing? (type in chat)]</i>	
% Employed in ag, forestry, fishing & hunting, & mining	67
% Employed in arts; entertainment; recreation; accommodation & food services	42
% Households with broadband connection	42
Median housing value	
Others: employment opportunities, land use planning/zoning, maintaining iconic/authentic landscapes, livable wages	

Table 4. Stakeholder Poll: Social Sustainability Responses

What aspects of quality of life are most important in the context of agritourism?	Percent
<i>[Answer options: Affordable housing, Access to healthcare, Employment opportunities, Meaningful labor, Education opportunities, Happiness, Safety and security, Access to information, Something missing? (type in chat)]</i>	
Employment opportunities	73
Affordable housing	53
Meaningful labor	53
Access to healthcare	47
Others: access to nature/outdoors, cultural aspects of tourism (blueberry and apple picking, corn mazes, sugar shacks)	
What aspects of democracy and governance are most important in the context of agritourism?	
<i>[Answer options: Inclusive participation in decision-making, Inclusive participation in setting goals, Responsible budgetary management, Transparency in rule-setting/policymaking/decision-making, Ability to access government officials and representatives, Ability to influence policy, Something missing? (Type in chat)]</i>	
Transparency in rule-setting/policy making/decision making	80
Ability to access government officials and representatives	73

Inclusive participation in decision making	73
Ability to influence policy	40
What aspects of equality and diversity are most important in the context of agritourism? <i>[Answer options: Demographic diversity (gender, race, age, income, religion etc.), Ideological diversity, Educational equality, Equitable access to employment opportunities, Healthcare, Income distribution, Something missing? (Type in chat)]</i>	
Demographic diversity (gender, race, age, income, religion, etc.)	73
Equitable access to employment opportunities	73
Income distribution	60
Healthcare	33
What aspects of social cohesion are most important in the context of agritourism? <i>[Answer options: Trust, Reciprocity, Sense of community belonging, Civic engagement (e.g., volunteering, participation in community events), Common identity, Shared values, Something missing? (Type in chat)]</i>	
Sense of community belonging	100
Civic engagement (e.g., volunteering)	73
Share values	67
Trust	40

C. Crop Varietal Diversity, *Terroir*, and Agritourism

There is a close connection between *terroir*, regional brand and agritourism. Globally, agritourism is frequently motivated by the desire to travel to enjoy particular foods and flavors. *Terroir*, a French term originally intended to describe the natural environment (soil, water, topography, and climate) that gives wine unique taste and flavors, can more broadly describe a region's unique flavors. For Vermont, *terroir* is a central aspect of the state agricultural brand. Although as Vermonters we often celebrate our *terroir*, from maple syrup to craft beer, we have done very little research exploring and developing unique crop varieties, the natural environment and links to flavors. This appendix lays out the needs for research on Vermont's unique crop varieties in light of agritourism.

Ecologically, *terroir* arises from a mixture of the crop varieties grown in a particular region and how those varieties respond to the soils, water, topography, climate, and human agricultural management of a region. In wine this might be the distinct flavor of St. Emillion in Bordeaux, or New Zealand Marlborough Sauvignon Blanc, or Argentinian Mendoza Malbec. Geneticists and breeders refer to the interaction of a crop variety and its environment as a genotype by environment interaction (G*E). Understanding genotype by environment interactions is a "Grand Challenge" of biology, being significant from human biology and medicine to agriculture, being referred to by National Science Foundation (NSF) as the "Genotype to phenotype map" (NSF, n.d.). Over the past decade and a half, it has become possible to cost-effectively sequence the entire genome of nearly any crop variety. Consequently, we can easily characterize a crop genotype. However, we still lack an equal capacity to predict a variety's performance in a particular region (soil, water, air, etc.) under different management conditions.

To support agritourism, and more broadly to support the Vermont brand, we need a description of crop varieties and animal breeds that contribute to *terroir* of Vermont foods and agricultural products. UVM faculty members von Wettberg (Plant and Soil Science, a crop geneticist), Tobin (Community Development and Applied Economics, a rural sociologist) and Reynolds (CDAE, development economics) formed the Consortium for Crop Genetic Heritage (CCGH) at the University of Vermont to address this need. The CCGH has begun assembling a database of crop varieties of significance in Vermont, through outreach to community seed saving groups, grower organizations, the Abenaki and resettled refugee communities, and UVM Extension.

Examining the diversity of agritourism operations in Vermont, we expect crop varieties in several crops to be particularly important. One of these crops is our iconic sugar maple, a crop where almost no formal breeding has ever been performed. However, with climate change, breeding in maples may become necessary, and could be done in a way that supports the state brand and local producers. It is widely reported that some trees are naturally better producers or make sap with a higher brix index (sugar content) which would make for improved varieties. Another set of crops are those favored in u-pick operations, such as apples, blueberries, and

raspberries and blackberries. A third set of crops are those of Vermont's native people, the Abenaki, who grew corn, beans, squash, and more, and whose varieties are still commonly found in both indigenous and settler fields and gardens. Our partners in the Vermont Indigenous Heritage Center's Seeds of Renewal project have started a collection of these crops. A fourth are crops that contribute to some of our most popular foods and beverages, such as small grains and hops for Vermont craft beers, pasture forages for grass-fed milk and meat, and cider apples. For many of these crops, microbes, such as wild yeasts, may be important for determining unique flavors.

We view the generation of data on crop genetic variation, as well as environmental interactions, as a key data need to support Vermont agritourism. We will need support to not only describe the crop varieties that are used in Vermont, but also what properties of the varieties interact with our landscape and climate to give unique flavors. If we understand this interaction, we can help farmers enhance it, and publicize it to increase the vibrancy of agritourism. Our research on Vermont heritage varieties has started with a few interrelated projects.

In our first effort, the CCGH has begun a "redlisting" effort for regional crop varieties. Inspired by the International Union for the Conservation of Nature (IUCN) and Naturserve's methodology to list species as "endangered," "critically endangered" etc., the group is developing similar methodology to evaluate threats to crop varieties based on their geographic spread, their life history (need for outcrossing, lifespan, etc.), their presence in the commercial seed industry, susceptibility to diseases, pests, risks from climate change, etc. Although this effort is early, our intention is to use listing of varieties as a mean to encourage community seed savers, and draw broader attention to the importance of crop diversity for food security, resilience against climate change, and the distinct *terroir* of Vermont. The project will work closely with the Vermont Indigenous Heritage Center's Seeds of Renewal Project, as well as with community seed saving groups, seed libraries, regional seed companies, and with the communities of resettled refugees in Chittenden County. Ideally, this effort will also draw on surveys of farmers, agritourism operators, and agritourists to see what varieties they grow and value, so that we can understand which varieties that are distinct to the Vermont brand or flavor are most at risk.

A closely related effort is to characterize the genetic variation in some of our local crops. Importantly, crop variety names do not always indicate their genetic basis, as often breeders or growers have applied names arbitrarily, particularly with varieties that are not officially registered. To assess the relationship between variety names and genetic diversity, we must sequence known varieties. This must be done in several crops to be informative. We are doing this with the complete Abenaki bean collection, and with a subset of their maize collection, with results anticipated in 2021. We have also sequenced some of the maize grown by resettled refugees, where we found unexpectedly high genetic diversity. We have begun sequencing some of the native hops of Vermont and the Northeast, in collaboration with Heather Darby and Stephen Keller. We expect to write grants in the coming years to expand

our work to all indigenous crop varieties, and to a broader range of crops grown by new American farmers and the varieties most valued by our diverse communities of seed savers.

A third related activity is to build social and physical infrastructure to better preserve varieties. Ultimately varieties are most vibrant when grown and preserved by communities. The art of seed saving however has been lost by many gardeners, as it has become far easier for many gardeners and farmers to just buy commercial seed. However, commercial seed sources may not be able to profitably produce the range of varieties that were once here. Consequently, we are working with local seed savers to offer more training to gardeners in seed saving, with the support of a City Market grant to assistant professor Daniel Tobin. In addition, we are building a backup “genebank” for endangered crop varieties. Seeds of most crops can be frozen, allowing them to be preserved for decades, buying us more time to ensure their survival. This genebank is currently housed in von Wettberg’s research laboratory, but ideally will move to a more suitable place with greater access to the community.

A fourth activity is to examine the microbiome of Vermont crops. Since *terroir* arises from an interaction of a crop variety with the place it is grown, microbes and yeasts in the soil, on the crop, and in the processing facility can all contribute to *terroir*. In the past microbial mediation of *terroir* was overlooked, largely due to the absence of the technology needed to rapidly characterize the diversity and biological function of microbial communities in soils, on plant and animal tissues, and in the human built environment. However, with the advent of cost-effective next generation DNA sequencing it has become possible to characterize microbiomes of different organisms, from human guts and skin to toilets, smart phones, cow udders, agricultural and undisturbed/uncultivated soils, and the open ocean. Although studies of microbiomes are one of the “hottest” areas of biology as of late 2020, few researchers have linked them to *terroir*. But there are examples of regionally distinct foods, such as San Francisco sourdough and pickling traditions from around the world, that clearly derive from local microbial communities. In Vermont there is an area of clear need. In the ARS soil health group, microbiomes have also emerged as a key area of needed work. UVM faculty have performed a few microbiome studies of Vermont agricultural crops and livestock, with Deb Neher and John Barlow studying dairy cow associated microbiomes, Neher studying Vermont compost operations, Jeanne Harris and Allison Brody having studied blueberry soil microbial communities, Matt Scarsborough (CEMS) performing analyses of potential PFAS degrading soil microbes, and von Wettberg and UVM postdoc Dr. Edward Marques having studied microbial diversity of corn-pea rotations. We see this area of research as one that has great potential for linkages to *terroir* in the future, even if currently the microbiome studies have not yet linked any specific microbes to Vermont’s distinct flavors.

D. Table of Metrics

Primary Sustainability Dimension	Metric	Indicators	Data Availability and Sources: Examples
Environmental	Open space (proxy for many environmental services and goods)	Water retention, water filtration, heat islands, erosion control, phosphorous retention, soil health, climate mitigation, carbon sequestration, amphibian habitats, wildlife, recreation, pollination	Watson et al., 2016, 2019, 2020; Sonter et al., 2016; Adams et al., 2018, 2020, Gourevitch et al., 2020, Nicholson et al., 2017
	Farm products (the environmental context that supports food production)	See Open Space	VT Agency of Natural Resources GIS Atlas (soils, land cover)
	Stewardship	Forest cover, levels of biodiversity, commitments to practices (certification, pollinator friendly habitat, delayed haying for nesting birds)	Vermont Agency of Natural Resources Biofinder; VT Audubon; NOFA-VT
	The Vermont Brand, including recreation, sense of place and <i>terroir</i> (Aspects of the environment)	interaction of a plant or animal variety with the environment and organisms in it (climate, soils, microbes, pests)	Sonter et al., 2016; Morse et al., 2020; Perry et al., 2018
Economic	Economic Impacts	Direct, indirect, and induced impacts	Data not currently available. Could be collected through consumer and producer surveys.
	Consumer Spending	Consumer expenditures at farms on direct sales of farm products, entertainment, outdoor recreation, hospitality, and education	Data not currently available. Could be collected through consumer surveys of Vermonters and visitors.
	Farm Profitability	Revenue and expenses from farm and non-farm-related sources, revenue and expenses from agritourism enterprises, sales per day of operation, percentage of total sales from agritourism and recreational services, percentage of sales from direct marketing, and	National agritourism survey of farmers led by UVM in 2019 has some variables. Agritourism Research Vermont Tourism Research Center The University of Vermont (uvm.edu)

		consumer spending on farm products, entertainment, recreation, education, and hospitality	NASS Census of Agriculture has revenues for agritourism and direct sales every five years with 2017 being the most recent.
	Farm Labor	Farm vs nonfarm average hourly wages, number of full-time staff, number of part-time and seasonal staff, family vs. non-family staff time, wages, benefits, total hours of employment, and the days of operation per year.	NASS Census of Agriculture includes number of days worked on farm per year. USDA ERS – Farm Labor
	Farmland	Average cost per acre of farmland, rent/mortgages paid, availability of financing/capital, number and types of policies tied to land access, opportunity cost of not developing agricultural land, amount of farmland used for food production and for agritourism, and the amount of farmland that is protected.	USDA ERS – Farmland Value
Social	Cultural Ecosystem Services	Wide variety of indicators within eight categories: recreation and ecotourism (e.g., recreation facilities, park visitation); sense of place (e.g., place attachment), aesthetic, cultural heritage, inspiration, social relations, cultural diversity, and spirituality and religion (e.g., memorials, spiritual sites).	Data not currently available; needs to be collected through farm and consumer surveys, mapping.
	Labor opportunities and conditions	Labor standards (wages and salaries; in-kind benefits; job security; standard of living), working conditions (health; workplace safety; dialogue and trust), participation and identity (workers' organization, sense of ownership and control; career potential)	Primary data could be collected through farm surveys. USDA ERS – Farm household well-being Bureau of Labor Statistics Data VT Dept of Labor – Economic and Market Information

	Social and informational infrastructure	Availability and accessibility of social infrastructure and information, including extension services, geographic proximity to resources, infrastructure such as access to high-speed internet.	Primary data could be collected through farm surveys. US Census Bureau American Community Survey provides, for example, data on broadband access at the county level.
	Sense of community, community networks, and civic engagement	Sense of Community Index (SCI) (measures feelings of belonging, support, worth, and commitment); Civic, social, and political participation (e.g. volunteering, membership, voting records); measures of Social Capital (e.g. frequency of interaction with friends/family, support networks, trust in neighbors, social integration)	Primary data could be collected through farm and consumer surveys. Social Capital Project Penn State Social Capital Variables
	Demographic and cultural diversity	Rates of farmers/employees that are women or underrepresented populations, physical accessibility for employees and community participants, usage of culturally traditional crops/methods, presence of cultural diversity awareness/celebration programming	NASS Census of Agriculture includes data on owners/producers from underrepresented populations. US Census Bureau American Community Survey Primary data could be collected through farm and consumer surveys.
	Good governance	Degree of effectiveness, transparency, accountability, participation, inclusivity, and equity within governing bodies	Data could be collected through farm surveys.
	Health, Safety, and Wellbeing	Food security, nutrition security, health status, health insurance/care, educational attainment, housing conditions, happiness, mental health, psychological safety, benefits from cultural ecosystem services	Primary data could be collected through farm and consumer surveys. USDA ERS – Food security Vermont Dept of Health – Public health data CDC – Health surveys County Health Rankings Vermont Agency of Education FBI Crime Reporting

E. Interdisciplinary Team

Susanna Baxley is a master's student in Food Systems and Agroecology at UVM focusing on land access for farmers. Also a nurse, herbalist, and part-time farmer, she is interested in the relationship between the natural environment, human well-being, and planetary health.

Christopher Brittain is a first-year master's student in the Food Systems program at UVM, focusing on how local foods can improve local economies and support sustainable food production. Prior to enrolling in the Food Systems program, he worked in community development and food access planning in Minnesota.

Lisa Chase is an Extension Professor and Natural Resources Specialist for UVM Extension, and the Director of the Vermont Tourism Research Center. Her research and outreach focus on the intersection of food systems, community vitality, and working landscapes. For the past two decades, she has worked with farmers and food entrepreneurs throughout Vermont and around the US.

Gillian Galford is a Research Associate Professor in the Rubenstein School for Environment and Natural Resources and a Fellow of the Gund Institute for Environment. She has expertise in ecosystems ecology with a focus on human-dominated environments, using tools of remote sensing and GIS, spatial modeling and ecosystem services. She has worked extensively on agriculture, ecosystem services and climate change in Vermont and internationally.

Amy Kelsey is a Research Specialist with the UVM Center for Rural Studies. Her research and consulting work focuses on community economic development and planning, program evaluation, and economic impact analysis. She is experienced in both qualitative and quantitative research methods.

Jane Kolodinsky, Professor and Chair, Community Development and Applied Economics (CDAE), & Director, Center for Rural Studies, has expertise in applied economics and consumer behavior applied to food systems, public health, and community well-being. She has worked extensively on development of metrics and their measurement at the individual, household, and community level.

Josiah Taylor is completing his dissertation in Food Systems at UVM to develop agroecological sustainability assessment methods for farms and community food systems. He is a farmer and works for UVM Extension facilitating outreach for agriculture risk management education.

Daniel Tobin, Assistant Professor in CDAE, is a rural sociologist who focuses on how farmers with small- and medium-sized operations pursue sustainable livelihoods. His research has explored aspects of food and nutrition security, market integration, and agrobiodiversity conservation through both quantitative and qualitative methods.

Eric von Wettberg, Associate Professor in Plant and Soil Science, has expertise in conservation of crop genetic diversity, and he is the director of UVM's Food Systems graduate program. His research aims to explore and conserve crop genetic diversity to build resilience for climate change.