ASSESSING AGROECOLOGICAL PRINCIPLES AT THE INTERVALE IN BURLINGTON, VERMONT: A CASE STUDY AND MULTIMETHOD RESEARCH WITH A PARTICIPATORY APPROACH IN A PERI-URBAN SOCIOECOLOGICAL SYSTEM

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ABSTRACT

The emerging field of urban agroecology promises to mend the prevalent unsustainable rupture between rural and urban/peri-urban agri-food endeavors since global industrial conglomerates took power. My research contributes to the efforts of mending this rupture by, first, advancing the academic discussion on how to fill an evidence-based gap on the use of the much theorized multidimensional and cross-disciplinary principles of agroecology to assess community-based agri-food systems beyond the farm level. To do so, my research uses the fifteen principles of agroecology proposed by the non-profit *Coopération Internationale pour le Développement et la Solidarité* (CIDSE, 2018). Second, my research expands the understanding of how these agroecological principles may be put into practice in different cases and scenarios, especially in urbanized environments. This investigation uses a single significant case study methodology to share a place-based experience as a possible example of urban agroecology. The case study is a 340-acre information-rich peri-urban organic agroecosystem in Burlington, Vermont, owned and managed by the Intervale Center. My research investigates how the Intervale, a non-profit organization and socioecological system, may be practicing agroecology and consider opportunities to strengthen such practices. My investigation involves a principles-focused and context-sensitive baseline assessment (inspired by Patton, 2018) using a qualitative multimethod framework and a participatory action research (PAR) approach. The multimethod framework triangulates a 'practical' PAR stream of inquiry for the co-creation of knowledge with a purposive sample of participants (semi-structured interviews with visual tools such as CIDSE's agroecological principles infographic, site mapping, and photovoicing) and a 'theoretical' stream where the researcher connects theory to practice (participatory observation, photo-documentation, and document analysis) for an integrated analysis. According to observations and participants' responses, the Intervale follows agroecological principles. The collective practices related to the agroecological principles of *strengthening local food producers and community* and *nourishing biodiversity and soils* are most prevalent at the Intervale. The organization also plays a noticeable role under the principle of *enhancing the power of the local market and building on a social and solidarity economy*. There are also some specific areas of intervention in the organization's operations to achieve higher levels of agroecological transformation, especially under the principles of *fostering more diversity and solidarity*, *encouraging stronger participation of food producers*, and *promoting more farmer-to-farmer exchanges*. Conclusively, this research reduces the evidence-based gap between the theory supporting a set of agroecological principles and their application beyond the farm level and in an urbanized setting. The comprehensive methodology and the results illuminate how the Intervale's placed-based practices could serve as an example to advance urban agroecology in North America and even other regions.

DEDICATION

I dedicate my dissertation to **my dear mother**.

I can truly say that my mother is the main reason I am doing a doctorate. When I was a little girl, she let me open my wings and gave me the freedom to achieve whatever I wanted to achieve or to be whoever I wanted to be without any dogmatic or gender-biased constraints. From the time I was a teenager, I was always swimming against the current of what was expected of a Catholic Puerto Rican woman. I remember my mother telling her friends, "this girl has big wings; she wants to fly too high." The reality is that all the time she was, as the lyric of the well-known song says, the wind I needed beneath my wings.

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1.

INTRODUCTION

Despite a widespread interest and expansion of urban agriculture in increasingly urbanized societies, and the concomitant rise of agroecology as a countermovement to the neoliberal forces of the agro-industrial conglomerates, little has been written about the possibility of an 'urban agroecology'. In the last decade, academic work is showing an emerging interest in conceptualizing agroecology for farming in urbanized environments and their socioecological conditions and constraints. Overarching agroecological principles have been proposed for the practice of agroecology and are gaining interest in the academic arena but there is still a lack of empirical studies on the use of these principles and their beneficial outcomes in different contexts, and particularly urban settings. Agroecology is a relatively recent field of study involving the understanding of complex systemic and context-sensitive intersections and interrelations of environmental, economic, social, and political domains. Thus, as an emerging field that requires a comprehensive transdisciplinary lens, as I will explain next, the study of agroecology provides opportunities for addressing knowledge gaps for the effective multi-level and multi-domain transformations of agri-food systems in different scenarios (Anderson et al., 2021, 2020, 2019; Bowen Siegner, 2019; Herrmann et al., 2018; Altieri and Nicholls, 2018; Sanderson Bellamy and Ioris, 2017; Tornaghi, 2017; Tornaghi and Hoekstra, 2017a, 2017b; Vaarst et al., 2018; Renting, 2017; Méndez et al., 2016; Nicholl et al., 2016; Fernández et al., 2016; Gregory et al., 2016; Ribeiro et al., 2015; Merçon et al., 2012).

Studies with a transdisciplinary lens[1] are not confined to academic or scientific disciplines, they go beyond conventional disciplines but, at the same time, are supported and enriched by them. Research with a transdisciplinary perspective crosses the boundaries of two or more disciplines and sectors of knowledge by integrating paradigms, premises, locally contextualized and Indigenous experiences, and methodologies. Thus, working with a

[1] Appendix 1 provides the definitions of multidisciplinarity and interdisciplinarity as well for further understanding of how transdisciplinarity differs from these two other known approaches.

transdisciplinary lens provides a much more holistic viewpoint to address real complex world issues by incorporating in the process the knowledges not only of different conventional disciplines but also of different stakeholders. Consequently, this broader perspective is highly inclusive and largely requires participatory processes. Transdisciplinarity does not compartmentalize the different disciplines and knowledges, nor the learning processes or analyses, it unifies and transcends them. The aim of this mindful unrestrained approach is to generate new contextualized and, at the same time, comprehensive wisdom under a humanistic light (Zaman and Goschin, 2010; Merçon et al. 2018). Ergo, agroecology is considered a transdisciplinary field (Méndez et al., 2016; Francis et al., 2008; Ruiz-Rosado, 2006) because, as Méndez et al. (2016: 5) argues, it values and subsumes "different types of knowledges, which can include information from scientific or academic disciplines, as well as experiential, local, Indigenous, or other forms of knowledge."

Drawing on an academic presentation by Loker (2020) who clearly argued that "the principles of agroecology are truly what defines it rather than any particular definition," defining 'principle' becomes most important since it underpins the focus and main conceptual framework of my research. A principle, according to the Oxford online dictionary (2020), is "a moral rule or a strong belief that influences human actions," "a law, a rule or a theory that something is based on" and "a belief that is accepted as a reason for acting or thinking in a particular way." In science, a principle "is a general or scientific law that explains how something works or why something happens." Consequently, principles can provide an encompassing perspective of a situation because they are built on values, credence, past experiences, and acquired knowledge. Principles help to appraise choices, guide decisions, decide what is appropriate for a particular situation, and help determine behavior, actions, or practices accordingly (Patton, 2018).

For Patton (2018: ix), "[l]earning to evaluate principles and applying what is learned from doing so, takes on increasing importance in an ever more complex world where effectiveness depends on adapting to context. *Principles guide adaptation"* (my emphasis). In his landmark book about principles-based evaluations which inspires my research work, Patton (2018: 276)

asserts that agroecology emerged "as an applied discipline based on principles," and most agroecologists agree with him (see later in this dissertation).

I organize this introduction by first presenting my research goals and questions. I then define, frame, and connect the key areas of studies that encompass my research work: agroecology, urban and peri-urban agriculture, and urban agroecology. I also define agroecosystem and socioecological system, both fundamental concepts for these areas of studies and my research work.

Research Goals and Questions

My research endeavor has two main goals and contributions, as well as two main research questions. My first goal is to advance the global discussion on the use of principles in agroecology by starting to fill an evidence-based gap in the literature due to the lack of studies on the use of principles-focused frameworks to assess specific agri-food initiatives. Second, I want to advance the understanding of how the many multi-dimensional and transdisciplinary principles, presented in the literature, may be put into practice in different cases and scenarios (i.e., contextualized praxis), *especially in urbanized environments* to advance the understanding of what has been recently termed as "urban agroecology". To achieve these two main goals, I selected a single case study methodology. I wanted to study and share the unique place-based experience of a single and significant case as a possible example of urban agroecology in North America to help extrapolate lessons learned. The case study selected is the Intervale Center (hereafter the Intervale), an information-rich case of a peri-urban farming community in Burlington, Vermont, United States. The Intervale has been cited and used as a model for local, organic, sustainable community supported agriculture, and a multifunctional agroecosystem in the United States (Comen, 2013; Phillips et al., 2013; Berman, 2011; Lovell et al., 2010b; Shuman et al., 2009; University of Michigan, 2009; Macias, 2008; Meadows, 1994). Accordingly, the research questions driving my research are: Is the Intervale a peri-urban agroecological organization? If yes, then why and how? If yes, what are the challenges and opportunities to strengthen agroecology at the Intervale?

Framing and Defining Key Terminology

Agroecology is defined by the Food and Agriculture Organization (FAO) as the simultaneous use of social and ecological concepts and principles for the design and management of sustainable agri-food systems (FAO, 2018). Francis et al. (2003), as well as Gliessman (2018a, 2015b), provide a simple definition of agroecology as the "ecology of entire food systems" emphasizing system thinking-based studies and interdisciplinary research teams to work with the wholeness of the interrelated and interdependent domains in agri-food systems. However, Wezel et al. (2009) define agroecology "as a science, a movement and a practice" to highlight the importance of its multi-dimensionality and comprehensiveness, which includes and combines studies and actions not only in the environmental, economic, and social domains, but also in the political/responsible governance arena (CIDSE, 2018; FAO, 2018; Dumont, 2016). But agroecology has gone through an "evolution of different meanings" (Wezel et al., 2009: 1) as a transdisciplinary field that even embraces a participatory and action-oriented approach (Méndez et al., 2016, 2017; Francis et al., 2008; Ruiz-Rosado, 2006) thus has been defined in different ways by different stakeholders (e.g., ALC, n.d.; Chappell et al, 2018; CIDSE, 2018; FAO, 2018; Méndez et al., 2016, 2017; Francis et al. 2003, 2008; Gliessman, 2018a; Nyéléni Newsletter, 2019; Ruiz-Rosado, 2006; Wezel et al., 2009; Altieri, 1995a).

Based on the literature, I assemble and use the following comprehensive definition of agroecology for my research fieldwork:

> Agroecology is a multidimensional and transdisciplinary-oriented practice and countermovement against the current unsustainable agri-food order for the holistic design and management of local, polyfunctional farming and food systems. It integrates locally contextualized and Indigenous knowledges with ecological science and progressive economic and sociopolitical studies to advance sustainability. It is grounded in the acknowledgment and respect of natural, social, and cultural histories and realities, and the uniqueness of human and non-human communities. Therefore, agroecology follows a set of ecological, economic, political, and socio-cultural principles, and it expresses itself as a science, practice,

> and social movement to achieve food justice, security, and sovereignty, as well as sustainable livelihoods.

Now the key question becomes how can this definition of agroecology be appertained or operationalized in agricultural initiatives in and around urbanized environments?

The most important characteristic of both **urban and peri-urban agriculture** (hereafter UPA), which sets them apart from rural agriculture is their integration into the urban fabric and the urbanized ecosystem. Urban agriculture is considered an agricultural enterprise specifically located within (intra-urban) or on the fringe (peri-urban) of a town, city, or metropolis, operating in different types of privately or publicly held lands. UPA produces, grows, processes, markets, and distributes a diversity of food and non-food products using and reusing human and material resources, products and services largely found – and distributed/consumed -in and around that urbanized area. Studies have shown that UPA can contribute substantially to the food security and sovereignty, health, livelihood, culture, and environment of urban dwellers, which ranges from the individual citizen to the household and community (Mougeot, 2000, 2005; Smit et al., 2001; Poulsen et al., 2014; Camps-Calvet et al., 2016; Opitz et al., 2016; Leitgeb et al., 2016; Vitalyst Health Foundation, 2017; Lin et al., 2017; Rashed, 2018; Altieri, 2019; Diekmann et al., 2020).

According to Food and Agriculture Organization's (FAO) Food for the Cities Initiative, the world's urban population already outnumbered the world's rural population, and it is expected that 70% of the world population will live in urbanized areas by 2050. In the Global South, the growth of urban populations corresponds to an increase in urban dwellers living in informal settlements with food insecurity, as well as with other precarious socioeconomic conditions and environmental-related degradations (FAO, 2021). Climate change is the most urgent environmental challenge given the current unsustainable practices by the corporate-led agri-food regime around the world. Supplying safe food to urban dwellers has to become a priority for city-region governments because "[m]eeting future demand for food under sustainable production schemes and through reasonable processes has become of vital importance for the future of humanity" (Rodríguez Dueñas, 2017: 46). As a holistic, transdisciplinary field that merges the socioeconomic, political, and ecological domains for a sustainable and just agri-food

system, agroecology promises not only an agroecology-informed UPA, but also a model for productive green infrastructure (Lin et al., 2017) that can mitigate the effects of climate change and contribute to food security, sovereignty, and justice within city-regions. City-regions have a paramount role in the attainment of more sustainable and equitable food systems as demonstrated by the Milan Urban Food Policy Pact of 2015 and the UN New Urban Agenda of 2016.[2] Furthermore, the acknowledgment of the importance of agroecology for transitions towards sustainable agri-food systems has also increased dramatically within international organizations like FAO (i.e., FAO's ten elements of agroecology) and the UN Conference on Trade and Development in the last decade (Barrios et al., 2020; Renting, 2017; Vaarst et al., 2018; Tornaghi, 2017; Tornaghi and Hoekstra, 2017a; Dubbeling et al., 2015; Forster and Escudero, 2014). Hence, urban and peri-urban agroecology can become the shared-vison needed by urbanites to develop sustainable, resilient and inclusive local urban food systems.

As a relatively innovative area of research, very little has been written about how **urban agroecology** can contribute to the sustainable enhancement of UPA. Fernández et al. (2016: 171) affirm that "[t]here has been little interaction between agroecology and urban agriculture. Agroecology can be an important tool for urban agriculture in the United States and abroad, but very little research has looked into the concept and practice of 'urban agroecology.'" Tornaghi and Hoekstra (2017b: 4) concur when they argue that "urban agroecology is still an emerging concept, and its ecological, social, political, economic and geographical meaning are far from having a shared understanding and narrative". Much has been written about UPA in terms of its historical development, typologies, multifunctional benefits, use of organic methods, challenges and importance for food justice and urban sustainability (Juncos-Gautier, 2017), but not so much about urban agroecology.

Before starting my fieldwork in July-August 2018, a review of different online indexes and databases in English and Spanish using main academic search engines (e.g., Google Scholar,

[2] The Milan Urban Policy Pact (2015) was signed by 177 cities with more than 450 million inhabitants around the world to work together for more resilient urban food systems. The United Nations' New Urban Agenda (a result of the 2016 Conference on Housing and Sustainable Urban Development (Habitat III), promotes a shared vision for a new model of sustainable, inclusive urban development. It also provides agreed-upon standards and principles to guide city governments (United Nations, 2016).

Omni Libraries, York Libraires) revealed 82,000 hits for 'agroecology' but very little on 'urban agroecology'. In fact, most research engines showed an average of five published documents, with the exception of Google Scholar which showed 81 in English and 133 in Spanish (under *agroecología urbana*). Most of these published documents use the concept of 'urban agroecology' in their title and a few times in their text, and they theorize around the concept using examples (e.g., Hermann et al., 2018; Vaarst et al., 2018; Rekow, 2017; Terrile et al., 2017; Saco Fortuna, 2017; Driscoll, 2017; Cederlöf, 2016; Gregory et al., 2016; Peredo Parada et al., 2016; Ribeiro et al., 2015; Montero di Wit, 2014; Sánchez Miñaro, 2013; Soler Montiel and Renting, 2013; Dimuro et al., 2013; Merçon et al. 2012; Casabuenas, 2016). Contrastingly, there was an abundance of published literature on 'urban agriculture' and 'urban farming', which amounted respectively to 59,700 and 13,700 documents.

Nevertheless, back in 2018 when I started researching urban agroecology, I found two publications that most comprehensively addressed the topic of 'urban agroecology'. The first was a special issue of the Resource Center for Urban Agriculture and Forestry's (RUAF) *Urban Agriculture (UA) Magazin*e (No. 33) published in November 2017 as a joint effort with the Center for Agroecology and Water Resilience. The editors of this special issue, Tornaghi and Hoekstra (2017a), included debates by practitioners, activists and scholars that reveal analogies, challenges, practices, and opportunities with examples of sustainable UPA initiatives around the world. These examples creatively take advantage of opportunities in urban contexts by overcoming socioeconomic and environmental hurdles. A second publication by Altieri and Nicholls (2018) explicitly uses six key ecological/agroecological principles that have been used at the farm scale for the design and management of farms in rural settings to promote 'urban agroecology' "for the design of diversified, productive, and resilient urban farms" (Altieri and Nicholls, 2018: 49).

Most recently, there are three new key publications on urban agroecology. Two of these publications are books edited by Egerer and Cohen (2021a), where I had the opportunity to co-author chapter fourteen (see Caswell et al., 2021), and by Tornaghi and Dehaene (2021a). The third publication is a scientific bulleting in Spanish by Nicholls and Altieri (2019). Egerer and Cohen posit (2021b) that while they were writing the book on urban agroecology in 2020, in Google

Scholar they only found 156 papers using this term, while under the term 'agroecology' they found 119,000 papers. Therefore, the above online searches (between 2018 and 2020) evidence the lack of empirical studies on urban agroecology, particularly in the contextualized application of agroecological principles in urbanized settings. Definitely, and based on the two recent publications by Tornaghi and Dehaene and by Egerer and Cohen, this is clearly an emerging issue for the urbanized societies of the 21st century.

Since the beginning, with the publication of the RUAF's special issue in 2017, it was evident that urban agroecology was becoming important from an *agroecological urbanism* or *urban political agroecology* perspective as a counter-hegemonic approach (Tornaghi and Dehaene, 2020, 2021a, 2021b; Tornaghi, 2017; Anderson, 2017; Deh-Tor, 2017, 2021; Van Dyck et al, 2017) for understanding and studying the issues behind food security, justice, and sovereignty in a highly urbanized world –in other words, "thinking the urban through an agroecological lens" and about "food as an urban question" (Deh-Tor, 2021: 17, 24). Therefore, drawing on Prizendt (2017: 69), I recognize the potential for urban agroecology as:

> [T]he emergence of a radical proposition of social transformation in urbanized settings that "distances itself from the simple practices of cultivation in urban spaces"; it moves towards the development of social solidarity and a much profound relationship with the earth "to awaken the populations of cities in relation to what they eat and how they live".

Other important concepts for my area of study are **agroecosystem and socioecological system.** An agroecosystem is, basically, two things. First, it is an ecosystem, a functional natural system composed of different types of complementary relationships between an array of living organisms and their environment. Second, it is an intentionally managed ecosystem by humans with the objective of growing, harvesting, distributing, and consuming food, as well as, in some cases, fuel and fiber. Ergo, an agroecosystem is the combination of the whole natural ecosystem with the agri-food production system. The boundaries of an agroecosystem comprise the intentional biophysical space dedicated to the production activities, as well as all its embedded natural and human resources, infrastructure, institutions, levels of organization, operations, and market networks that enable bringing the produce to the plate (i.e., directly to the

consumer) or the processing factory. An agroecosystem has different concurrent, nested, and hierarchical operative scales (e.g., farm field, local or community, bioregional, national) (Cabell and Oelofse, 2012; Bland and Bell, 2007; Gliessman, 2004).

For my research work, I use agroecosystem to refer specifically to the property of about 340 acres,[3] owned and managed by the Intervale Center. This property contains farmlands, hedgerows, gardens, forests, riverbanks, wetlands, and different type of infrastructure, and is embedded within the peri-urban zone of Burlington in Vermont. Within this agroecosystem, a series of managed activities are carried out to balance the sustainable use and conservation of natural resources, as well as the production and local distribution of food through different market networks. An agroecosystem can be described as a 'holon', as proposed by Bland and Bell (2007: 280), which they define as "an *intentional* entity embedded in an *ecology* of contexts" (original emphasis) that denotes the world's multilayered and multidimensional socioecological complexities with changing relationships and interactions. This "*intentional* entity" simultaneously works in some ways as a whole (system) and in other ways as a part (of larger systems) (Koestler, 1967). I later elaborate about The Intervale's agroecosystem as a holon and given its different component areas, I refer to this case as a socioecological system as well.

A **socioecological system** or ecological-societal system refers to the nature-society continuum that enmesh societally constructed systems within a natural ecosystem. Accordingly, an agroecosystem is a type of agroecological system. The term 'socioecological system' is then use as a framework to study the open relationships and interactions between humans and their surrounding environments at different intentionally defined scales and hierarchies like agroecosystems. Together, humans and the environment where they intervene, are an open co-evolving wholeness of different scales and hierarchies that, at the highest level, form the planet's biosphere (Kay and Boyle, 2008; Holling, 2001). I also use the socioecological system framework since my methodological approach involves multidimensional principles to understand and assess the complex interrelated and multifunctional components of the Intervale's agroecosystem. At

[3] As calculated in 2020 using ArcGIS and geo data for the Intervale obtained from Chittenden County Regional Planning Commission.

the Intervale the delicate balance of human-environment interactions at the local scale is always playing a central role in the decision-making processes. For this reason, the Intervale as a socioecological system requires a transdisciplinary lens to deal with the contextualized complexities of its different dimensions and functions.

Preview of Chapters

My dissertation is structured into eight chapters. The next chapter, **Epistemology of Agroecology** accounts the milestones in the development of agroecology as a field of knowledge, including urban agroecology, and its limits according to its critics. This chapter also presents different propositions of agroecology principles to argue for the robustness of the set of principles selected for this particular research. The third chapter, **The Intervale in Burlington, Vermont,** describes the natural and cultural history, as well as the present socioecological context of the case study. The fourth chapter, **Methodology: Assessing Agroecology Principles,** describes in detail the multifaceted methodology of the case study using a principles-focused analytical framework with multimethod and a participatory action research (PAR) approach. The fifth chapter **Growing Agroecological Principles at the Intervale** focuses on sharing and discussing the overall results of my research that frame my triangulation and analysis. This chapter also provide a contextualized examination of the three principles with most substantive significance at the Intervale. The next three chapters, under the main title **Expressions and Practices of Agroecology at the Intervale,** focus on how the principles of agroecology are contextualized under each domain, as proposed by CIDSE (2018): economic and political (chapter 6), environmental (chapter 7), and socio-cultural (chapter 8). Each of these chapters synthesizes the main expressions and practices of CIDSE (2018) principles at the Intervale and discusses their contextualized manifestations using a combination of direct quotes and photographs from participants, as well as my observations and photo-documentation. Chapter 9 presents and discusses the **Opportunities for an Ongoing Agroecological Transformation** at the Intervale. The **Conclusion** recaps key findings highlights my research contributions, and avenues for further research.

2.

EPISTEMOLOGY OF AGROECOLOGY: EVOLUTION TO REVOLUTION

> "To address the problems confronting agriculture, the focus of agricultural research will have to shift from the physiological/molecular levels up to the higher, ecological levels of organization: populations, communities and ecosystems" (Weiner, 2003:375).

Agroecology is a countermovement that emerged in the 20th century. It emerged against the industrialized and globalized agri-food conglomerate forces and their homogenized, agrochemical fixes and technologies. These reductionist scientific techno-fixes have had significant negative impacts on the environment and socio-cultural fabric of many communities around the globe. Against the hegemonic force, called the 'Green Revolution', agroecology evolved as a transdisciplinary discipline merging science, practice, and social movement (Wezel et al., 2009).

This chapter is divided in four sections starting with **The Green Revolution: The Trigger**. Following is an historical overview, **The Sprouts of Agroecology,** of how the discipline evolved from Indigenous wisdom and the use of ecological science to a transdisciplinary field inclusive of different types of knowledge systems and embracing a socio-political countermovement. The third section **Agroecology: "An Epistemological Revolution"** focuses on how the discipline is breaking conventional epistemological theory. Following that is a section on the different roots and epistemological differences of **Agroecology in the Americas**. The next section, **The Principles of Agroecology,** reviews the plurality of the agroecological principles and the robustness behind the set of principles selected for this study. The penultimate section, **Critiques of Agroecology**, provides an overview of the main narratives by detractors and agroecologists' responses. The chapter closes with **Urbanizing Agroecology** and an overview of how 'urban agroecology' is expanding agroecology into urban and peri-urban farming endeavors.

The Green Revolution: The Trigger

The Green Revolution is seen by agroecologists as the leading cause for the emergence of agroecology as an area of research and study, as well as a global movement. The Green Revolution was a global technological undertaking in the name of 'progress' that started after World War II and expanded considerably in the 1960s. It was spearheaded by the Global North and backed mostly by the Rockefeller and Ford Foundations in the beginning. The original aim was to increase productivity as well as address rural poverty and world hunger by using genetically modified high yielding seeds, extensive irrigation systems, mechanization, chemical fertilizers, and pesticides (Food First, n.d.). The fertilizers and pesticides used were developed from the vast stocks of nitrates and poisons of World War II (Altieri and Holt-Gimenez, 2016). The development of genetically engineered hybrid seeds to increase crop yields and reduce the cost of production, as well as the panacea of chemical recipes for the intensification of agriculture and mass production of food products led to a rapid growth of industrial agriculture in the Global North (Altieri and Nicholls, 2017). Eventually, the advancement of the mass production of techno-chemical fixes by the agroindustry was exported to the Global South (Altieri and Holt-Gimenez, 2016). The Green Revolution was very successful for international agribusiness corporations that took control over production processes and resources. For example, by the 1990s around 40 percent of farmers in the Global South were already buying hybrid seeds. Also, almost 75 percent of Asian rice, 70 percent of the world's corn, and 50 percent of the wheat planted in Africa, Latin American, and Asia came from the new varieties of patented seeds developed and sold by agro-industrial corporations (Rosset et al., 2000). These hegemonic agro-industrial forces increased the dependence of farmers on patented seeds and synthetic inputs.

Furthermore, the international agribusinesses backed by government interests installed many neoliberal policies that promoted "accumulation by dispossession" (Anderson et al., 2021, p. 51; Araghi, 2008) namely, the concentration of land ownership and agricultural processes in the hands of fewer and fewer actors (Anderson et al., 2021) who had the capital (and power) to intensify agricultural production. Through massive government investments backed from incentives and loans from international organizations like the International Monetary Fund and the World Bank, millions of farmers contracted loans and worked on subsidized projects for the

mass production of food. Thus, the mass production of food for international markets boomed in the 1960s but the Green Revolution favored large farm businesses while dispossessing the smallholders from their lands and livelihoods. This so called 'modernization' was characterized by exploitation, denial of peasants' rights, and disruption of traditional and Indigenous farming and lifestyle (Sanderson Bellamy and Ioris, 2017; Figueroa-Helland et al., 2018; Rosset et al., 2021; Araghi, 2008).

With time the Green Revolution proved to be a social, cultural, and economic failure. The chemicals used in fertilizers and herbicides, as well as the intensification of monocultural practices for the mass production of crops for the international market, soon depleted and eroded the fertile topsoil, leaving peasant farmers to struggle to restore the ecological farming systems by themselves. To maintain the same yields, farmers started to increase the number of fertilizers and pesticides applied to the soil to about three times more by the end of the 20th century. However, after the yields steadily grew during the 1970s and 1980s, they started to drop gradually in the 1990s because exploited agricultural lands became unproductive (Rosset et al., 2000). Therefore, this irreversible phenomenon economically ruined many small farmers and did not reduce the problem of hunger or advance 'progress' in many parts of the world. Between 1970 and 1990, the total available food in the world rose by 11 percent, but despite the grain surpluses, the number of hungry people also rose by 11 percent (Food First, n.d.). Rosset et al. (2000: 4) stressed that the lesson taught by the history of the Green Revolution is that the increase of industrial production "can – and often does – go hand in hand with greater hunger."

Nevertheless, the Green Revolution continued to gain momentum in the 21st century, through a 'gene revolution' (i.e., genetically modified seeds that are herbicide resistant, such as the most pervasive of Monsanto's seeds) (Food First, n.d.). The so-called 'New Green Revolution' advocated by corporate agricultural producers also tried to co-opt the surge of the agroecology countermovement, which did not avail (Méndez et al., 2013).

The Sprouts of Agroecology

The term 'agroecology' emerged in the 20th century but, the science and practice behind it "are as old as the origins of agriculture" (Hecht, 1995: 1). By studying Indigenous agriculture,

researchers have learned that many sustainable ecological practices were already used by Indigenous communities around the world and were based on centuries of observation and experimentation. Even the socio-cultural and economic principles promulgated today by agroecologists for sustainable agri-food systems, were already present in Indigenous cultures with "their rich symbolic and ritual systems" around farming and food (Hecht, 1995: 2). In the name of Westerners' reductionistic science, colonizers forced a change to the view of nature from a living organic being to be respected (as Indigenous communities understood it) to a nonliving machine that can be exploited (Hecht, 1995). The Green Revolution, as described above, is the epitome of this westernized worldview.

Wezel et al. (2009) identified two significant historical periods in agroecology: the 'old age' (1930s-1960s) and the expansion of agroecology (1970s-2000s). Scholars trace the beginning of the term 'agroecology' back to 1928 when K. H. Klages, an agroeconomist in the United States, linked ecology and agronomy in a scientific article (Francis et al., 2008). However, the term was first used by Russian agronomist Basil M. Bensin (1928, 1930) in two scientific publications, in which agroecology was defined as "the use of ecological methods in research on commercial crop plants" (cited in Wezel et al., 2009: 2). However, in the 1920s, Klages popularized the complex relationships between crop plants and their environment with an emphasis on physiological and agroeconomic factors. Later, in the 1940s, Klages also included historical, technological, and socioeconomic factors (Rosset and Altieri, 2017).

After Bensin and Klages, currents of holistic or systems thinking influenced the development of agroecology through organic farming (Rosset and Altieri, 2017). Sir Albert Howard's (1943) *An Agricultural Testament* emphasized the connection between soil fertility and the health of crops, livestock, and humans. Lady Eve Balfour's *The Living Soil* (1949) popularized the concept of organic farming. Alfonso Draghetti's (1948) *Farm Physiology Principles* viewed soil fertility maintenance as the main physiological objective for gaining long-term productivity. This 'old age' period of agroecology strived to bring together ecology, agriculture, agronomy, and zoology to solve issues related to soil biology, pest management, plant protection, and so on (Wezel et al. 2009; Gliessman, 1998, in Francis et al., 2008). By the end of this period, the definition of 'agroecology' evolved into an "applied ecology to plant production and agricultural

land management" (Henin, 1967, in Wezel et al., 2009: 3) and "the study of the physical characteristics of the environment, climate and soil, in relation to the development of agricultural plants" (Azzi, 1956, in Wezel et al., 2009:3). The term 'agroecology' as the discipline that we know today was used by the German ecologist Wolfgang Tischler who published the first book titled 'Agroecology' in 1965 which focused on the connection of soil fertility, pest management and plant protection (Wezel et al., 2009).

The concept of agroecology started to gain momentum around the 1970s with a generation of scholars that moved beyond the narrow field of biogeochemical environment, towards a more extensive focus that encompassed the ecological, economic, and social dimensions (including the ethics and value systems), and finally the food system in its entirety (Francis et al., 2008; Wezel et al., 2009). Agroecology as a field brought a virtual explosion of research about sustainable concerns and methods, such as the diversification of cropping systems, nature mimicry for productivity and conservation of nutrients, and integrated pest management (IPM) with even the inclusion of Indigenous knowledge systems (Rosset and Altieri, 2017). The 1970s saw a "gradual shifting toward an ecosystem approach to agriculture, with an enormous expansion of agroeconomic literature with an agroecological perspective" (Rosset and Altieri, 2017: 43). During this second period of agroecology (Wezel et al., 2009), the work by the well-known agroecologists Miguel A. Altieri, a Chilean born entomologist, and Stephen R. Gliessman, a plant ecologist, stands out for its contribution to the field. Gliessman worked in the Mexican fields in the 1970s, where he combined observation, practice, and integrated cultural particularities to conclude that agroecosystems should mirror the functioning of local ecosystems. This explosion of research and practices in agroecology came as a direct response to the promises and failures of the Green Revolution in the 1960s and 1970s (Rosset and Altieri, 2017) to create a transformative countermovement with reformist and radical ideas for food sovereignty and ecological restoration (Holt-Gimenez and Altieri, 2013).

The first formal academic program in agroecology was established at the University of California, Santa Cruz in 1982, backing the already flourishing agroecological approach with education and research (Gliessman, 2015a). The consolidation as an academic discipline represented a game-changer in the agroecological landscape with textbooks (e.g., Altieri, 1995a;

Gliessman, 1998) and field and laboratory manuals (Gliessman, 2015a). Research over the following decades further developed the field of agroecology with systems science. Academics also explored how agroecological concepts could be integrated to transform mainstream curricula of, for example, agronomy and other biological sciences (Francis et al., 2008).

Although the term 'agroecology' remained vaguely defined in the 2000s, publications escalated significantly with different definitions, methodologies, and management principles for evaluating sustainability in agroecosystems. Since 2015, more than 20 international and regional symposia have taken place in different world regions, promoting new legal frameworks and policies, and innovative approaches to agriculture (Wezel and Soldat, 2009; Wezel et al., 2009; Gliessman, 2015a). Agroecology became a field of study that is no longer only about the practices of the farmer, the farm system, and the processes involved in the production of crops. According to Gliessman (2018a), it now includes everyone who eats via networks of relationship-based markets, alternatives to the social, political, and economic power systems, and innovative agricultural practices. Thus, the definition of agroecology was further expanded to include the "ecology of the food system" (Francis et al., 2003).

Agroecology as a discipline progressed even more alongside systems science, specifically complex socioecological systems incorporating even further the social organization domain to recognize the "appreciative system" (Vickers 1983) and "organized use of rational thought" (Checkland, 1985) of farmers and their communities (as I explain later). Thus, an encompassing discipline like agroecology became more than a science and practice; its definition evolved to recognize the fact that behind agroecology rests a strong social (political, cultural, and economic) component (Wezel et al., 2009; Rivera-Ferre, 2018; Dumont et al., 2006). Most recently, Méndez et al. (2013, 2016) suggested that agroecology, in addition to being grounded in ecological thinking, is also a transdisciplinary, participatory, action-oriented discipline. Accordingly, Gliessman (2018a: 599) defines agroecology a "the integration of research, education, action and change that brings sustainability to all parts of the food system: ecological, economic, and social."

From the early definition focused on the specific use of ecological methods on the farm field for commercial crop plants and soil health in the 20th century to more holistic definitions in the 21st century that incorporated different disciplines and domains, agroecology embraces the

application of the concept of sustainability in the agri-food system, specifically the acknowledgment and integration of the social sphere, with its complex manifestations (e.g., culture, politics, economics), which has direct influence in the agri-food systems, locally, nationally, and internationally. This more comprehensive definition reflects better the evolution of the discipline as a systems science that deals with the complexity of agroecosystems within specific contextualized socioecological systems. The following table (Table 2.1) summarizes some key examples of the evolving definitions of agroecology.[4]

Authors	Agroecology Definitions
Bensin, B.M. (1930) in Wezel et al. (2009: 2).	Agroecology is "the use of ecological methods in research on commercial crop plants."
Altieri (1987), Gliessman (1990) in Méndez et al. (2013: 4)	"Agroecology is applying ecological concepts and principles to the design of sustainable agricultural systems."
Hecht (1995: 4)	"The term agroecology has come to mean many things. Loosely defined, agroecology often incorporates ideas about a more environmentally and socially sensitive approach to agriculture, one that focuses not only on production, but also on the ecological sustainability of the production system. This might be called the "normative" or "prescriptive' use of the term agroecology, because it implies a number of features about society and production that go well beyond the limits of the agricultural field."
Francis et al. (2003: 114)	"Agroecology is the study of the whole food system, embracing both natural and social sciences, and emphasizing systems thinking and ecological principles."
Wezel et al. (2009:1)	Agroecology today means "either a scientific discipline, agricultural practice, or political or social movement."
Méndez, et al. (2013 :6; 2016, 2010). See also Francis et al. (2003, 2008); Wezel et al. (2009).	Agroecology "integrates transdisciplinary, participatory, and action-oriented approaches" with "firm roots in the sciences of ecology and agronomy" and is "critically engaged with sociopolitical and economic issues that impact agro-food systems."
International Forum for Agroecology, Nyéléni, 2015: 4)	"Agroecology is a way of life and the language of Nature, that we learn as her children. It is not a mere set of technologies or production practices. It cannot be implemented the same way in all territories. Rather it is based on principles that, while they may be similar across the diversity of our territories, can and are practiced in many different ways, with each sector contributing their own colors of their local reality and culture, while always respecting Mother Earth and our common, shared values."
Gliessman, 2018a: 599)	"Agroecology is the integration of research, education, action and change that brings sustainability to all parts of the food system: ecological, economic, and social. It's transdisciplinary in that it values all forms of knowledge and

[4] Other scholars, government agencies, and international and non-profit organizations around the globe have provided definitions, but these are key examples inclusive of other definitions. The Agroecology Info Pool webpage by Biovision provides a list of definitions to explore, including those by the Food and Agricultural Organization (FAO) and the U.S. Department of Agriculture.

	experience in food system change. It's participatory in that it requires the involvement of all stakeholders from the farm to the table and everyone in between. And it is action-oriented because it confronts the economic and political power structures of the current industrial food system with alternative social structures and policy action. The approach is grounded in ecological thinking where a holistic, systems-level understanding of food system sustainability is required.

Table 2.1: Evolution of Agroecology Definitions

Agroecology: "An Epistemological Revolution"

Since agroecology does not agree with the universal and conventional assumptions of modern industrialized agriculture, it calls for a reformulation of the epistemological foundation of what and how we know about agriculture in order to set baseline agroecological principles. Since agroecology promotes a participatory action-oriented approach (Méndez et al., 2013, 2016) with different actors, it also emphasizes contextual and systems thinking (more on this point later). Thus, agroecology evades any specific epistemological paradigm because it resists any universalization (Bell and Bellon, 2018). As Bell and Bellon (2018: 609) explain, agroecology relies simultaneously on two ontological insights: "the same is always the different, at least a little bit" and yet the "different is never the different, at least absolutely." "The same is always the different" because agroecologists do not take the particular experience of a case and assume that it can be replicated across-the board in other cases. In other words, agroecologists do "not confuse the box with the contents -nor the field with the crops, the farm with the region, the region with the world" (Bell and Bellon, 2018: 609). At the same time, "the different is never the different" because with the use of common key principles agroecologists can share the experience of a particular case in "time and space" with other cases with different times and places. Different "contexts are not islands" either (Bell and Bellon, 2018: 609). In other words, to some degree different experiences in agroecology can be sorted and compared for the purposes of learning, and for contextualizing general principles based on fundamental values and specific experiences for the co-creation of knowledge (Bell and Bellon, 2018). Therefore, the most recent incorporation of the participatory as well as the transdisciplinary aspects in the definition of agroecology shows that agroecology is contributing significantly to the recognition and

importance of plurality in realities and knowledges, thus helping to gradually change conventional hegemonic and reductionistic paradigms.

Consequently, agroecology is making a profound epistemological leap that changes the way of doing science. Victor Toledo, a Mexican ethnoecologist, in an interview with Diana Quiroz (2016) called that "an epistemological revolution." Toledo explained that this revolution was possible through the "*diálogo de saberes*" or "dialogue of knowledges" which has to do with "the decolonization of the mind,'' a major shift from scientists' attitude of supremacy and arrogance, where they think they know it all to an attitude of humility that accepts that science is not the only way to know the world (Quiroz, 2016). The same leap is recognized by Bell and Bellon (2018), and Ostergaard et al. (2010:23) who advocate for "phenomenon-based education" in agroecology to "bridge two learning communities: the university environment, where most traditional education takes place, and that of the stakeholder groups in farming and food systems."

Such dialogues of knowledge are happening today all over the world, but Victor Toledo (in Quiroz, 2016) drew attention to the "epistemology of the South," especially Mexico, where modernity works hand in hand with tradition to create advanced systems of food production. Toledo also mentioned a Ph.D. program in the Andean region developed for farmers and through farmers, and many of the graduates are farmers themselves. Farmers contribute to the development of a new scientific paradigm, where traditional knowledge is no longer a mere object of study but a triggering force that brings together the movement, practice, and science in an honest and fruitful dialogue of different transdisciplinary and local knowledges (Quiroz, 2016; Wezel et al., 2009). Therefore, agroecology "is based on a plural epistemology, and thus we should not waste too much energy seeking homogeneity" (Ferguson et al., 2019: 722). Agroecology represents an "epistemological revolution" (Toledo in Quiroz, 2016) that challenges the theory of knowledge as we know it due to its transdisciplinarity and the inclusion of different knowledge systems through respectful horizontal dialogues (Ferguson, 2019).

Agroecology in the Americas

In North America, agroecology is firmly established as a science. Advancements in ecology and sustainability from the 1980s influenced the development of agroecology in the scientific realm. In the United States, where my research is located, academic institutions have pioneered scientific research in agroecology, yet they did not manage to intentionally connect scientific advancements with social movements until recently (Chappell et al., 2019). Eventually, agroecology programs in higher education benefited from the emerging socio-political advocacy work of activists in the United States and around the world and institutionalized the countermovement concerns. Yet, there was an evident divorce between theory and practice, and few organizations used the term 'agroecology' when describing their work, even when following known agroecological principles and practices (Fernández et al., 2013). The creation of the Agroecology Action-Research Collective (ARC) in the 2016 among academic and civil society which advocates for agroecology in the U.S., Canada, and Mexico (ARC, 2021), made this connection possible, but this was just the beginning. Scholars urged a broader coalition between grassroots allies and supportive scholars to push for a more integrative and innovative agenda (Chappell et al., 2019). Fernández et al., (2013) identified four paths within the United States' agri-food sector that could yield a stronger connection: Food Policy Councils (FPCs), the food sovereignty concept, urban food movements, and the 're-agrarization' of the rural landscape. Since then, the United States has taken essential steps to involve stakeholders from each area of the food system to make food production more environmentally sustainable, to create partnerships between agroecologists and local actors, and to improve policies for the benefit of all. Still, there is much work to be done (Fernández et al., 2013).

By far, Latin America leads the way in agroecology, having the most prominent academic production, social movements, advocacy work, and communities of practice, compared to the agroecology endeavors in North America. Not only that, but Latin America is "qualitatively more political, more social, more cultural, and more driven by grassroots social movements" turning this part of the globe into the epitome of agroecology (Rosset et al., 2021). To put it simply, the identity of Latin American agroecology has been most directly shaped by the socio-political movement against the Green Revolution promoters and the hegemony of the agri-food industrial

conglomerates. Agroecologists in Latin America started to fight back against the promises of the Green Revolution, specifically to stop the "cooptation, subordination, and revisionist projects" that were trying to erase the region's "history and strip it of its political meaning" (Altieri and Holt-Gimenez, 2016:4). For example, in Mexico, agroecologists used traditional Mexican agriculture, coupled with the Indigenous knowledge about the natural mechanisms of food production, to enhance complex and localized farming systems. The aim was to help peasant farmers create a sustainable environment while meeting their own subsistence needs through polycultures (Val et al., 2019). Agroecologists recognized that mimicking the natural models and the resourceful self-reliance of traditional Indigenous farmers was the best way to enhance diversity, integration, and the lifestyle of smallholders in the so-called developing nations (Altieri and Toledo, 2011).

The mobilization of rural communities through the *campesino a campesino* (farmer-to-farmer) movement, first in Mexico and later throughout Latin America, was the cornerstone of agroecological development in the Global South. Hundreds of agroecological programs promoted by NGOs spread across rural Latin America and proved profitable for production, return rates, income, and livelihood of small farmers. Besides, these agroecological initiatives ensured enhanced biodiversity, soil protection, and conservation (Altieri and Nicholls, 2017) while also encouraging a militant approach for peasants to resist the advancement of industrial agriculture. The organized agrarian movement, *La Via Campesina*, focus on farmers' autonomy, local markets, and community agency as a counterbalance to neoliberal policies and the industrial-agricultural model (Altieri and Nicholls, 2017). The political dimension of this movement forced agroecology out of the academic ivory tower down into the streets, where it became a strategic ideology, consolidating agrarian social advocacy. It turned into a more politicized and ideological movement that invited alternative practices, in a participatory manner with other actors such as NGOs, researchers, private companies and governmental agencies (Rosset and Martinez-Torres, 2012).

The 1980s represented a significant milestone in the emphasis of the ecological approach to agriculture in Latin America. In 1982, Altieri published the Spanish version of his book *Agroecology: The Scientific Basis of Alternative Agriculture* -- which sparked the interest of

agronomists and ecologists. Other books followed suit throughout the 1980s and reinforced the newly emerging discipline, particularly in Mexico. New courses were developed to train young university professors, who later developed ongoing research programs and launched academic initiatives in other surrounding countries. The creation of the Latin American Scientific Society of Agroecology (SOCLA) in 2007 consolidated the academic endeavors by implementing doctoral agroecology programs and regional research programs (Altieri and Nicholls, 2017).

Five geographical areas in Latin America and the Caribbean experienced a genuine revolution in agroecological endeavors by actively implementing technological, cognitive, and social innovations (Altieri and Toledo, 2011). In Brazil, the agroecological advances focused on stopping the enormous agrarian injustices of the Green Revolution, educating farmers, training a new generation of agroecologists, and then placing them into key positions across the state and federal government. The collapse of the Soviet Union and the United States trade embargo forced Cuba to turn inward to self-reliance for food production – which led to more training and research organizations working with family farmers in the *campesino a campesino* movement to significantly impact the agrarian society. The implementation of agroecological strategies helped Cuba reach the highest productivity, sustainability, and efficiency in the region (McCune and Sánchez, 2019). Altieri and Toledo (2011) claimed that *campesino a campesino* started as a knowledge exchange between the Guatemalan and Mexican farmers and quickly expanded across Nicaragua, Honduras, and Guatemala. This geographical area then saw an explosion of agroecological reforms. The so-called 'peasant pedagogy' or *promotor campesino* worked as a disseminator of agroecological knowledge and farming practices in the absence of researchers or third parties. Also, the method of learning-by-doing (i.e., hands-on experience rather than classrooms) yielded successful outcomes among farmers (McCune and Sánchez, 2019). In the Andean region of Peru, Ecuador, and Bolivia, rural movements coupled with an influential group of researchers and activists led to the re-creation of peasant agriculture through a successful mixture of traditional practices and scientific discoveries of agroecology. Cooperative work among farmers, NGOs, and local agencies restored abandoned ancient terraces, extended the growing season, and implemented sustainable practices, among other benefits (Altieri and Toledo, 2011). Probably the most potent agroecological reform took place in Mexico. The

dismantling of large *latifundia* or *haciendas* (large land estates) at the beginning of the 20th century was a crucial factor of reform, and so was the re-establishment and recognition of old Indigenous communities and communal access to land and resources. A series of initiatives led to the restoration of degraded lands (reforestation, crop diversification, etc.), conservation of agrobiodiversity, and ecological production. As the fifth largest producer of coffee in the world and the lead producer of certified organic coffee, Mexico boasts nowadays a complex net of small farmers, cooperatives, and agroecological strategies that helped to make that reform possible (Altieri and Toledo, 2011).

Agroecologists agree that Latin America represents a unique case and a role model in the rapid development of agroecology. The synergistic relationship between traditional agricultures, Indigenous communities and their ontologies laid the basis for unprecedented historical development. Moreover, the identity of agroecology was openly articulated into socio-political countermovements that militated for farmers' autonomy and agency over land, crops, and alternative cultivation methods, and the preservation of traditional ways of life. The countermovement in Latin America has persevered through these grassroots initiatives, farmers' training in agroecology, and constant dialogue between scholars and farmers about their shared experiences (Rosset et al., 2021).

Conclusively, no matter how much the field of agroecology has advanced in the last decades, there is still a powerful ideological sector that keeps pushing for an industrialized globalized agriculture. The current challenge for agroecologists is to keep developing the discipline as a multidimensional, transdisciplinary, and participatory endeavor. This multidimensional, transdisciplinary, and participatory approach is one that equally involves the discussion and negotiation different knowledge systems- such as academic, experiential, and Indigenous- and helps to solve problem-focused cases. A participatory method brings together research and agricultural action with producers to directly benefit farming and rural communities (Méndez et al., 2013, 2016; Méndez, 2010). Embracing this collaborative approach of different knowledge systems in the study and practice of agroecology provides an effective path for scaling-up and scaling-out agroecology as a science, movement, and practice (Gliessman, 2018b; Wezel et al., 2009; Méndez et al., 2013; Altieri and Nicholl, 2008). Notwithstanding, scaling in

agroecology does not relate to a "single big endeavor, but a multiple of contextualized, articulated agroecologies" that "reinforces autonomy, biocultural diversity, spirituality, and conviviality", and challenges the hegemonic forces of "capitalism, colonialism, standardization, industrialization, patriarchy, and other forms of injustice" (Ferguson et al., 2019: 723).

The Principles of Agroecology

"Agroecology is defined by principles" (Tittonell et al. 2020: 13) -in other words, it is "an applied discipline based on principles" (Patton, 2018: 276). There is consensus among agroecologists that the discipline of agroecology developed throughout the years around a set of principles, based on key fundamental values, resulting from the cumulative experience of knowledgeable Indigenous farmers, activists, and scholars concerned with advancing ecologically sustainable farming and just food systems (Wezel et al., 2009, 2020; Barrios et al., 2020; Gliessman, 2018a; Méndez, 2010; Francis et al. 2003).

In terms of practice, principles provide guidance and are especially important when dealing with complex agri-food systems and their intricate close-knit networks of economic, ecological, social, and political affairs within different contextualized scenarios. Bell and Bellon (2018: 605) reinforce Tittonell et al. and Patton's claim above about the importance of principles in agroecology when they succinctly posit that "agroecological theory focuses on the consequences of *context*." Agroecologists need to have a "contextual thinking," which goes a step further from thinking in terms of connections (i.e., system thinking). Principles have "general relevance but not universal outcomes," thus the use of principles in agroecology facilitates contextualization for "generalization without universalization" (Bell and Bellon, 2018: 609, 608). As Patton (2018, p. ix) emphasized "principles guide adaptation." Thereupon, the value of using the principles of agroecology is to move forward a global countermovement based on sustainable and just agroecological transformations in different scenarios including complex urban ones. Using agroecological principles for "agroecological urbanism," Tornaghi and Dehaena (2021):

> "provide and effective framework to capture the multiple ecological, social, economic and political dimensions of urban farming, beyond yield, and profits, enabling those seeking

> transformative food systems change in the U.S. a common language and opportunity to measure and communicate more clearly the multiple benefits worthy of public investment" (Bowen Siegner et al. 2019: 22).

Since the discipline has been evolving as a "multiple of contextualized, articulated agroecologies" (Ferguson et al., 2019: 723), there are also different proposed principles from different scholars and practitioners around the world, corresponding to the epistemological plurality of the discipline. Table 2.2 shows a selection of various known and key sets of principles based on an initial comprehensive exploration and compilation of proposed principles found in literature (see Appendix 2). Some of these principles focus on guiding the ecological domain of agroecology i.e., looking at the farm as a potential sustainable agroecosystem (Altieri and Nicholls, 2005; Nicholls et al., 2016, 2020, among others) while others focus on the social and economic domains or socio-cultural and political domains, such as inclusion and empowerment of women and youth (e.g., Dumont et al., 2016; CIDSE, 2018; International Forum for Agroecology, Nyéléni, 2015; Petersen, et al., 2020).

The most radical and politically oriented set of principles are those proposed by the International Forum for Agroecology, Nyéléni (2015). The Forum was mostly attended by social movement groups from around the world like, for example, *La Via Campesina*, and the principles are focused on "the voices and priorities of marginalized food producers" that are struggling for food sovereignty (Anderson et al., 2021: 16). Few proposals also offer principles that highlight the importance of contextualization and methodological approaches for agroecological transition and participatory processes (e.g., Bell and Bellon, 2018; Kapgen and Roudart, 2020). Nevertheless, most proposals cover multiple domains, revealing the systems thinking approach and transdisciplinarity of agroecology. Given this plurality of principles, I chose three sets of agroecological principles particularly important to highlight for my research: the scientifically accepted ecological principles for transitioning and managing agroecosystems; the so-called elements of agroecology promoted by the United Nations Food and Agriculture Organization

		Sustainability Principles				Additional/Specific Principles			
Proponents	**Total principles/ subprinciples**	**Ecological**	**Economic**	**Political**	**Socio- cultural, Spiritual, Educational**	**Women empowerment**	**Youth inclusion**	**Contextual**	**Methodological**
ALC -UVM,[1] CASFS-UC, Santa Cruz,[2] CAN[3] in Patton (2018)[4]	**11/21**	●	●	●	●				
Altieri (1996…+),[5] Reijntje et al. (1992), SOCLA,[6] TWN[7]	**6**	●							
Bell & Bellon (2018)	**9**	●			●			●	
CIDSE (2018)[8]	**15**	●	●	●	●	●	●		
Dumont et al. (2016)	**13**		●	●	●				
FAO's Agroecology Knowledge Hub	**10**	●	●	●	●			●	
Gliessman (2015)	**12**	●			●				
Intl. Forum for Agroecology (IFA), Nyéléni (2015)	**11**	●	●	●	●	●	●		
INKOTA (2019)[9]	**10**	●	●	●	●				●
Kapgen & Roudart (2020)	**21**	●	●	●	●				●
Lume/ Petersen, et al. (2020), CAWR[10]	**5/34**	●	●	●	●	●	●		
Scarborough, Méndez & Bisson (2014)	**10**	●	●	●	●				
Stassart et al. (2012)	**13**	●	●	●	●				●
Tittonell (2015)	**5**	●							
Toledo (2012)	**10**	●	●	●	●				
Shiva (2016)	**9**	●	●	●	●	●			
Wezel et al. (2020)	**13**	●	●	●	●				

[1] Agroecology and Livelihoods Collaborative (Co-Directors, Ernesto Méndez and Martha Caswell,) University of Vermont, Burlington, VT
[2] Center for Agroecology and Sustainable Food Systems (founded by Stephen Gliessman), University of California, Santa Cruz, CA
[3] Community Agroecology Network (Stephen Gliessman, Chairman of the Board, and Roseann Cohen, Executive Director)
[4] As referenced in Michael Patton's book *Principles-focused Evaluation* (2018: 280), Chapter 30, "Principles defining the emergent field of agroecology: how principles inform and GUIDE practices."
[5] Miguel A. Altieri and Clara I. Nicholls, UC Berkeley, Berkeley, CA. Principles appear in many of their publications (with some variations).
[6] Sociedad Científica Latinoamericana de Agroecología
[7] Third World Network
[8] Coopération Internationale pour le Développement et la Solidarité
[9] INformation, KOordination, TAgungen (German)
[10] Center for Agroecology, Water and Resilience, Coventry University, U.K. (Michael Pimbert, Executive Director)

Table 2.2: Principles of Agroecology

(FAO), and the 15 principles of agroecology proposed by the international non-for-profit organization *Coopération Internationale pour le Développement et la Solidarité* (CIDSE).[5]

The **ecological principles** guiding sustainable and resilient farming systems are considered the heart of agroecology. Altieri (1995b; 2000, 2017) and Nicholls et al. (2016, 2020) have distilled six basics ecological principles (often repeated in other sets of principles) for the design of sustainable agroecosystem (Nicholls et al. 2020: 31):

1. "Enhance the recycling of biomass, with a view to optimizing organic matter decomposition and nutrient cycling over time;
2. Strengthen the 'immune system' of agricultural systems through enhancement of functional biodiversity – natural enemies, antagonists, etc., by creating appropriate habitats;
3. Provide the most favorable soil conditions for plant growth, particularly by managing organic matter and by enhancing soil biological activity;
4. Minimize losses of energy, water, nutrients, and genetic resources by enhancing conservation and regeneration of soil and water resources and agrobiodiversity;
5. Diversify species and genetic resources in the agroecosystem over time and space at the field and landscape level;
6. Enhance beneficial biological interactions and synergies among the components of agrobiodiversity, thereby promoting key ecological processes and services."

The **United Nations Food and Agriculture Organization** (FAO, 2018: 3-12) proposes 10 'elements' of agroecology covering the environmental, economic, socioeconomic and socio-political domains:

1. "Diversity: diversification is key to agroecological transitions to ensure food security and nutrition while conserving, protecting, and enhancing natural resources;
2. Co-creation and sharing knowledge: agricultural innovations respond better to local challenges when they are co-created through participatory processes;
3. Synergies: building synergies enhances key functions across food systems, supporting production and multiple ecosystem services;
4. Efficiency: innovative agroecological practices produce more using fewer external resources;

[5] CIDSE (n.d.) is "an international family of Catholic social justice organizations working for transformational change to end poverty and inequalities, challenging systemic injustice, inequity, destruction of nature and promoting just and environmentally sustainable alternatives."

5. Recycling: more recycling means agricultural production with lower economic and environmental costs;
6. Resilience: enhanced resilience of people, communities and ecosystems is key to sustainable food and agricultural systems;
7. Human and social value: protecting and improving rural livelihoods, equity and social well-being is essential for sustainable food and agricultural systems;
8. Culture and food tradition: by supporting healthy, diversified and culturally appropriate diets, agroecology contributes to food security and nutrition while maintaining the health of ecosystems;
9. Responsible governance: sustainable food and agriculture require responsible and effective governance mechanisms at different scales – from local to national to global;
10. Circular and solidarity economy: reconnect producers and consumers to provide innovative solutions for living within our planetary boundaries while ensuring the social foundation for inclusive and sustainable development."

FAO's elements of agroecology emerged from the First FAO International Symposium on Agroecology for Food Security and Nutrition in 2014. The symposium also saw the creation of FAO's Agroecology Knowledge Hub to collect and disseminate information on agroecology (FAO 2015). Between 2015 and 2019, the Hub's multidisciplinary team led an extensive consultation process with multi-stakeholders and experts on agroecology from around the world along with the review of published work. Because of the inherent epistemological plurality and contextual thinking (Bell and Bellon, 2018) that characterizes the field, FAO decided to structure their work around a broad set of 'elements'. The objective of this framework based on 'elements' was to easily communicate in different languages the essential components, interactions, emergent properties, and the enabling environment that facilitate the process of agroecological transitions in different contexts. After FAO's governing bodies reviewed and revised the proposal recommending '10 Elements of Agroecology', the proposal was officially approved by FAO in 2019 (FAO, 2019). The elements selected align with FAO's Common Vision for Sustainable Food and Agriculture (FAO, 2014). According to Barrios et al. (2020: 233), the FAO multi-stakeholder process confirms that:

> "[T]here is no unique definition and no single way to apply agroecology. Agroecological transitions, therefore, should be designed in an inclusive manner that embodies the local contexts and constraints. The 10 Elements help to frame agroecology in an

> inclusive way, without privileging one definition, stakeholder group, or region, and they provide a structure for other entities contributing to advancing the uptake of agroecology."

There is some criticism around the FAO elements of agroecology because they do not address the political issues the same way the principles proposed by NGOs and social movements do. From the perspective of the countermovement's activists, the reason is that an international organization is constrained in their political stance. Historically, FAO has backed green revolution approaches and methods by agro-industrial conglomerates. Thus, as I will explain in the next section, activities have legitimate concern for the co-option of agroecology for 'nature-positive' technical fixes without questioning the issue of the elite actors' power in governance versus the agency of food producers (Altieri and Holt-Giménez, 2016; Giraldo and Rosset, 2018; Wezel et al., 2018; Held, 2021; Anderson, et al. 2021).

The CIDSE principles were chosen as the framework for my qualitative research with a participatory action research (PAR) approach that involved actors of the farming community as co-investigators in the process (see Methodology chapter). CIDSE (2018) proposes 15 principles, and Table 2.3 provides a succinct description of these principles in comparison to FAO's elements (FAO, 2018) and Nicholls et al. (2020) ecological principles, showing "the wholeness, interconnectedness and interdependence of agroecology" (Barrios et al., 2020: 232).

CIDSE's principles are comprehensive and robust enough to use as framework for an assessment of agroecology's multidimensional practices. The NGO had a special task force on agroecology that worked for a whole year, back in 2017, on distilling the principles in consultation and dialogue with their network of charitable, social, and environmental justice organizations in Europe, Mesoamerica and South America. They wanted to "clarify what agroecology is and what is not in order to gather political support, for the discipline to flourish, to avoid co-option and fight against false solutions, etc." (CIDSE, 2018: 3). CIDSE divided their 15 principles into four domains or dimensions of sustainability: economic, political, environmental, and socio-cultural - to "capture the complexity and multi-dimensional aspect of agroecology" (CIDSE, 2018: 3). Besides, CIDSE's principles and dimensions are the result of the appraisal of previous work done by recognized advocacy organizations, practitioners, and scholars that embrace or are part of the agroecological movement around the world, as can be gleaned in their publication *The Principles*

of Agroecology: Towards Just, Resilient and Sustainable Food Systems (CIDSE, 2018). Some important examples used by CIDSE's task force include the Declaration of the International Forum of Agroecology in Nyéléni, Mali, representing the worldwide grassroots countermovement of the small-scale food producers (e.g., *La Via Campesina*); the Latin American Scientific Society for Agroecology (SOCLA, for its acronym in Spanish); and key publications from recognized agroecologists such as Miguel Altieri (2000) and Michael Pimbert (2015). They also appraised and considered FAO's 10 elements of agroecology. Ergo, CIDSE's proposed set of principles provide a trusted framework to guide my principles-focused study.

CIDSE's Principles (2018)		**FAO's Elements (2018)**	**Nicholls et al. (2020) Ecological Principles**
Economic dimension			
1	**Promotes fair, short, distribution webs, producers and consumers working together.** Promotes fair, short local/regional distribution networks rather than international/global linear distribution chains of the prevalent economy and builds a transparent network of relationships (often invisible in prevalent economy) between producers and consumers.	Circular and solidarity economy, resilience	
2	**Increases resilience through diversification of farm incomes and strengthen community autonomy.** Promotes diversification of on-farm incomes giving farmers greater financial independence, increases resilience by multiplying sources of production and livelihood, promoting independence from external inputs, and reducing crop failure through its diversified system. Reduces dependence on aid and increases community autonomy by encouraging sustainable livelihoods and dignity. Primarily helps provide livelihoods for peasant families and contributes to making local markets, economies, and employment more robust.	Diversity, circular and solidarity economy, resilience	
3	**Aims to enhance the power of local markets and build on a social and solidarity economy vision.** Harnesses the power of local markets by enabling food producers to sell their produce at fair prices and respond actively to local market demand. Is built on a vision of a social and solidarity economy.	Circular and solidarity economy, resilience	
Political dimension			
4	**Aims to put control of seeds, land and territories in the hands of people.** Puts control of seed, biodiversity, land and territories, water, knowledge, and the commons into the hands of the people who are part of the food system and so achieves better integrated and participatory resource management.	Responsible governance	

5	**Encourages new forms of decentralized, collective, participatory governance of food systems.** Encourages forms of social organization needed for decentralized governance and local adaptive management of food and agricultural systems. It also incentivizes the self-organization and collective management of groups and networks at different levels, from local to global (farmers organizations, consumers, research organizations, academic institutions, etc.). Prioritizes the needs and interests of small-scale food producers who supply the majority of the world's food, and it de-emphasizes the interests of large industrial food and agricultural systems.	Responsible governance	
6	**Requires supportive public policies and investments.** Requires a set of supportive, complementary public policies, supportive policymakers and institutions, and public investment to achieve its full potential.	Responsible governance	
7	**Encourages stronger participation of food producers/consumers in decision making.** Can change power relationships by encouraging greater participation of food producers and consumers in decision-making on food systems and offers new governance structures. Does not necessarily require expensive external certification as it often relies on producer-consumer relations and transactions based on trust, promoting alternatives to certification such as PGS (Participatory Guarantee System) and CSA (Community-Supported Agriculture).	Co-creation and sharing of knowledge, responsible governance, circular and solidarity economy	
Environmental dimension			
8	**Supports resilience and adaptation to climate change.** Supports climate adaptation and resilience while contributing to greenhouse gas emission mitigation (reduction and sequestration) through lower use of fossil fuels and higher carbon sequestration in soils.	Resilience	1. Enhance the recycling of biomass, with a view to optimizing organic matter decomposition and nutrient cycling over time 2. Strengthen the 'immune system' of agricultural systems through enhancement of functional biodiversity – natural enemies, antagonists, etc., by creating appropriate habitats 3. Provide the most favorable soil conditions for plant growth, particularly by managing organic matter and by enhancing soil biological activity 4. Minimize losses of energy, water, nutrients, and genetic resources
9	**Nourishes biodiversity and soils.** Optimizes and maintains biodiversity above and below ground (a wide range of species and varieties, genetic resources, locally adapted varieties/breeds, etc.) over time and space (at plot, farm, and landscape level). Builds and conserves life in the soil to provide favorable conditions for plant growth.	Diversity, recycling, synergies, resilience	
10	**Eliminates use of and dependence on agroecosystems.** Eliminates the use of and dependency on external synthetic inputs by enabling farmers to control pests, weeds and improve fertility through ecological management.	Synergies, recycling, efficiency, resilience	

11	**Enhances integration of various elements of agroecosystems (plants, animals…).** Enhances positive interaction, synergy, integration, and complementarities between the elements of agroecosystems (plants, animals, trees, soil, water, etc.) and food systems (water, renewable energy, and the connections of re-localized food chains). Optimizes and closes resource loops (nutrients, biomass) by recycling existing nutrients and biomass in farming and food systems.	Synergies, diversity, efficiency, resilience	by enhancing conservation and regeneration of soil and water resources and agrobiodiversity 5. Diversify species and genetic resources in the agroecosystem over time and space at the field and landscape level 6. Enhance beneficial biological interactions and synergies among the components of agrobiodiversity, thereby promoting key ecological processes and services
Socio-Cultural dimension			
12	**Promotes farmer-to-farmers exchanges for sharing knowledge.** Is knowledge-intensive and promotes horizontal (farmer-to-farmer) contacts for sharing of knowledge, skills, and innovations, together with alliances giving equal weight to the knowledge of farmer and researchers/scholars.	Co-creation and sharing of knowledge	
13	**Strengthen food producers, local communities, culture, knowledge, spirituality.** Is rooted in the culture, identity, tradition, innovation, and knowledge of local communities; supports peoples and communities in maintaining their spiritual and material relationship with their land and environment.	Human and social values, culture and food tradition	
14	**Promotes healthy diets and livelihoods.** Contributes to healthy, diversified, seasonally- and culturally appropriate diets.	Human and social values, culture and food traditions	
15	**Encourages diversity and solidarity among peoples, encourages women and youth empowerment.** Creates opportunities for and promotion of solidarity and discussion between and among culturally diverse peoples (e.g., different ethnic groups that share the same values yet have different practices), and between rural and urban populations. Respects diversity between people in terms of gender, race, sexual orientation, and religion, creates opportunities for racialized people, young people, and women; encourages women's leadership and gender equality.	Human and social values, diversity	

Table 2.3: Comparative Principles

CIDSE (2018), FAO (2018) and Nicholls et al. (2020**)**

Critique of Agroecology

Over the past few decades since agroecology gained momentum, more voices concerned with the issue of hunger raised the question whether sustainable agriculture can meet the challenge of feeding the world (Moore, 2016; Adidja, 2019; Arroyo, 2018). Recent research showed that there were roughly 500 million food-insecure and deprived households around the world in 2010 and the developing countries were still struggling to implement new food security policies to address this problem (Vanloqueren, 2011). On the other hand, the world population is expected to reach 8 billion people around 2025, yet the cultivable land remains the same while declining in fertility and healthy nutrients because it has been decimated by pesticides and herbicides and non-sustainable agricultural techniques (Food First, n.d.). Moore (2016) added salinization of irrigated areas, water waste, increasing pest resistance and climate change to this recipe for disaster. Besides, the public investment in agriculture has shrunk, the political commitment has dwindled, and the divorce between the public and private sector has deepened the problem as well (Arroyo, 2018). Under these circumstances, the capacity of agroecology to solve world hunger is legitimate.

Lynas (2020), one of the critics of agroecology, claims that agroecology in many African regions may be trapping farmers in poverty and food insecurity. Not only does agroecology have no benefits for most poor farmers, but it also lures them to give more to the soil than what they get in exchange, becoming even more poverty-ridden than before. Therefore, agroecology may not fit smallholder farmers' need to overcome low crop productivity and food insecurity (Corbeels et al., 2020; Lynas, 2020). Critics also state that agroecology does not offer farmers an appealing alternative to what they already got from the Green Revolution (high yielding seeds, chemical fertilizers, financial support for larger farms, etc.), since it cannot contribute to agricultural intensification. Also, claims about social justice and equality, women empowerment and other issues are not substantiated enough by research in agroecology in different contexts. But the most aggressive criticism is that agroecology is just another term for 'traditional farming' since it revives the traditional practices and stresses the importance of the cooperation between researchers and peasants (Mugwanya, 2019; Isgren and Tibasiima, 2019).

Adidja et al. (2019) provide a comprehensive study to respond to such criticism. The authors selected several major global assessments that reviewed hundreds of agroecological projects throughout the world and reported the yields, outcomes of food production, and food security. They concluded that evidence from different studies strongly supported the great contribution of agroecology in addressing the world hunger successfully. Moreover, agroecology addresses the root causes of hunger in the world as well because its holistic approach deals with inequality, increased poverty and malnutrition rates, while offering efficient solutions to the farming system by conserving biodiversity and natural resources, and increasing resilience to climate change (Adidja et al., 2019).

Another study by D'Annolfo et al. (2017) reviewed 17 papers on the economic performance of agroecology and found evidence that it contributes to improve financial capital of small farmers. The explanation for improved financial capital can be found in Pretty et al. (2003) study, which explored yields of small farms that applied sustainable practices and technologies. They examined 208 projects from 52 countries. They found that the yield increases of 50-100% were typically bigger for lower yields, meaning greater income for the poorest farmers. Therefore, the agroecology has a more comprehensive answer for the question about feeding the world. Farmers, peasants, and other smallholders around the world can set out the formidable journey to feed their own communities with organic, nourishing, healthy foods. In other words, each community should feed itself, not the entire world, because sustainable farming practices are different "across the diversity of our territories… with each sector contributing their own colors of their local reality and culture" (International Forum for Agroecology, Nyéléni, 2015). When this goal is attained, the problem of world hunger should be solved. Furthermore, the root causes for world hunger are not the same globally (Adidja et al., 2019), so each case needs a particular approach. Agroecology does not promote a one-fit-all solution; it encourages individualized approaches that are integrative, participatory, and action-oriented for each different socioecological system (Gliessman, 2018a; Méndez 2103, 2016).

Beside criticism, agroecology faces some major challenges. As mentioned before, many activists and scholars agree that the most important challenge for agroecology today is the attempt to co-opt the discipline through subversive discourses and the definitions (Altieri and

Holt-Giménez, 2016; Wezel et al., 2018; Giraldo and Rosset, 2018; Held, 2021; Anderson, et al. 2021). Over the years, agroecology has passed through an interesting repositioning. It went from being the Cinderella of agriculture, a movement ignored, ridiculed, and excluded by the powerful institutions at the helm of the world agriculture into a radically surprising presence. Most recently, some key power actors have started to see agroecology as an alternative approach to address the food crises generated by the Green Revolution and to revive the human trust in industrial agriculture (Rosset and Altieri, 2017). So, agroecology is standing today at a crossroads, where it has to choose between the path of smooth assimilation into the industrial agriculture or the difficult road of pressuring institutions, governments, research centers, and many others to accept what it stands for (Altieri and Holt-Giménez, 2016). The corporate food companies tried to redefine agroecology in a very narrow way, as a technological fix to sustainable food practices. That would allow an easy co-optation of agroecology into the mainstream industrial production of food, while the existing power structures of the agri-food industrial conglomerates would remain unchallenged (Altieri and Holt-Giménez, 2016; Wezel et al., 2018; Giraldo and Rosset, 2018; Held, 2021; Anderson, et al. 2021). This subversive method would also "fine-tune the industrial food system, while paying lip service to the environmental discourse" under the names of "climate-smart agriculture" or "sustainable" agriculture or "ecological-intensification" or even "organic" food produced with industrial monoculture, among other proposals (International Forum for Agroecology, Nyéléni, 2015: 4).

Notwithstanding, this appropriation of agroecology has been exposed as false, wrong, and dangerous Giraldo and Rosset (2018). The governments, private sectors, and other large actors, including the Food and Agriculture Organization (FAO), see agroecology as an opportunity to solve the food crisis and fine-tune the agenda of industrial agriculture. On the other hand, the social movements and grassroots initiatives see agroecology as an alternative to industrial agriculture that would transform the approach to agriculture (Giraldo and Rosset, 2018; Rosset and Altieri, 2017).

The second danger comes from using the narratives of multiple 'agroecologies,' in other words, more agricultural paradigms that claim to be an agroecological model (Wezel et al., 2018). Drawing upon cognitive theory, Sanford (2011: 283) claims that the dichotomy between

industrial agriculture and agroecology has been shaped by language. Industrial agriculture is contingent on a discourse of "mechanistic relationships" between the human agents and the passive land, while agroecology advances a narrative of "interdependence and reciprocity" that rejects the industrial formula. The multiplicity of narratives is also explored by Rivera-Ferre (2018) through a lexicometry analysis of policy documents from around the world. The author contends that the fragmentation of agroecology definition has facilitated more competing narratives. Some agents are focusing only on the science of it, others have turned agroecology into a political movement for everything modern agriculture encompasses, while others are even rejecting the science and the social aspect and have decided to focus only on the agricultural practices. The principles of agroecology show this range of interests.

The above challenges have been met by agroecologists with constant resistance against everything that would pervert or simplify the unique pluralistic trajectory of the discipline with its inclusion of diverse knowledges systems and transdisciplinary lens. Agroecology rejects despotic positivist regime of 'epistemological monism' by constructing egalitarian, contextualized, and complex system thinking alternatives for building communities of practice, science and sociopolitical action (Anderson et al., 2021; Gomez, Rios-Osorio and Eschenhagen, 2015).

Urbanizing Agroecology

Urban agroecology is of upmost importance for the 21st century as the world urban population already surpassed the rural population in 2008 (FAO, 2021). In what appears to be the first full publication focused exclusively on the topic of 'urban agroecology' by the Resource Center for Urban Agriculture and Forestry (RUAF) 2017 special issue of *Urban Agriculture (UA) Magazin*e, editors Hoekstra and Tornaghi (2017) explore the emerging topic and advances it theoretically for better understanding and possible policies. In the same magazine, Tornaghi (2017: 795-796) succinctly explain that:

> "A promising ground for reconnecting urban and agrarian food movements (and perhaps a conceptual foregrounding for a radical alternative urbanism), is the one emerging under the banner of 'urban agroecology'. Loosely defined, and yet largely under-

> theorised… urban agroecology is taking shape as a political praxis that foresees, debates and takes forward ideas and alliances for building productive ecosystems in the urban realm, and identifying forms of coexistence between urban functions, agroecosystems, human and non-human biotopes."

The evolution of agroecology as a discipline had so far been focused on rural agriculture and communities (e.g., peasant studies, rural politics and development). However, despite obvious differences between the rural and the urban, there are also fundamental commonalities in their needs and struggles. In addition to building community ties and promoting environmental restoration and stewardship, a common thread among groups promoting agroecology in urban settings and agroecological peasant movements is their explicit political and socioeconomic justice commitment. At its core, agroecology, as a countermovement, aims to mend the metabolic rift between land/nature and laborer. Therefore, urban agroecology could reinforce the politically driven food-growing initiatives for agroecological food systems within city-regions to mend the disruptive metabolic dichotomy of the rural/urban and embrace the natural continuum and intricacy of socioecological systems. The urban agroecological countermovement can enable an egalitarian transformation towards food security, justice and sovereignty in vulnerable urban and peri-urban areas (Vaaest et al., 2018; Giraldo and Rosset, 2018; Tornaghi, 2017; Tornaghi and Hoekstra, 2017a; Renting, 2017; Rodríguez Dueñas, 2017; Deh-Tor, 2017, 2021; Dahaene et al., 2016; Altieri and Holt-Giménez, 2016; McClintock, 2010; Wezel et al., 2009; Polanyi, 2001; Foster, 1999; Marx, 1999). The reciprocity of the agroecological and urban agricultural countermovements "may help create the *principles* and *dimensions* of an agroecological approach to productive systems, social subjects and urban territories" under the banner of urban agroecology (Oliveira de Almeida and Biazoti, 2017:14, my emphasis).[6]

Urban agroecology is certainly generating more interests. Two books published this year (in 2021) specifically address specifically the topic of 'urban agroecology' (Egerer and Cohen, 2021b; Tornaghi and Dehaene, 2021a). In their edited book entitled *Urban Agroecology:*

[6] Appendix 2 synthesizes the synergies between the interest and study of agroecology and urban and peri-urban agriculture, which, again, evidence both their multifunctionality and transdisciplinary nature.

Interdisciplinary Research and Future Directions, Egerer and Cohen (2021b: 6) posit that "an *urban agroecological approach* takes form at the critical juncture between agriculture, ecology, and urbanization" and that urban agroecology addresses the relationship between urban agriculture, land-use change, and food movements, which intertwines with urban ecology.

Urban ecology studies have evolved throughout the years from just studying the impact of urbanization on local biodiversity to studying the complex ecosystems/socioecological systems within cities (i.e., ecological theories applied to cities with the social and economic dimensions of human populations that shape, transform, and manage the urban ecosystem at different scales). However, few urban ecologists have focused on studying the spaces for urban agriculture and their potential for enhancing urbanized socioecological systems from an urban food systems lens. On the other hand, agroecologists have mostly addressed urbanization as an external coercion that have social and ecological impacts on the agriculture of agrarian communities. Thus, the new term 'urban agroecology' "sits at the intersection of urban ecology and rural agroecology" (Egerer and Cohen, 2021b: 7).

The interest in urban agriculture in general, both in the public and academic realms, has soared since the mid-1990s (Lin et al., 2015) as well as expanded to embrace the scale of city-regions (e.g., Foster and Escudero, 2015; Foster et al., 2015; Vaarst et al., 2017; Renting, 2017). Furthermore, the first known use of the term 'urban agroecology' was in a 2007 study by Terrile et al. (2007) about urban agriculture in Rosario, Argentina (Terri et al, 2007; Egerer and Cohen, 2021b). Since then, the use of the term, along urban agriculture, has started to escalate, especially in the second decade of the 21st century. Since the beginning, 'urban agroecology' manifested its importance as a multifunctional venture when the term has been used to promote educational initiatives, revitalization of urban areas, ecosystem services, health, new urban livability policies, and community empowerment in addition to sustainable agri-food production in the city (Merçon et al., 2012; Sánchez Miñarro, 2013-2014; Montenegro de Wit, 2014; Ribeiro et al., 2015; Casasbuenas, 2016; Gregory et al., 2016; Hoekstra and Tornaghi, 2017; Vaarst et al., 2017; Driscoll, 2017; Altieri and Nicholls, 2018; Hermann et al., 2018; Siegner et al., 2020). However, without using specifically the term 'urban agroecology', Altieri (1999) first described the management of

urban farms and gardens in Cuba using agroecological principles (Altieri, 1999; Egerer and Cohen, 2021b). As Altieri (1999: 135) writes:

> "Much of the spread and success of urban agriculture in Cuba is due to the fact that it is based on local resources and agroecological techniques emphasizing two pillars of agricultural sustainability: integrated pest management and organic soil management. Garden productivity has been sustained using minimal external inputs, applying principles of agroecology and organic agriculture, which are low cost, environmentally sound, and based on locally available resources."

Hence, Cuba was the first case study known that specifically used the principles of agroecology to study sustainable urban agriculture initiatives. Urban agriculture in Cuba, it is worth highlighting, was one of the important strategies to strengthen Cuban's food security as result of the economic and social challenges during the Special Period of the 1990s with the dissolution of and support withdrawal from the Soviet Union.

The use of agroecological principles for urban and peri-urban agriculture could certainly bring multiple benefits for sustainable, resilient, innovative, restorative and even emancipatory transformations of urban environments around productive city farms, especially in post-industrial cities. Urbanites could affirm their collective right to participate democratically in the production and restoration of urban spaces through action-oriented participatory processes. Also, the use of agroecological principles could yield much needed transdisciplinary and multidimensional approaches for agricultural policies and sustainable practices to tap into the urban and rural interconnectedness and complementarities (Herrmann et al., 2018; Altieri and Nicholls, 2018; Pimbert, 2017; Deh-Tor, 2017; Méndez et al., 2016; Fernández et al., 2016; Dumont et al., 2016; Mougeot, 2006, 2005, 2000). Aiming at these multiple benefits are important when addressing the complex and tightly interconnected interplay of social, economic, political, and ecological conditions in urban socioecological systems with multi-level stakeholders.

While Altieri and Nicholls have led the practice of using agroecological principles for assessing and managing agricultural activities (Altieri, 2000; Nicholls et al., 2016; 2020, among many of their publications), including in urban settings (Nicholls and Altieri, 2019; Altieri and Nicholls, 2018; Altieri et al., 2017; Altieri et al. 2014-2016), their important work has mostly

focused on the ecological dimension of agroecology: attainting sustainability and resilience in both the rural and urban agroecosystems for long-term benefits. Thus, there is much to be done in the assessment of the other dimensions as well, the socio-economic/political and cultural, and their interconnectedness. As Egerer and Cohen (2021b: 7) argue:

> "[T]he history of agroecology research can serve as a reference for directing future research in urban agroecology" because "understanding how agroecological principles might be applied to urban agroecosystems can help guide the recent explosion of urban agriculture growth" and "may offer future directions for understanding the drivers and impacts of urban cultivation in cities."

Accordingly, my research contributes new knowledge in this exciting and complex new field of 'urban agroecology' with a detailed qualitative study of agroecological principles at the Intervale Center's peri-urban agroecosystem in Burlington, Vermont. But context being vital, the next chapter provides an overview of the natural, cultural, and political history of my case study.

3.

THE INTERVALE IN BURLINGTON, VERMONT: A UNIQUE EXPERIENCE IN THE UNITED STATES

The Intervale Center is perhaps the most important food and farming organization in Burlington, Vermont. In existence since 1988 as a non-profit, the Intervale manages in public trust a 340-acre property of farmland, trails and open space along the Winooski River, a tributary of Lake Champlain. Under the mantra of "Farms, Land, People," the organization goals are to enhance the viability of farming, to promote the sustainable use and stewardship of agricultural lands, and to ensure community engagement in the food systems. Accordingly, the mission, vision, and programmatic areas of the Intervale extend beyond the 340-acre property at the outskirts of Burlington and serve the state of Vermont. In 2020 alone, the Intervale provided support to 110 local farms (including 52 farm start-ups), restored the equivalent of 188 football fields of forest, and offered 57,000 lbs of produce gleaned for hunger relief (Intervale Center, 2020). The success of the Intervale is very much based on their current activities and programs, but it also rests on a rich natural and cultural history.

A Brief Natural History

For centuries, Burlington, Vermont, has benefitted from rich soil and milder climates due to Lake Champlain, and diverse riverine ecosystems in the lower elevations. Early New England colonists used the word 'intervale' to describe these lower elevations of fertile flat and narrow valleys along rivers and between hills that were enriched by alluvial soils from the adjacent hills as a result of the overflow of the rivers over time (Berman, 2011). Such areas were well suitable for agriculture compared to upland sites. The Intervale includes areas such as Otter Creek and the Winooski, Lamoille, and the Missisquoi river valleys weaving through Vermont's mountains, which originate in the Green Mountains to the east. These river valleys that zigzag the mountains of Vermont are rich in social and ecological history. For centuries these low alluvial plains have

provided locals not only with fertile soils for agriculture, but also with ease of travel due to their proximity to the coast and waterbodies (UVM and Shelburne Farm, n.d.-a; Berman, 2011).

Nowadays, in Vermont, the word 'intervale' is particularly associated with the Intervale Center. The Intervale Center (hereafter the Intervale) is located within an 870-acre floodplain on the Burlington side of the Lower Winooski River valley. The whole valley encompasses approximately 3,500 acres, and the lower Winooski River flows through Burlington, Winooski, and Colchester (see Figure 3.1). The alluvial soils of these flat bottomlands are highly stratified, containing layers of alluvium deposited with each flooding episode, successively over 10,000 years. The soil is rich and ideal for agriculture (Figure 3.2). Nevertheless, today, the Lower Winooski River valley, where the Intervale is located, has a diverse land use. In addition to conserved floodplain forests and riverine ecosystems, the area includes a network of wetlands and marshes, intermittent streams, patches of ponds as well as farms, recreational areas, private commercial and residential zoned areas, municipal-owned and managed lands, and key public and transportation infrastructure and corridors (VHB, 2019; UVM and Shelburne Farm, n.d.-a, n.b.-c; Boettinger, 2005). The Intervale's floodplain property is saturated with water and therefore land uses are limited with physical and legal restrictions by the United States' Federal Emergency Management Agency (FEMA) (Figure 3.1).

Figure 3.2 illustrates the different soil types at the Intervale. The Intervale' soils are highly fertile and fall into the Classes I and II of agricultural capabilities.[7] Hadley soils are remarkable fertile soils because they are deep and well drained. During the spring, when these soils are usually flooded, they dry relatively fast. Hadley soils contain fine sandy loam and slit loam and have moderately high available moisture capacity. The Limerick soils are also highly fertile with moderately high moisture capacity. Generally, Limerick soils are deep, contain silt loam, and poorly drained. During a period of time during the year, they get frequently flooded. In the Champlain valley region, the Winooski soils are located in floodplains along major rivers and tributaries. Winooski soils have also natural high fertility because they are deep and moderately

[7] Class I and II are the two land capability classes that contains soils with no limitations or very low limitations for cultivation (i.e., natural fertile soils). This classification is provided by the Natural Sources Conservation Service (NRSC) of the US Department of Agriculture. There are other classifications (classes III to VIII) that have different levels of limitations and restrictions for cultivation (NRDC, 2001).

well drained. They are formed from sediments of fine sandy loam and silt loams (Tobi, 2014; McKeon et al., 1993).

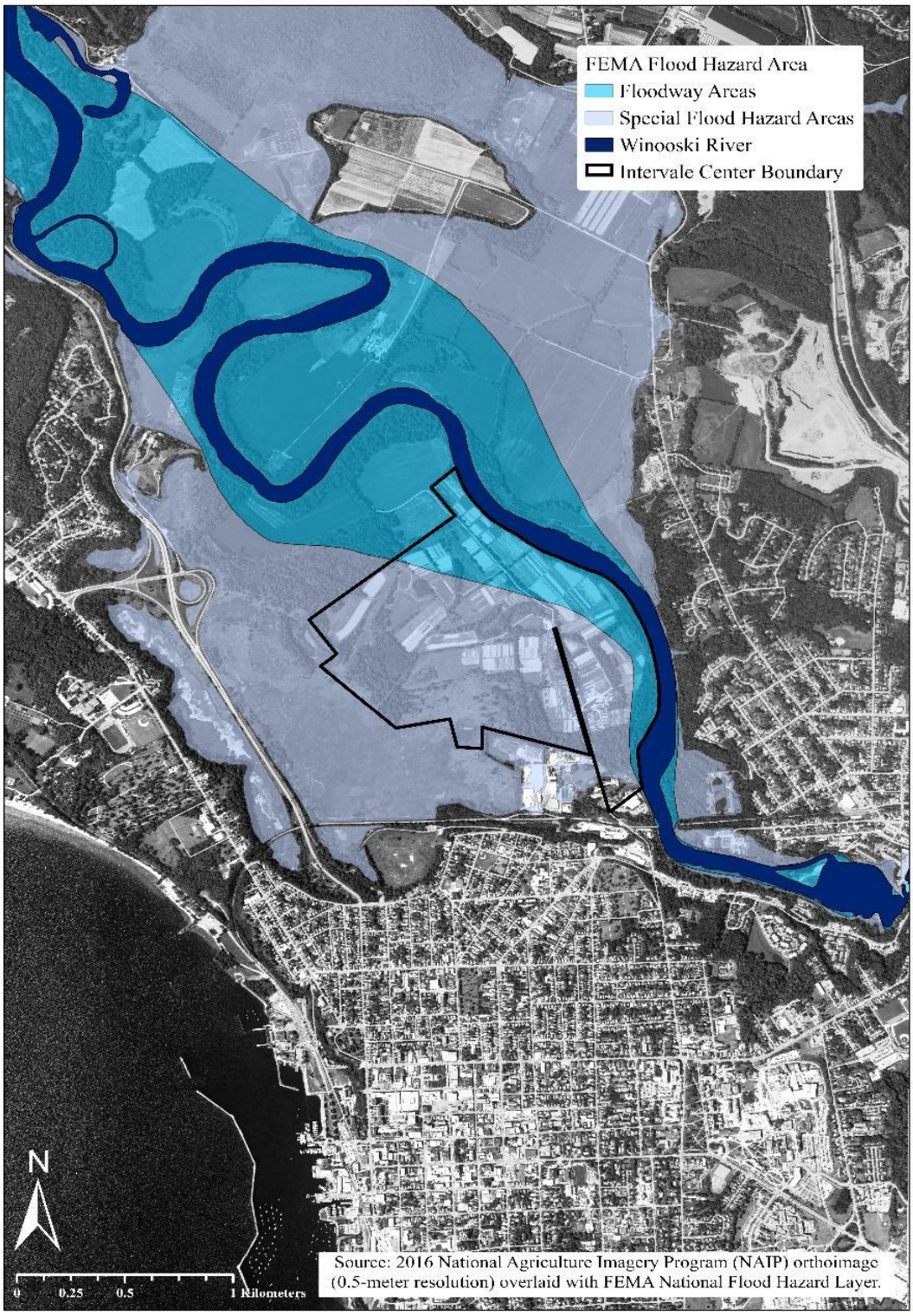


Figure 3.1: Burlington's Floodplain Area along the Winooski River

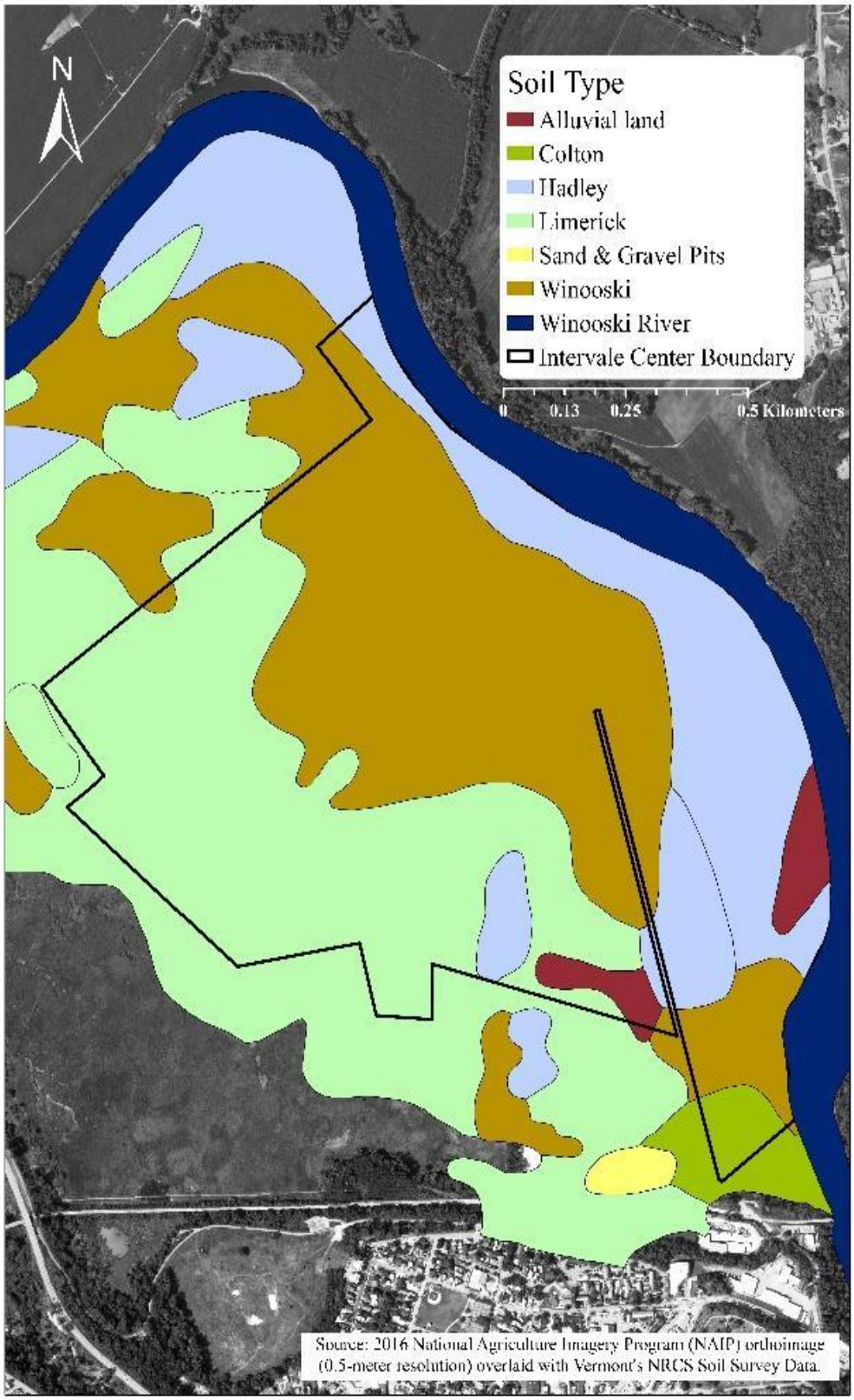


Figure 3.2: Soil Types at the Intervale

The Intervale is known for more than its agricultural opportunities. At the Intervale, the riparian forest serves as an important habitat corridor for an abundance of native and migratory birds. The public recreational Calkins Trail following the Winooski River to the Ethan Allen Homestead[8] allows for year-long bird watching. According to Vermont bird observation reports, numerous avian species has been observed in this floodplain. Some examples of these bird species are northern cardinal (*Cardinalis cardinalis*), blue jay (*Cyanocitta cristata*), Canada goose (*Branta canadensis*), red-tailed hawk (*Buteo jamaicensis*), American crow (*Corvus brachyrhynchos*), American robin (*Turdus migratorius*), American black duck (*Anas rubripes*), wood duck (*Aix sponsa*), mallard (*Anas platyrhynchos*), common merganser (*Mergus merganser*), American goldfinch (*Spinus tristis*), rock pigeon (*Columba livia*), mourning dove (*Zenaida macroura*), ring-billed gull (*Larus delawarensis*), great blue heron (*Ardea herodias*), among many others. In addition to various species of birds, wildlife enthusiasts can observe a variety of reptiles and amphibians like, for example, the painted turtle (*Chrysemys picta*), northern leopard frog (*Lithobates pipiens*), American toad (*Anaxyrus americanus*), and the garter snake (*Thamnophis*). Also, mammals like the eastern chipmunk (*Tamias striatus*), beaver (*Castor*), American mink (*Neovison vison*), muskrat (*Ondatra zibethicus*), raccoon (*Procyon lotor*), red fox (*Vulpes vulpes*), little brown bat (*Myotis lucifugus*), and many insects, most notably monarch (*Danaus plexippus*) and viceroy butterflies (*Limenitis Archippus*). Fishing is also a popular activity along the Winooski River. Rock bass (*Ambloplites rupestris*), walleye (*Sander vitreus*), steelhead rainbow trout (*Oncorhynchus mykiss*), lake sturgeon (*Acipenser fulvescens*), and landlocked Atlantic salmon (*Salmo salar*) are some fish reported (Marsden and Langdon, 2012; UVM and Shelburne Farms, n.d.-a, n.d.-c; Lawrence, 1995; Vermont Fish and Wildlife Dept., n.d.-a, n.d.-b; Cornell Lab of Ornithology, n.d.).

The Intervale's Wildlife Management Area (IWMA) sitting on the west side of the property has been part of the Vermont Agency of Transportation since 1987 to develop and mitigate the loss of wetlands as a result of the construction of Route 127. The IWMA (Figure 3.3) consists of

[8] The Ethan Allen Homestead is a museum and a 294-acre public park on the northwestern side of Intervale, also along the Winooski River. It is a public non-profit corporation owned by Winooski Valley Park District (Ethen Allen Homestead Museum, 2021).

188 acres of riparian upland and engineered wetlands managed by the Vermont Fish and Wildlife Department for wildlife habitats conservation (Vermont Fish and Wildlife Dept., n.d.-a; VHB, 2019).

The Intervale has a combination of four distinct natural areas within walking distance from one another. One natural area is the mature floodplain forest, specifically, a combination of silver maple-ostrich fern riverine floodplain forest with silver maple-sensitive riverine floodplain forest. The silver maple-ostrich fern riverine forest is described as the classic floodplain forest in the moderate-gradient portions of most rivers in Vermont. The dominant species in this forest are silver maple (*Acer saccharinum*) that can survive regular flooding and shade the humid undergrowth and ostrich ferns (*Matteuccia struthiopteris*) in the understory. The soils are generally well-drained nutrient rich sandy alluvium. In the silver maple-sensitive fern riverine, the sensitive fern (*Onoclea sensibilis*) and false nettle (*Boehmeria cylindrica*) dominate the understory. The soils in this forest are moist, predominantly mottled, silty alluvium. Other species of trees that can be found in the mature floodplain forest are, for example, cottonwood (*Populus deltoides*), American and slippery elms (*Ulmus americana* and *Ulmurubra*), hackberry (*Celtis occidentalis*) and box elder (*Acer negundo*) (UVM and Shelburne Farm, n.d.-c; Tobi, 2014; USDA, n.d.-a; Vermont Fish and Wildlife Dept., n.d.-b)

The floodplain forest, within the mature floodplain forest, is the wetter type of riverine floodplain forest located in the lower gradient portions of the larger rivers, including deltas, and in the wetter depressions of the floodplains. The dominant tree is the silver maple, but there may be also abundance of green hash (*Fraxinus pennsylvanica*) and swamp white oak (*Quercus bicolor*) trees with sensitive fern. The second natural area that dominates the area is the early succession floodplain forest (i.e., forest grown over the last 10-20 years from abandoned farm fields), located between the mature floodplain forest and the cleared farmlands. The canopy trees that dominate the succession forest include the fast-growing boxelder or ash-leaved maple (*Acer Negundo*) and cottonwood. Patches of flowers such as the Jerusalem artichoke (*Helianthus tuberosus*) and riverbank grape vines (*Vitis riparia*) are common in areas where the sun penetrates the canopy. Undisturbed, the early succession floodplain forest can eventually

develop into a mature floodplain forest (UVM and Shelburne Farm, n.d.-c; University of Minnesota Extension, n.d.; United States Department of Agriculture, n.d.).

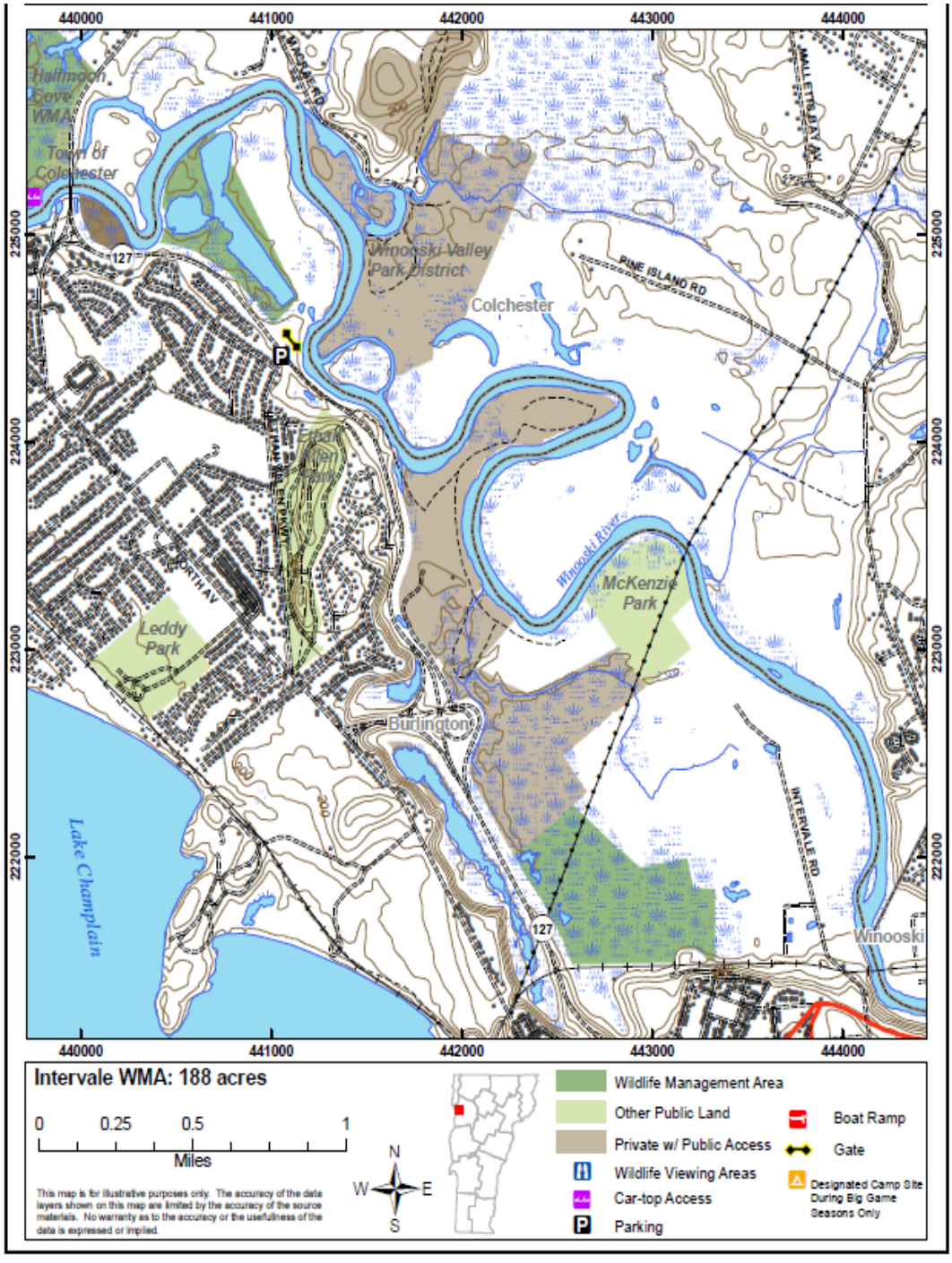


Figure 3.3: The Intervale Wildlife Management Area
Source: Vermont Fish and Wildlife Department (n.d.-a).

The third type of natural area is a river shore meadow, another example of early succession. As the river flows, it drops riverine silt and sand on a sharp curve of the river on the other side of the mature floodplain forest, forming a patch of beach that widens and hold the new soil as the river continues to meander. The succession then brings new plant communities that cover the ground over time. These plant communities include cockleburs (*Xanthium strumarium*), stinging nettle (*Urtica dioica*), sandbar willow (*Salix exigua Nutt*), and numerous grasses. With time and no significant alterations to the landscape, this river shore meadow could become an early succession riparian forest (UVM and Shelburne Farm, n.d.-c; USDA, n.d.-a).

The fourth type of natural area is the riverbank farm field. This area is an upstream prairie with little or no forested buffer zone that runs to the riverbank. Since the bank is steep, there are restoration efforts using sandbar willow and cottonwood trees to reduce erosion and stabilize the bank. Nevertheless, the steep bank provides a nesting area for the belted kingfishers (*Megaceryle alcyon*), wood ducks (*Aix sponsa*), different types of songbirds, red-tailed hawks (*Buteo jamaicensis*), and occasionally, ospreys (*Pandion haliaetus*) can also be seen (MacPherson, 2020; UVM and Shelburne Farm, n.d.-c).

Two pressing and sustainable forest management concerns are reported at the Intervale: invasive species and ostrich ferns overharvesting. The ostrich fern or fiddlehead has increasingly become a springtime delicacy in New England and Eastern Canada. Llewellyn (2020) studied 30 ostrich ferns (each producing a minimum of four fiddleheads per crown) growing underneath mature sugar maples. Llewellyn (2020) found that in even only one season of overharvesting, the ostrich ferns suffered a significant decline in growth or were killed altogether in subsequent years. The Intervale also faced the challenge of controlling and eradicating invasive species to restore and protect the native local biodiversity. Some of the most pervasive species are the Japanese knotweed (*Fallopia japonica*), goutweed (*Aegopodium*), multiflora rose (*Rosa multiflora*), purple loosestrife (*Lythrum salicaria*), common buckthorn (*Rhamnus cathartica*), garlic mustard (*Alliaria petiolata*), among others. Invasive species have proliferated the undergrowth due to human settlements and generations of land-use changes (Tobi, 2014; UVM and Shelburne Farm, n.d.-c; USDA, n.d.-a).

A Brief Cultural History

The Lower Winooski River Valley also has a rich cultural history. There is archeological evidence that this low river valley was important for the livelihood of Abenaki communities who inhabited the northeast region of North America. Burial sites, stone hearths, tools, ceramics, and plant remains evidence that the Abenaki used the area to hunt, fish, gather and grow food and medicinal plants since 3000 BC. By clearing and burning the land, Abenakis grew a diversity of crops, including corn and squash, and helped to maintain meadows and prairies. These low laying lands also facilitated transport by foot and boat. Thereby, the Intervale is located in one of the most sensitive archeological sites in the region (VHB, 2019; Berman, 2011; Manore, 2011; Ives, 2007; Haviland and Power, 1994; UVM and Shelburne Farm, n.d.-b).

French explorers arrived at this river valley in the 1600s followed by English colonizers in the late 1700s who took over the lands and settled in Vermont. With the arrival of the Europeans, the notion of land ownership was introduced. The Europeans marked the land with private fields and fences, something completely unfamiliar to the Abenakis. This erasure of the natural open commons, together with new diseases brought by the colonizers, and conflicts escalating into wars, contributed to the significant reduction of the Abenaki population in the area. Nevertheless, the Abenakis that survived and stayed in the area kept using the land where the Intervale is located for their livelihoods (e.g., hunting, foraging, fishing) throughout the 19th to early 20th centuries. Many Abenakis also worked as laborers in the Burlington or Winooski mills (VHB, 2019; Manore, 2011; Ives, 2007; O'Brien, 2006; Haviland and Power, 1994; UVM and Shelburne Farm, n.d.-b).

European colonizers settled at the Intervale Burlington site in the 1770s and cultivated the land throughout the late 18th to early 20th centuries. The land surrounding the mouth of the Winooski River, known back then as the Onion River,[9] was labeled in the maps of these European settlers as "Great Swamp", indicating that the Lower Winooski River Valley was mostly swamps and wetlands, as it is today. Settlers started to fill and drain these wetlands and swamps for farming. In 1773, Ethan Allen, a settler known as one of the 'founders' of Vermont, purchased

[9] "Winooski" derives from the word *winoskik*, an Abenaki word the means "at wild onion land" because of the wild onions that were once common along riverbanks.

large tracts of land around the Winooski River through a land speculation enterprise, the Onion River Land Company. Allen was able to purchase 1,400 acres of Burlington and constructed his homestead in 1787. He also leased land to farmers arriving in the area. In fact, throughout the late 18th and during the 19th centuries, most lands in the Lower Winooski River Valley were farmed by tenant farmers for subsistence. These subsistence farmers leased the land from different absentee landowners (VHB, 2019; Jackson, 1993; Mckeon et al., 1993; UVM and Shelburne Farm, n.d.-b).

After the American Revolution in 1783, the Intervale land was mostly known as an essential granary that produced different grains as well corn, flax, and some farm animal products. The uplands in the valley were harvested for hardwoods and pine. From the early to mid-19th century, the course of the Winooski River along this stretch of low land suffered a significant change as a consequence of the upstream watershed farming practices. Like most of Vermont, upstream hills were deforested to create pastures for the merino sheep industry. Consequently, surface runoff, flooding, and sediment increased considerably downstream. These changes upstream shifted the river 600 to 1000 feet in the floodplain where the Intervale is located. The construction of the railroad through the Lower Winooski River Valley region in the mid-19th century forced grain markets to move west, therefore, local farms turned to dairy production (milk, cheese, butter) and stock breeding. The railroad served the entire area, and it still crosses the main entrance of the Intervale's property (VHB, 2019; Jackson, 1993; Mckeon et al., 1993; UVM and Shelburne Farm (n.d.-b; United States Department of the Interior, 2004).

The story of the Intervale historic farmstead goes back to early 1860 when Gorge Reynolds bought a total of 100 acres of land in the floodplain. The ranch was constructed in 1868 but historic records show that one of the barns on the property was an older barn built around 1830. The Reynolds family operated a dairy farm, and their property grew to 126 acres by 1870. The farm's proximity to the railroad seems to have benefited the Reynolds. Dairy farms in Vermont used the railroad as the main transportation means to sell their products to other markets. The family managed the farm until 1907, when they moved out and started to employ tenant farmers who operated and lived on the property until 1937. As a floodplain, the Lower Winooski River Valley suffered significant flooding events. There was a well-documented flood in

1830 that destroyed several mills. Another significant flooding event in 1927 changed the river's course and destroyed farms' infrastructure and fields. Most farms where the Intervale is presently located were abandoned after this major flooding. Local mills faced economic failure in the 1930s due to flood damage or the historic and severe economic depression of that decade. After the 1927 flood, the Intervale became a dumpsite, junkyard, and a place for homeless encampments. However, in 1930, Fayette and Ella Calkins purchased the dairy farm from the Reynolds family. The Calkins did not move to the farm right away. They also employed tenant farmers until 1937 when Ella Calkins moved to the farm. Her daughter Rena joined her in 1941. The two women lived in the brick farmhouse that now houses the Intervale main administrative office (known historically as the Reynolds/Calkins farmhouse). Rena took over the operation of the farm when her mother died in 1947. With her employees, she operated a successful dairy production until she was 91 years old. Rena lived on the farm for 80 years. The dairy operation stopped in 1991 when Rena began to have health-related problems. She died in 1996. The Calkins property was passed on to her nephew, Paul Calkins (VHB, 2019; Tonn, 2017; Intervale Center, 2018a; Intervale Center, n.d.-o; Thomson et al., 1964; UVM and Shelburne Farms, n.d.-b).

In the 1960s, as a result of the heightening of environmental awareness and movements in the United States, people in Burlington started to realize the value of the floodplain as a green open space at the fringe of the urban area along the Winooski River. Specifically, the entrepreneur Will Raap, who founded the locally based Gardener's Supply Company (nowadays a 100% employee-owned company), envisioned this peri-urban green space as a perfect location to promote local, sustainable farming, as well as other related and compatible sustainable businesses. Raap advocated for the potential of the Intervale to provide at least 10% of the city needs for fresh food with organic farming. Raap (now in his 70s) is known as a visionary businessman. He has a bachelors' degree in urban planning, a Master of Business Administration (MBA), and went to England to work for E.F. Schumacher, the influential economist and author of *Small is Beautiful: Economics as if People Mattered*. This pivotal book published in 1972 has been an important reference to spearhead alternative human-scale and locally based economies for sustainability. In 1985, Raap established the first store of Gardeners' Supply at the entrance of the Intervale in an abandoned pig slaughterhouse. Since 1987 Burlington's zoning codes have

forbidden residential and commercial development in the floodplain where the Intervale is now located. In the 1988, after cleaning the dumping ground and junkyard adjacent to his store, Raap started the Intervale Center, initially called the Intervale Foundation, a non-profit organization with the support of the municipality. The aim of the Foundation was to restore the land and farmstead for sustainable agriculture, businesses, and recreational opportunities (Raap, 2021; Schumacher Center for a New Economic, 2021; Tonn, 2017; Berman, 2011; Phillips et al., 2013; Daly, n.d.; UVM and Shelburne Farms, n.d.-b). According to Berman (2011: 5), since 1988 the non-profit has been a "vehicle to reinvigorate urban agriculture and to create a sustainable, local food system" in Burlington.

In the beginning, the Intervale Foundation rented the farmstead from the Calkins family. In 2002, the Calkins donated the farmstead with seven acres of land to the Foundation. In 2005, the family donated 53 additional acres. The historical farmstead was deteriorated but the Intervale has been able to restore the property thanks to private donors, grants, and a co-held easement of the farmstead's interiors and exteriors with the Vermont Housing Conservation Board, the Preservation Trust of Vermont, and the Vermont Division for Historic Preservation. In 1992, the Vermont Division of Historic Preservation declared that the Intervale farmstead was the last remaining farmstead in Burlington (Boone, 1992, Tonn, 2017; Preservation Trust Vermont, 2004). As described by Boone (1992: 1), the Intervale farmstead is a "surviving historic resource" and an "important local landmark" with its late 19th century Italianate-style farmhouse nestled within "an agricultural landscape that were once common even within the boundaries of Vermont's largest city."

In addition to the original farmhouse built by the Reynolds family, the Intervale farmstead includes other historic buildings, notably a horse barn (c. 1877) constructed from recycled timbers from two separate English barns built between in the late 18th and early 19th centuries. This barn was located across the street from the farmhouse and was owned and occupied by different farmers until the property was sold to the City of Burlington for the McNeil Generating Plant. The barn was then moved to the Intervale site in 2003 for restoration and conservation. The Calkins family used it to house their prize horses while operating the dairy business between 1907 and

1918. The barn is now the “Community Barn” used by the Intervale for public and private events (Tonn, 2017; Intervale Center, 2018a, 2018b, n.d.-o).

Historic infrastructure at the Intervale farmstead also includes a silo (c. 1890), a corn crib (c. 1870) probably built by the Reynolds and repurposed as a storage shed, and two other barns. One of the barns (c. 1830) was reconstructed after a fire in 2008. This reconstructed barn serves as an example of a typical 18th to early 19th century threshing or hay barn imported by the colonists. The barn is currently used as a workshop, storage, and cooler space. The second barn is an original dairy barn constructed by the Reynolds (c. 1890) and carefully reconstructed with most of its original materials in 2013. This barn presently houses the Intervale’s Food Hub and the operations of the Gleaning and Food Rescue program (Tonn, 2017; Intervale Center, 2018a, 2018b; n.d.-o).

Based on 2020 geomatics and public information from Chittenden County on land parcels, The Intervale owns and manages around 340 acres of the floodplain within the city limits of Burlington, including, approximately 84.65 acres leased from the Calkins family under the Calkins Trustee (Figure 3.4). The Calkins also donated 60 acres to the Intervale Centre between 2002 and 2005 (Intervale Center, 2018b).

Because of the importance of the Intervale property as part of the Lower Winooski River Valley (with its mix of fertile soil for peri-urban agriculture, forests, wetlands, wildlife habitats, and desired green infrastructure for Burlington), the Vermont Land Trust, with the Vermont Agency of Agriculture, Food and Markets, and the Vermont Housing and Conservation Board hold since 2007 development rights and a perpetual easement in 232 acres of the Intervale (Figure 3.5). These 232 acres include tillable and open land, forest and wetland areas, the agricultural buildings area, as well as the area where the composting enterprise used to be located. As the Grant of Development Rights and Conservation Restrictions states, the primary objectives of the easement agreement are to: “(a) conserve productive agricultural and forestry lands and soil resources in order to facilitate active and economically viable farm use of the Protected Property now and the future; and (b) to sustain the Protected Property as a source for the production of raw and valued-added agricultural products for the Burlington area, the incubation of developing farm operations, and public, agricultural and ecological education; and (c) to facilitate

appropriate public access on the Protected Property" (Vermont Land Trust et al., 2007). A secondary objective is "to conserve the unique working landscape… including its scenic, natural and archeological resources, improve the quality of life for Vermonters and maintain for the benefit of future generations the essential characteristics of the Vermont countryside" (Vermont Land Trust et al., 2007).

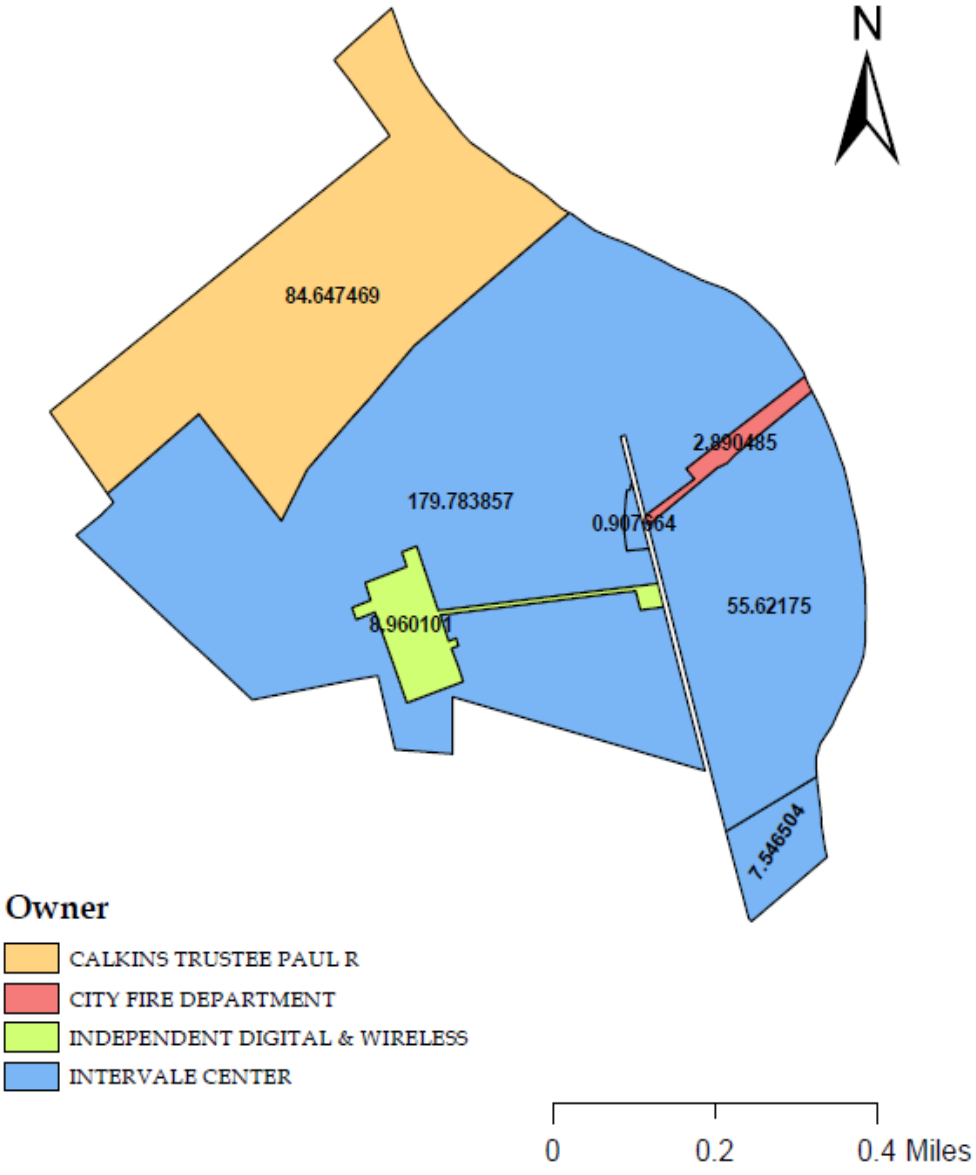


Figure 3.4: Land Parcels at the Intervale (Parcel Data, Acres)
Source: State of Vermont (2021a)

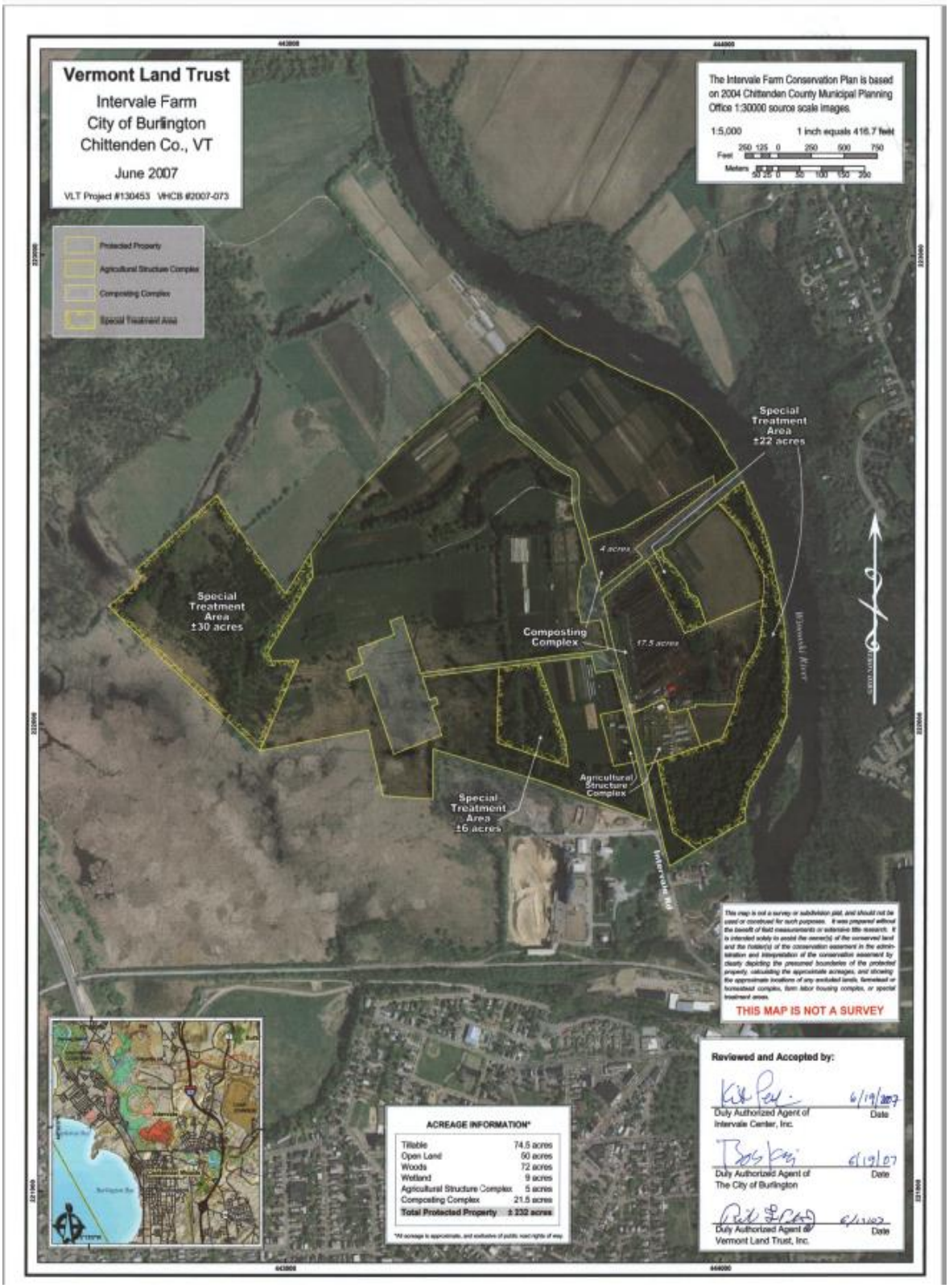


Figure 3.5: **The Intervale Easement**
Source: Vermont Land Trust et al. (2007)

The Socioecological System

As an organization, the Intervale has evolved and changed throughout the years. The non-profit has been a fertile ground to explore new ideas and projects as a way to guarantee its sustainable development. Some examples are the composting operation, the proposal of an eco-park, and a farm incubator program. The Intervale used to own a composting non-for-profit enterprise called Compost Products that occupied 16 acres of the property. The enterprise was successful, but it grew too large to be located at a floodplain and it confronted regulatory and legal issues "as an environmental and archaeological hazard" (Ives, 2007). It was also charged with discarding contaminated wastewater and impacting an important Abenaki archeological site. According to Ives (2007) from *Vermont's Seven Days* weekly newspaper, Judy Down, a member of the Vermont Commission on Native American Affairs, claimed that the compost facility was atop a sensitive Abenaki burial ground. Consequently, in 2008, the compost operation (now Green Mountain Compost) was sold to the Chittenden Solid Waste District and moved to Williston in Chittenden County (Phillips et al., 2013; Ives, 2007; Intervale Center, n.d.-k; Green Mountain Compost, 2021a, 2021b).

One of the other projects is Riverside EcoPark planned by Will Raap but never realized. The Riverside EcoPark was an industrial ecology proposal with a visitors' center, greenhouses, and other sustainable businesses using the excess heat of the McNeil Generating Station located almost across the street from the Intervale's main offices (VHB, 2019; Phillips et al., 2013). Another example is the Intervale's farm incubator program which used to run at the Intervale's property for over twenty years. This program was designed to help small new farmers succeed by overcoming typical start-up barriers (e.g., access to affordable land at the Intervale, as well as to equipment and infrastructure, connections to the local and regional markets, networking with other experienced farmers, business planning couching and encouragement). In 2018, the Intervale decided to end the farm incubator program at the property. Instead, they started to focus their farm viability and land securing efforts for beginner farmers all over the state (Intervale Center, n.d.-l). Notwithstanding, currently around 34% of the property is under cultivation, approximately 117 acres, based on 2020 geomatics (Figure 3.6).

Figure 3.6. The Intervale's Cultivated Fields and Farms
(with Land Cover/Land Use and Classes' Percentage Area, 2020)

These cultivated acres include eight farms that are currently leasing land from the Intervale: Intervale Community Farm (ICF); Pitchfork Farm; Digger's' Mirth Collective Farm; Half Pint Farm; Hallow Herbs Farm; June Farm; Sugarsnap Farm, and Franklin Heyburn's Bee (hives sprinkled throughout the property's cultivated fields). These farming operations provide around 60 full-time, part-time, and seasonal jobs in Burlington throughout the year (Intervale, n.d.-j, n.d.-I). The other cultivates fields are managed under different programs of the Intervale Center, notably People's Garden and People's Farm (for the Gleaning and Food Rescue program), the New American's field (under a collaborative agreement with New Farms for New Americans), and the Abenaki Heritage Garden (managed by the Intervale to honor the original inhabitants of the land by cultivating and producing Indigenous heirloom varieties of crops and seeds, and to educate visitors).

The Intervale's 340-acre property is zoned by Chittenden County and the City of Burlington as agricultural (Figure 3.7). The urban and peri-urban lands surrounding the Intervale are zoned to the south and to the east as mostly residential, with some other uses (i.e., business/industrial, enterprise, processing and manufacturing, downtown Burlington, and institutional/UVM). The main access to the Intervale's property is through Intervale Road located at the south of the property and to the north side of the City of Burlington, specifically at the edge of the Old North End neighborhood. Around this main entrance, there are several businesses and industrial operations (zoned specifically as enterprise, and mostly agricultural processing and manufacturing). Right on the northwest corner of the intersection is Charlebois Rigging and Hardware (an electrical, plumbing and hardware wholesaler). A little further down the road is Finishing Solutions, LLC (a coating, engraving and allied services enterprise), Queen City Steel Scrapyard (a steel, aluminum, and stainless-steel wholesaler, and retailer), the crossing of the Vermont Central Railroad tracks, and Gardener's Supply Company founded by Will Raap. Just after passing the Intervale's farmstead, where the Food Hub is located, a few steps away from the organization's main office in the Reynolds/Calkins farmhouse, on the west side of Intervale Road is the McNeil Generating Station (owned by the Burlington Electric Power, Green Mountain Power, and Vermont Public Power Supply Authority). McNeil supplies energy to the city of Burlington by converting wood fuel and other biomass to electricity.

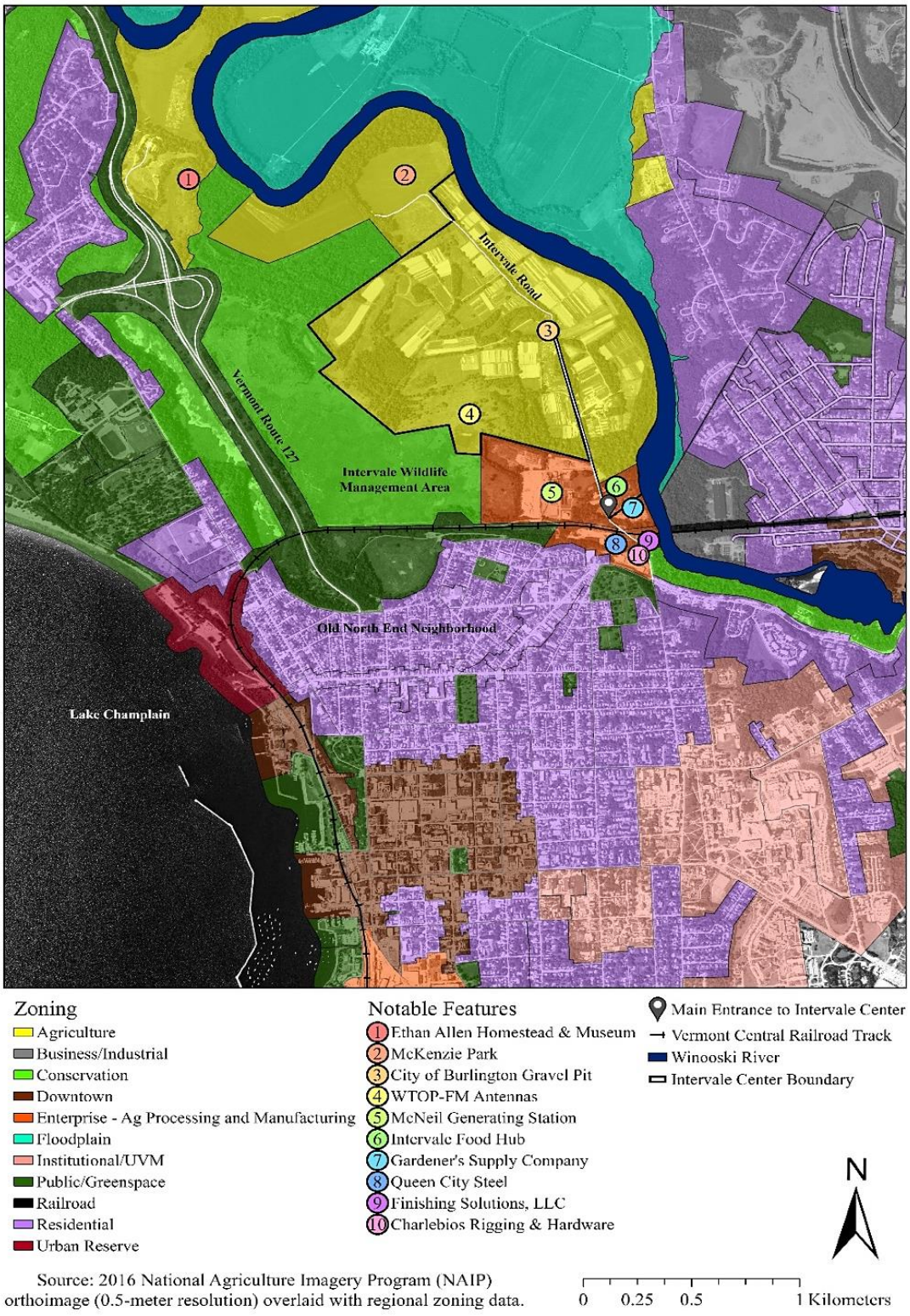


Figure 3.7: The Intervale's Peri-Urban Location in Burlington (Zoning)

Almost immediately after McNeil Generating Station, on the same side of the road, is Intervale Community Farm (ICF) with part of its infrastructure. The ICF is the first farm on the west side of the property when entering the Intervale through Intervale Road. To the right, just across the road, is June Farm, a small flower farm. Passers-by and visitors can also see the 200-foot cluster of antennas from the WTOP-FM radio tower behind or to the west of the Intervale Centre. WTOP-FM has a right-of-way on the Intervale's property. Further north on Intervale Road, and to the west as well, is one of the Intervale's main public amenities, the picnic grove, and behind is the site of the community gardens (Tommy Thompson Community Garden). Next, to the west is small, gated area used by the City of Burlington to pile old pavement and gravel (known as the gravel pit and shown in Figure 3.6 as impervious surface). To the east are the greenhouses and agricultural infrastructure complex. The farms that lease land at the Intervale can be appreciated on both sides of the road (see Figure 3.8). The limit of land parcels leased for farming at the east side of Intervale Road is the strip of riverine forest that has the Calkins Trail (another public amenity) and serves as buffer along the Winooski River. The limit of the farming parcels at the west side are the wetlands and the riparian upland habitat (i.e., the Intervale Wildlife Management Area) followed by State Road 127/Burlington Beltline. To the north of the property is McKenzie Park, a section of the floodplain forest owned by the City of Burlington and managed by Burlington Parks, Recreation & Waterfront, and to the northwest is Ethan Allen Homestead and Museum. Overall, the Intervale site depicts what Mckeon (1993: 20) describes as "a rural landscape that is rarely seen today in such proximity to a large urban area. The contrast between natural and built features is clearly evident."

The Intervale Center, the Non-Profit Organisation

As a non-governmental and non-for-profit 501(3) organization (NGO), the Intervale sustains itself through program revenues and grants. It has achieved financial stability through the development of social enterprises (i.e.., Food Hub, Conservation Nursery) and programs (e.g., Farm Business Planning) that provide different services to the local and regional community.

The non-profit is led by a Board of Directors with 13 volunteer members from the community that work directly with the Executive Director Travis Marcotte on general governance

Figure 3.8: Main Infrastructure and Public Amenities at the Intervale (2020)

and policy issues. Presently, and based on their website (Intervale Center, n.d.-a), 27 employees are in charge of the day-to-day operations of the organization's different areas of activities. In 2019, when I conducted most of my research fieldwork, the Intervale generated $2.5 million in revenues and $2.8 million in assets (Nonprofit Metrics LLC, 2021).

Based on the Intervale's 2019 Impact Report (Figure 3.9), 46% of the revenues come from sales and services (including land leasing to farmers and the rental of the Community Barn for different type of events), 38% comes from community and corporate giving (i.e., fundraising campaigns), and 16% from governmental grants (Intervale Center, 2019). These percentages varied slightly in the 2020 Impact Report: 43% from sales and services, 33.9% from community and corporate giving, and 11.2% from corporate grants, with an additional 8.9% coming from the federal Paycheck Protection Program (PPP) due to COVID-19 (Intervale Center, 2020). According to a personal communication with the Intervale Land Manager, Patrick Dunseith (May 28, 2021), the Intervale's revenue is forecasted at $ 3.0 million for 2021. In terms of agricultural activities, the Intervale helps produce approximately $1.4 million worth of produce per year to Burlington residents with the collaborative effort of all the farms located in its property (Intervale Center, n.d.-j).

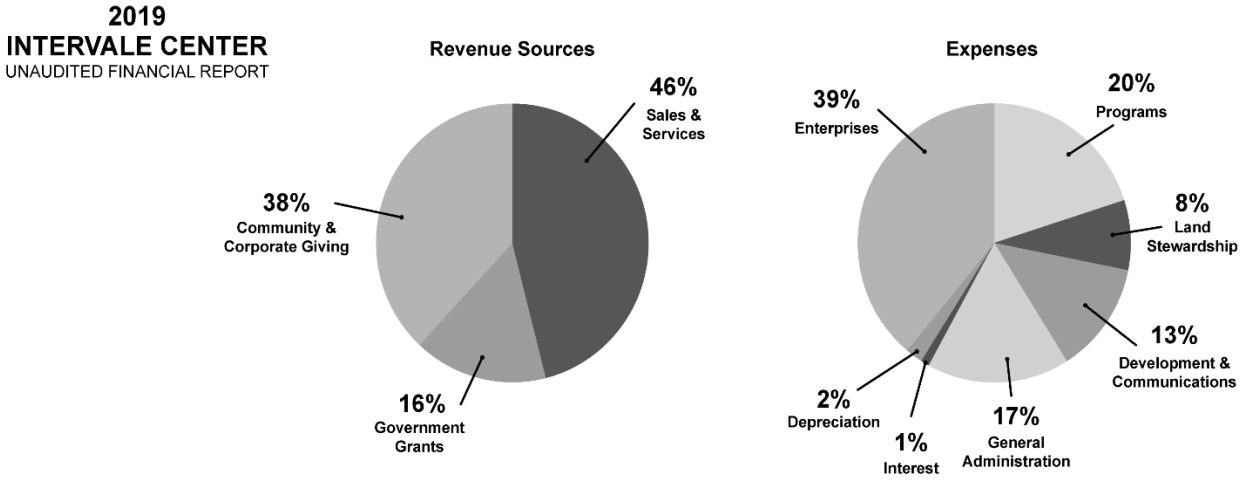


Figure 3.9: The Intervale's Sources of Revenues and Expenses
(Source: The Intervale Center, 2019)

The Intervale's programs are very comprehensive as they encompass a food system approach (Daly, n.d.). This approach is clear in the Intervale's mission "to strengthen community food systems" and vision: "We believe in the power of good food. We envision food systems that support joyful, vibrant communities. Farms and food businesses thrive, natural resources are healthy and protected, and people are nourished and happy. The Intervale Center – our people, programs, and place – is the living embodiment of this vision" (Intervale Center, n.d.-a).

As a socioecological system, the Intervale carries out different but tightly interweaved activities on the 340-acre property which I grouped under *Farms, Land* and *People* (Figure 3.10):

- *Farms* as in independent farms that lease the land and the Intervale Food Hub;
- *Land* for the Intervale's pivotal land and natural areas' stewardship, and the Conservation Nursery;
- *People* as in the Intervale's Gleaning and Food Rescue program and the community gardens located at their property.

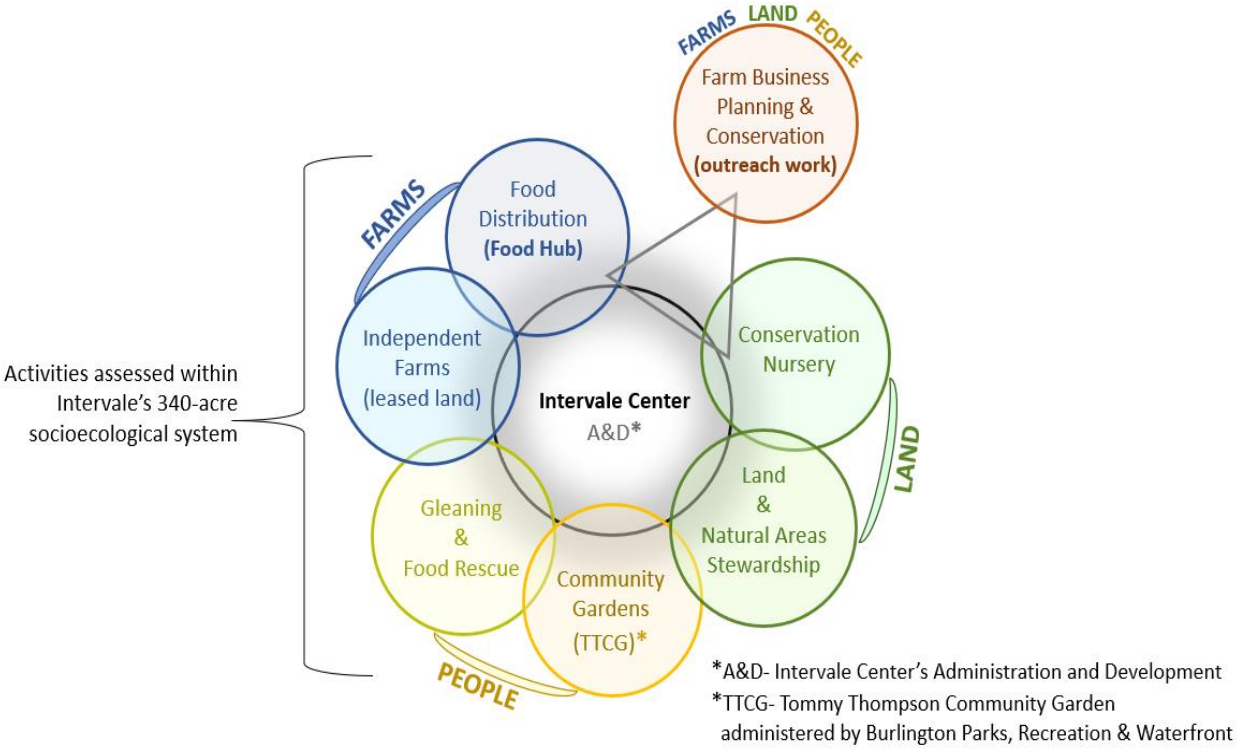


Figure 3.10: Activities within the Intervale's Socioecological System

Intervale Food Hub

A food hub is a food business model that manages the aggregation, distribution, and marketing of locally and regionally sourced-identified food products. Food hubs create new local and regional food value chains by connecting small to mid-sized farmers with the surrounding markets to strengthen their ability to satisfy wholesale, retail, and institutional demands. By facilitating these connections, food hubs also strengthen the local and regional food system (Housekeeper, 2017; Knigge et al., 2016). The Intervale Food Hub (IFH) is a non-for-profit social enterprise founded in 2008 under the umbrella of the Intervale that offers direct-to-consumer home delivery of local and regional produce in Burlington. It also does some wholesale business as an approved food vendor of the University of Vermont through Sodexo. As stated on their website, IFH's aim is to boost the local food economy by using innovative, replicable, and place-based strategies to transform the food system from its global, anonymous, and industrial status to one that is local, restorative, familiar and human-scale. The IFH's mission is "to bring more Vermonters into community food system through their weekly, year-round deliveries of local food to homes and community sites in the greater Burlington area." As of 2020-2021, a five-employees team works with the small and medium-size farms in the Intervale and the state of Vermont, as well as other food-related businesses that provide food with organic, sustainable, and ethical practices. IFH also allows small farms that sell their produce through the Hub to use the Hub as a community-supported agriculture (CSA) model if they are too small to support one on their own. Based on the Intervale's 2019 Impact Report, the IFH delivered 15,000 baskets of fresh produced that particular year. One of the Intervale's leaflets states that between 2015 and 2019, the IFH reported $4,000,000 in sales. On both the Intervale and IFH websites, the organization publicizes that they work with and supports more than 50 producers and food-related businesses in Vermont using organic, humane, and sustainable farming methods. The IFH also offers more than 60 recipes to use with the fresh produce they distribute (Daly, n.d.; Intervale Food Hub, 2021a, 2021b; Intervale Center, 2019; Intervale Center, n.d.-g, n.d.-p). According to Keith Drinkwine, IFH's Purchasing and Quality Assurance Manager (personal communication, July 5, 2019), the IFC provides a "huge revenue cushion" for the Intervale. In the

summer of 2019, IFH served “336 customers within a 10-mile radius” (B. Teed, IFH’s Operation Lead, personal communication, July 19, 2019).

Gleaning and Food Rescue

The Intervale’s Gleaning and Food Rescue (IGFR) program is part of the Vermont Gleaning Collective that connects gleaning organizations throughout the state. These organizations glean and collect post-harvest food surplus for the benefit of Vermonters in need via free food share programs. As a member of the collective, the IGFR gleans fresh vegetables from the Intervale farms as well as other farms in Chittenden County. In 2019, the Program gleaned and distributed 37,000 pounds of food. Also, via their Fair Share initiative, the organization provides the gleaned fresh food to about 200 income eligible individuals and families, and to twenty local social service agencies. Fair Share runs for 16 weeks from spring to fall. During this time period, eligible participants can pick-up, at no cost, an average of 6 to 8 pounds of fresh produce every Monday afternoon. Fair Share also coordinates and provides culinary skills workshops and nutrition education to qualified participants (Intervale Center, 2019; Daly, n.d.; Intervale Center, n.d.-b, n.d.-p).

Intervale Conservation Nursery

The Intervale Conservation Nursery (ICN), founded in 2001, grows more than 30 native woody plant species which include trees and shrubs for different conservation and restoration projects. Most of the services provided by the ICN aim at restoring and protecting Vermont’s watersheds and waterbodies. The ICN also uses ecologically sound practices (i.e., no synthetic fertilizers, herbicides or pesticides), and they work via collaborative and contractual agreements with state and federal agencies, other non-for-profits, private landowners, and farmers. As stated in a field guide, the ICN “provides comprehensive planting services for restoration and conservation projects” with a trained crew and the necessary technical equipment. The ICN also provides removal of invasive species and maintenance services of the planting projects. Thus, the ICN has available native trees and shrubs for wetlands, lowlands, and uplands, as well as native grasses and flowering perennials for wetland restoration, retention ponds and storm water runoff sites.

In addition, the ICN provides bioengineering services with live stakes and fascines build-out of native willow and dogwood to revegetate and stabilize slopes and streambanks. Between 2015 and 2019, ICN grew 158,500 plant stems and planted 635 acres around Vermont (Intervale Center, n.d.-c, n.d.-n; ICN, n.d.).

Land and Natural Areas Stewardship

Within its 340-acres, the Intervale has a mosaic of land uses. In addition to 102 acres of cultivated land for organic farming, as referenced before, it also has strips and patches of forest and wetland areas and public amenities for the benefit of the local community. The Intervale also stewards 6.4 miles of recreational trails, including groomed cross country ski trails around the farm fields, and the Rena Calkin Trail loop along a strip of the Winooski River's riparian corridor and buffer to the east of the property. Besides the site for community gardening under the jurisdiction of the City of Burlington (more below), the Intervale also has a public picnic grove, parking areas along the Intervale Road, and a small memorial garden (Alan Gottesman Memorial Garden) for peaceful contemplation that are part of the amenities the organization oversees. According to the Intervale's website, over 30,000 locals and tourists yearly visit the Intervale for passive recreation (e.g., walking, biking, gardening, picnicking, cross-country skiing during the winter) (Intervale Center, n.d.-d, n.d.-n).

Vermont Land Trust et al. (2007) and the other state entities' conservation easement provides the binding mandate for the Intervale to steward the property for the perpetual conservation and sustainable management of its diverse uses. The Intervale's agreement stipulates development rights and guarantees the conservation easement with clear restrictions for the use of the property. One of the mandates of the agreement is to keep an updated and comprehensive Land Management Plan which has to be approved by the grantees of the easement. Generally, the Plan requires outlining how the Intervale is going to: lease land for farms and other sustainable food-related enterprises; minimize any adverse impact on the soil and protect the quality of the water bodies; conserve and restore ecological sensitive areas for natural communities of plants, wildlife, and aquatic habitats; carry out sustainable forest management activities; keep an inventory and maintain the property's infrastructure and amenities for public recreational uses; and protect archeologically valuable sites in the property.

The Intervale's Land Management Plan (Intervale Center, 2009) together with their Forest Management Plan (Tobi, 2014), address all these criteria. Consequently, the land and natural areas stewardship mandate is an important part of the organization's day-to-day activities that has to be taken into consideration when assessing their 340-acre socioecological system.

Outreach Work – Farm Business Planning

The Intervale's outreach work consists of assisting small individual and family farms throughout Vermont. Through the Vermont Farm and Forest Viability Program (VFFVP), the Intervale provides farmers assistance over a period of two years to develop their business plans based on the area value-added food businesses' needs and connects famers with the market stakeholders. VFFVP also provides famers with expertise support in farm transfer planning, and related legal and regulatory expertise. The Intervale manages the Vermont Land Link, a farmland access portal and clearinghouse that helps to match farmers seeking land in Vermont with potential farmland owners looking to sell, lease or create other contractual arrangements. The VFFVP is supported and funded by the Vermont Housing and Conservation Board. Through the Beginning Farmer Business and Coaching program, the Intervale also offers new farmers business planning and consulting services, as well as one-to-one coaching sessions (Intervale Center (n.d.-e; Vermont Housing and Conservation Board, n.d.; Phillips et al., 2013).

Independent Farms (Leased Land)

Presently, the Intervale leases land to eight different organic farming-related enterprises that range from very small to medium size. According to the Intervale Center (n.d.-m), between 2011 and 2016, $6,800,000 worth of food was sold by the farms operating at the Intervale. Three of these farms are locally well-known vegetable farms and the largest tenants at the Intervale: Intervale Community Farm, Digger's' Mirth Collective Farm, and Pitchfork Farm.

Intervale Community Farm (ICF), the largest farm at the Intervale occupying 58 acres as of 2019, is a Community Supported Agriculture (CSA) consumer cooperative. ICF was the first CSA in Vermont and now is the largest in northeastern New England, serving more than 600-member households annually through summer and winter CSA shares. During the summer, ICF produces

more than 40 different types of vegetables and herbs, based on their website, including some fruits and flowers. This consumer cooperative started in 1990 with the mission to provide the Greater Burlington Area with "*an affordable source of fresh, high-quality organic produce*" (ICF, 2019a). The farm's long-term stewardship and governance are overseen by a nine-member Board of Directors elected by the cooperative members. It is managed by a paid staff of permanent and seasonal farmers. There are four full-time, year-round employees and a part-time year-round bookkeeper/administrator. Andy Jones, a locally well-known and experienced farmer, has been ICF's Manager since 1993. He has been past president and board member of the Northeast Organic Farming Association (NOFA-VT) and the Vermont Vegetable and Berry Growers' Association. The rest of staff is seasonal, usually with nine full-time employees and a few part-timers during high production season (ICF, 2019a, 2019b; Intervale Center, n.d.-f; Phillips et al., 2013; Jones, personal communication, 2019).

Diggers' Mirth Collective Farm is the third largest farm in the Intervale leasing and producing 16 acres in 2019. It was founded in 1992 and is a limited liability company (LLC), which means that the farmers collectively own and operate the farm. The collective had five owners with equal percentage ownership that operated the farm and two employees in 2019.[10]

The name Diggers' Mirth was derived from a British agrarian collective that operated in the mid-1600s. The original Digger's reclaimed abandoned land to grow food for themselves and the poor. Each year, Diggers cultivates over 25 different types of vegetables and fruits (including salad greens, cooking greens, herbs, roots, and what they call "other fun things") in approximately two-thirds of the field they leased. The other portion of the field is left in cover crops to ensure soil regeneration. Diggers sell to locally owned and organic-oriented grocery stores (e.g., Healthy Living and City Market Coop), the Intervale Food Hub, and to a significant number of local restaurants and catering services. On Tuesdays, they offer some home deliveries and pickups at two specific locations, one at the South End and the other in the Old North End neighborhoods. Additionally, Diggers' farmers participate in the Burlington Farmers Market on

[10] Though the owners have change throughout the years as they pursue other career opportunities, during my fieldwork I was able to meet three of the oldest and locally-well known collective owners: Hilary Martin, Dylan Zeitlyn and Elango Dev.

Saturdays (including pre-order pickups), and a smaller neighborhood market, the Old North End Farmers Market, on Tuesdays. Diggers initiated the Old North End Famers Market in 1992, the same year they founded the collective, with the aim of reaching out and selling their produce to their neighbours (the 'Diggers' have usually lived in the Old North End), as well as providing fresh food access at fair prices to the most economically and diverse neighborhood in Burlington (Diggers' Mirth Collective Farm, n.d.; Intervale Center, n.d.-h; Center for Agriculture and Food System, n.d.; Martin, personal communication, 2019).

Pitchfork Farm is also a limited liability company (LLC), and it is the second largest organic farm. They started to lease to the Intervale in 2006 as part of the Intervale's farm incubator program. In 2019, Pitchfork was leasing around 22 acres. The owners, farmers Eric Seitz and Rob Rock, focus on the local and regional wholesale market selling their produce directly to restaurants, grocery stores, the Intervale Food Hub, and other distributors in Chittenden County. Both, Seitz and Rock have a one-on-one business relationship with local chefs and food buyers. Throughout the years, Pitchfork has grown more than 80 varieties of crops. In 2019, they were growing 20 different crops, specializing in salad greens, roots, peppers, radishes, onions, herbs, and cabbages. Today, with the support of 10 to 14 crew members, depending on the time of the year, Pitchfork delivers twice a week and supply over 35 recurrent business accounts of various sizes in Burlington and regionally in Chittenden County. Most recently, Pitchfork has expanded its operations with an affiliate business, Pitchfork Pickle, specializing in fermented vegetables and hot sauces as value-added products from the farm. This affiliate business is led by July Irish, a Pitchfork Farm employee, who is now co-owner with Seitz and Rock of the pickle affiliated business in the Soda Plant on Pine Street (Pitchfork Farm, n.d; Pitchfork Pickle, n.d.; Intervale Center, n.d.-I; NOFA, n.d.-a; Pollack, 2019; Seitz, personal communication, 2020).

Presently, the Intervale leases land to five other smaller farms that cultivate a diverse variety of organic produce, as well as flowers and honey. These farms include Half Pint Farm (focusing on baby and specialty vegetables), Sugarsnap Farm (focusing on fruits and vegetables for its catering business), Hallow Herbs Farm (a very small medicinal herbs farm), June Farm (a small flower farm), and scattered around the Intervale, Franklin Heyburn's Bees beehives for honey production (Intervale Center, n.d.-j).

The Intervale also houses the Intervale Farming Equipment Coop (IFEC). This cooperative is owned collectively by the farms and the Intervale. They collectively purchase and manage farm equipment and greenhouses to reduce their individual overhead costs. In 2007, several of the farmers operating at the Intervale reached out to the non-profit concerning leasing space and equipment owned by the Intervale. With the support of the Intervale, they formed the IFEC and jointly made an initial purchase of over $130,000 (Maden, n.d.). The Intervale contributed with 35% to start the cooperative, thus, it owns the largest portion (Intervale Center, 2017c; n.d.-q). The 2019-2020 operating budget was not available but, according to Maden (n.d), in 2012 the operating budget was $80,000. In 2011 IFEC also started to lease from the Intervale the office, shop, and part of the land where the composting business enterprise used to operate before it closed (Maden, n.d.). In addition to the shop tools (e.g., hand tools, welder, power tools, air compressors), the farms own collectively two heated greenhouses, two tractors and twenty-five different implements (Intervale Center, 2017c, n.d.-q; Dunseith, personal communication, 2021).

Community Gardens (Tommy Thompson Community Garden)

The Tommy Thomson Community Garden (TTCG) is located in the Intervale but is part of the Burlington Area Community Gardens program under the jurisdiction of the Burlington Parks, Recreation, & Waterfront division (BPRW) of the City of Burlington. Community gardeners were already using the site for gardening even before the Intervale was funded in 1988. When the Intervale was funded as a non-profit and acquire the land to steward it through an agreement with the City of Burlington, the Intervale agreed to leave the TTCG under the jurisdiction of BPRW. The non-profit collaborates with the BPRW to ensure the site preservation for community gardening (Marcotte, personal communication, 2019). The TTCG presently occupies six acres based on 2020 geomatics (approximately 1.64% of the Intervale's property), and it is literally embedded in the Intervale's socioecological system.

The history of the TTCG goes back to the 1970s when inflation and an energy crisis brought government attention back to gardening in the United States. Families were urged to plant vegetable gardens. Lyman Wood, a visionary entrepreneur and gardening advocate, was committed to connecting local gardeners to underused and abandoned urban sites to develop

community gardens. In 1973, Wood established Gardens for All, a non-profit dedicated to promoting community gardening and education with Tommy Thompson as the Community Garden Director. Thompson helped to expand community gardens considerably in all Burlington by mid 1970s. By the end of the decade, Gardens for All started to focus its attention more on promoting community gardening at a national level. Nevertheless, in 1979 the organization hired Larry Sommers as the Burlington Community Garden Coordinator who, that same year, established the Intervale Community Garden with 20 plots. In 1983, the Burlington Area Community Gardens branched as a grassroot non-profit from Gardens for All and negotiated a 20-year leased for the Intervale Community Garden in 1985. In 1988 the Intervale Community Garden name changed to Tommy Thompson Community Garden in honor to Tommy Thompson who died in 1983. The then-Major of Burlington Bernie Sanders was a guest speaker during the dedication (Banister and Watts, 2018; Dwight, 2003; Flint, 2001; Burlington Parks, Recreation & Waterfront, n.d.-a, n.d.-b.; Vermont Community Garden Network, 2021).

The City of Burlington and the State of Vermont

The City of Burlington is located on the eastern shore of Lake Champlain, 45 miles (72 kms) south of the Canada-United States border. It is the most populous urban area in Vermont with a population of 42,819 based on the 2019 U.S. Census. Burlington is relatively small, consisting of 10.31 mi^2 of urbanized land in Chittenden County, the state's most populous county with 19 municipalities and a diverse landscape of farms, forests, water bodies, small cities, villages, and suburbanized areas. Burlington's population density is around 4,116 people/mi^2 and its racial composition is 85.3% White, 5.8% Asian, 5.7% Black or African American, 3.1% Hispanic or Latino, 2.8% two or more races, and 0.20% Native American. Other demographic data from the U.S. Census indicate that the median household income is $51,394, per capita income is $28,480, the average household size is 2.14 persons, and 53.3% has a bachelor's degree or higher education, and the poverty rate is 26.4% (U.S. Census Bureau, 2019a, 2019b; Hodgson et al., 2015).

The main economic activity in what is considered the Greater Burlington metropolitan area (Chittenden, Franklin, and Grand Isle counties) is not agriculture but manufacturing, specifically electronic and computer parts industries, supporting almost one-third of all

manufacturing employment in Vermont. It is considered one to the top emerging and innovation technology centers. Hundreds of small manufacturers' plants, both national and international, are located on The Greater Burlington producing a wide variety of products. The second largest economic source is the service industry (e.g., tourism, retail, government, education) with around 20 blocks of a mixed-use downtown district and the University of Vermont. Downtown Burlington is actually the second largest employment area in Vermont. Of the service industries, tourism is the largest (Advameg, Inc., 2021). Burlington has a reputation of one of the ten top 'food cities' in the United States (Livability-Journal Communications, Inc., 2010-2021).

According to the Vermont Agriculture and Food System Plan: 2020 (Vermont Agency of Agriculture, Food and Markets, and Farm to Plate, 2020), the state has a long history of agricultural production as a mostly rural state, where 78% of the land is forested (Lovell et. Al, 2010c). The 2017 U.S. Census of Agriculture indicates that Vermont has 1.2. million acres of land in farms and 6,808 farms, and most of the farms are between 10 and 179 acres (American Farmland Trust, 2021). Specifically, Chittenden County has 64,226 acres of land in farms, 585 farms with an average size of the farms being 110 acres (USDA, 2019). As depicted in Table 3.1, most farms in Chittenden County are small, between 10 and 49 acres (38%), followed by farms of 50 and 499 acres (29%). It is interesting to note that 42% of the farms have less than $2,500 in value of sales, indicating that the owners of these farms must have other sources of income, and most probably farm production and sales must be a sideline activity. Only 108 or 18% for the Chittenden County farms have a value of sales of more than $50,000.

Farms by Size	Number	Percent of Total	Farms by Value of Sales	Number	Percent of Total
1 to 9 acres	94	16	Less than $2,500	243	42
10 to 49 acres	224	38	$2,500 to $4,999	61	10
50 to 179 acres	169	29	$5,000 to $9,999	76	13
180 to 499 acres	75	13	$10,000 to $24,999	60	10
500 to 999 acres	17	3	$25,000 to $49,999	37	6
1,000 + acres	6	1	$50,000 to $99,999	38	6
			$100,000 or more	70	12

Table 3.1: Chittenden County Agriculture Profile
(Source: USDA, 2017, 2019).

Nevertheless, it should be noted that the state of Vermont was rated as having the strongest local food system in the United States: it has the highest farmers' market per capita as well as the highest rate of locals' participation in Community Supported Agriculture (CSA) than any other state (Vermont Agency of Commerce and Community Development et al., 2016). The total market value of agricultural products sold directly to consumers for 2017 in Vermont was $49,971,000. Direct selling activities to consumers promotes strong connections between producers and consumers. Also, the estimated total market value of products sold directly to retail markets, institutions, and food hubs for local or regional branded products is $54,134,00 (American Farmland Trust, 2021). Furthermore, from 2007 to 2017, the economic output of the state's food system grew from $7.5 billion to $11.3 billion, a remarkable 48% in ten years. Food manufacturing is the second-largest manufacturing industry in Vermont accounting for $3 billion or 26.5% of the economic output. Furthermore, data available from 2009 to 2018 reveals that 11,500 farms and food-related business in Vermont employ directly over 64,000 people. From 2009 to 2018, net new food system employment increased 11.2 % or 6,529 new jobs (Vermont Agency of Agriculture, Food and Markets, and Farm to Plate, 2020). Obviously, Burlington is ingrained in Vermont's effervescent food system economy.

In general, the residents in Chittenden County are very supportive of the local market and businesses, including the local food economy (e.g., farmers markets, farm-to-institution, and to-restaurant activities). Chittenden County is also home to the Northeast Organic Farming Association of Vermont (NOFA), one of the oldest organic farming associations in the United States. In Burlington, the University of Vermont its known nationally and internationally for its undergraduate and graduate programs in Food Systems (Growing Food Connections, n.d.; UVM, 2021).

The Intervale as Legacy of Progressive Politics

> "Burlington has long focused on civic and social leadership development and the results have been evident over years. It started nearly 30 years ago, with the election of Bernie Sanders, now a Vermont U.S. Senator, as Mayor on Burlington. Bringing a fresh perspective this was the turning point, or 'tipping' point. Ahead of the curve, there were points of focus such as an emphasis on sustainability" (Phillips et al., 2013:8).

The City of Burlington has been known as a politically progressive city. As Mayor (1981-1989), Bernie Sanders established Burlington's Community and Economic Development Office (CEDO) in 1983, with the mission to strengthen the local economy and to look after the city's neighbourhoods to guarantee quality of life, a healthy environment, and equity and opportunities for all citizens. To achieve its mission, the CEDO's economic development plan combines private sector's market-based approaches with the social and environmental aspirations of the public and non-profit sectors in order to promote a social economy, including within the local agri-food system, by helping to grow resources for small, grassroot homegrown, and cooperative enterprises. One of the 11 goals CEDO outlined in its 2010 Jobs & People IV: Towards a Sustainable Economy is to keep protecting and enhancing the Intervale's multi-use property, "the 200+ acre agricultural breadbasket – home to market farming, community supported agriculture, community gardens, farmer training, and composting" (Brooks and Schramm, 2010, p. 4; City of Burlington, n.d.; Phillips et al., 2013).

In 2000, the Vermont Progressive Party was established and, since then, numerous Progressives have been elected to the Vermont Legislature. Also, since Sanders was elected, Progressives held the mayor office in Burlington in every election but one until 2012. Currently, Burlington City Council has six Progressives, and one is the City Council President (Vermont Progressive Party, n.d.). Ergo, Vermont is one of the most progressive states in the United States, and when it comes to its food economy, it "has long been a national leader in promoting sustainable agriculture practices and local food" (Sawyer, 2017: 13). Also, Vermonters highly value their farmland and farming traditions. As Hillary Martin, co-owner and farmer of Diggers' Mirth shared (personal communication, 2019):

> "It's definitely a privilege to be a farmer in this community where people just really value, like love local food, local farms… It's the support, like literally pours in, into our markets, and it's great… We don't have to educate people because they're educating themselves. I mean, we participate in that, obviously, but it's not an effort for us. We just have to show up with the food and make it happen. And it's both on a wholesale level, chefs, at farmers' markets, the infrastructure, the city, the non-profits in the area, like there's so much supporting. That supports farms, and it's still growing and building. So, that's really amazing!"

A 2008 survey by Moser et al. (2008) for the UVM Center for Rural Studies revealed that the highest-ranked value by all respondents (97.2 %) was "I value the working landscape and heritage." In the same study, 69% of respondents agreed that they are highly concerned about "the health and viability of Vermont farms and the agricultural sector" (Moser et al., 2008). Fredrickson (2018) couldn't have said it better in the UVM Food Feed blog:

> "[I]n Vermont, saving farmland is a top priority. Drive any of the roads between Montpelier and Burlington and you'll find small farms galore that enjoy a rural lifestyle and still engage directly with the towns and cities they surround. These farms exist because of state policy that protect farmland, and that policy has fostered to pay affordable mortgages. With the help of these resources, Vermont farmers are often able to invest in multiple enterprises, bringing in more income and allowing them to market themselves to surrounding communities."

As Mayor of Burlington, Bernie Sanders was an important player in the institutionalization of the Intervale. Will Raap was able to move forward and start the Intervale Foundation with the support of Sanders' municipal government. Sanders also officially formalized the Burlington Area Community Garden Programs (BACG) under Burlington's Parks, Recreation & Waterfront division in the mid-eighties when BACG confronted funding issues as a grassroot non-profit (Levitt, 2011; Phillips et al., 2013; Burlington Parks, Recreation & Waterfront (n.d.-b).

Presently, the City of Burlington and the State of Vermont have many additional resources in place to support a successful sustainable local and regional food system. Burlington is home to City Market Onion River Coop, a locally well-known and successful community-owned coop that

started operating in 1973. As the Coop's website posits, by becoming a member "you are supporting a thriving local and healthy food system" because they carry over 2,500 local or made in Vermont products and they are "always looking for more" (City Market Onion River Coop, n.d. -a, n.b.-b). Burlington Farmers Market is also part of this locally striving food system. Since 1980, the Market, overseen by a Steering Committee composed mostly of local vendor members, is held every Saturday starting late spring to late fall. Other examples of key players in the sustainable agriculture and food movement in Burlington and Vermont are, in addition to Burlington's CEDO, UVM's Food System academic programs, BACG, NOFA and City Market Coop, the Vermont Land Trust, Vermont Sustainable Jobs Fund, and Vermont Farm and Viability Program through the Vermont Housing and Conservation Board. These organizations have all been working for years in various capacities to sustain agriculture and protect agricultural land from being developed (Daly, n.d.; Phillips et al., 2013; Wallace, 2020; Burlington Farmer Market, 2020; Vermont Land Trust, 2020; Vermont Housing and Conservation Board, n.d.; Vermont Sustainable Jobs Fund, 2021).

Furthermore, with the support of Burlington's CEDO in 1990, Vermont was the first state in the United States to establish a social responsibility non-profit association for business owners, the Vermont Business for Social Responsibility. This organization also houses the Local First Vermont Program to "preserve and enhance the economic, human, and natural vitality of Vermont communities by promoting the importance of purchasing from locally owned independent businesses" (Vermont Business for Social Responsibility, n.d.; Phillips et al., 2013). Likewise, Chittenden County Regional Planning Commission (CCRPC) and the City of Burlington, in collaboration with state agencies and the Vermont Sustainable Jobs Fund, are enabling innovative policy initiatives to strengthen the regional food system. These policy initiatives are focused on facilitating the production, processing, and distribution of food, as well as workforce training, via partnerships with non-profits and other organizations in the community. Some of these initiatives include Vermont Farm to Plate and its network, Hunger Free Vermont and its Hunger Council of Chittenden County, Burlington School Food Project, and the Urban Agriculture Zoning Regulation No. ZA-14-08 of 2014 to facilitate and regulate urban agriculture activities, among others (Growing Food Connections, n.d). According to Sawyer (2017: 10), Vermont Farm

to Plate system-level planning is “one of the most advanced and comprehensive and most relevant for building resilience at the level of communities,” and Vermont’s “relatively low population… makes its experience applicable to many communities and regions across the country.” Vermont Farm to Plate aims to promote economic development and jobs within the local agri-food system and enhance the access to healthy, locally produced food for Vermonters (Vermont Sustainable Jobs Fund, 2021a). The Vermont Sustainable Job Fund (2021b), another non-profit created by successful business leaders within the Vermont Business for Social Responsibility, partners with other non-profits, the state government, and private sector enterprises to also help create quality jobs and, at the same time, conserve and protect “Vermont’s social and natural environments as a primary means of maintaining economic vitality and the quality of life of Vermont.” An important goal of the Fund is to position the state as a sustainable development educational center “by greening its economy, promoting social justice and equity, and practicing stewardship of its natural environment” with the start-up, expansion and nurturing of micro and small business, especially in the growing sector of sustainability-related green businesses like sustainable agriculture, renewable energy, and environmental technologies, among others (Vermont Sustainable Job Fund, 2021b).

In short, Vermont in general and Burlington in particular have a strong agricultural heritage and flourishing local and alternative agri-food system that have developed through time, as well as a general communal aspiration for sustainability by conserving natural areas and farmlands, supporting local small business, and consuming locally produced and organic food (Lovell et al., 2010b, 2010c; Sawyer, 2017) (Figure 3.11). Burlington therefore becomes an ideal location to study peri-urban agroecology. Mandy Fisher, the Intervale’s Director of Development (personal communication, 2019), shared how important working lands and the environment is to Vermonters:

> “When you think about Vermont and the Vermont state song, and these green hills and silver waters, and the idea that our job as Vermonters is to live, to protect the natural beauty of our state… Everyone in Vermont values working landscapes, values our forests, our beautiful hillsides, our rivers. That’s Green Mountains.”

Figure 3.11: Context Matters!
(Source: M. Juncos-Gautier, 2019-2020)

As we will see in the next chapters, this valuing of the natural environment and working landscapes becomes quite significant in the implementation of comprehensive agroecology principles at the Intervale Centre.

4.

METHODOLOGY:
ASSESSING AGROECOLOGICAL PRINCIPLES

My research fills a gap in the literature related to the lack of empirical studies on the use of agroecological principles to assess the contextualized adherence of specific agri-food systems to achieve sustainability. My research also contributes to the understanding of how multi-dimensional and transdisciplinary agroecological principles may be put into practice (or praxis), especially in urbanized environments. With these contributions, my dissertation advances the global discussions on the use of agroecological principles and the study of urban agroecology – ergo, the use of an exemplary case study, the Intervale Center (hereafter the Intervale) in Burlington, Vermont. My specific research questions are: Is the Intervale a peri-urban agroecological organization? If yes, then why and how? And based on an extensive assessment of agroecological principles, if yes, what are the challenges and opportunities to strengthen agroecology at the Intervale?

Accordingly, based on my research questions and desired contributions, my qualitative and multimethod case study uses as conceptual framework the principles of agroecology to conduct a baseline and in-depth utilization focus and principles-based analysis (inspired by Patton, 2018, 2015a, 2015b) using participatory action research (PAR) to engage participants as co-investigators in the research process. This particular methodology allowed me to gain a thorough understanding of urban agroecology within a specific socioecological context in an urban/peri-urban community and organization, and mainly from the perspectives of those having the experiences in the field. I also use multiple qualitative data collection methods to add greater breadth with cross-validation (Kim et al., 2017; Méndez et al., 2017, 2016; Patton, 2015b; Lambert and Lambert, 2012; Greene, 2015; Hunter and Brewer, 2015; Maxwell et al., 2015; Hyett et al., 2014; Creswell, 2014; Zucker, 2009).

The Intervale Center is a single, instrumental, and critical concept-focused information-rich case (Patton, 2015; Onwuegbuzie and Collins, 2007; Yin, 2003; Zucker, 2009) of peri-urban farming

in the United States. As an exemplar landmark case in Burlington, Vermont, the Intervale and the farms it supports are already showcasing important features around the topic of my research, urban agroecology. For example, according to Berman (2011: 10), the Intervale has a "national and international reputation as a model for successful community food system development." Furthermore, Shuman et al. (2009) posit that the Intervale is one of the most important international community-based food enterprises that have revolutionized and advanced the social, economic, and environmental impact of local foods. Since its foundation in 1988, the Intervale has helped improve peri-urban farmland accessibility and viability through organic farming and land management practices. It has also worked with Vermonters to strengthen the local and regional community agri-food system by holistically integrating into its mission the environmental, social, economic, and nutritional aspects (Berman, 2011; UVM and Shelburne Farm, n.d.-a, n.d.-b). As Reno (1993: 1) propounded almost three decades ago, the Intervale is an "unusual 'urban wilderness' sitting on the edge of a densely populated Burlington area, is a wildlife refuge, the city's last local farmland, and a much-needed expanse of natural beauty and outdoor activity." Thus, studying the Intervale has presented an opportunity to directly assess the use of agroecological-related principles and their contextualized and practical expressions in and around a particular urbanized environment. And as Patton (2015: 313) argues, "[t]he validity, meaningfulness, and insights generated from qualitative inquiry have more to do with the information richness of the case selected and the observational/analytical capabilities of the researcher than with the sample size."

My fieldwork was conducted between March 2019 and October 2020 at the Intervale's managed property of about 340 acres that served as contextual bounds of the organization's socioecological system. This bounded jurisdictional system provides a unique and coherent opportunity to study the principles of agroecology at a larger landscape spatial scale which goes beyond a specific farm field or small interest group to include multiple stakeholders or other key users of the Intervale's resources (Cockburn et al., 2019, 2020a, 2020b; Prager et al., 2012) As Prager et al. (2012: 1) explain, a landscape scale "refers to a spatial scale above the field-, farm- and local scale; it can be a catchment, an area of coherent landscape character or a sub-unit of a natural region." The Intervale provided not only a coherent 'relational hub' of social networks

(Cockburn et al., 2020a) but also a coherent natural sub-unit recognized and delimited by the local community (Prager et al., 2012; Cockburn et al., 2019) of the Winooski River's floodplain forest. This relational hub supports an agroecosystem and socioecological system managed for multifunctional activities that include the production and distribution of food, the protection of natural resources and their environmental benefits, and the access to open natural spaces for the passive recreation of the community.

Participatory Action Research (PAR) Approach

My professional work has always been focused on achieving tangible and practical outputs to advance changes in particular situations or to benefit a group of people. Also, I strongly believe in working directly with non-academic community members and in incorporating their perceptions and subjective experiences, especially within their situated socio-cultural knowledges and realities. That is to say, I have a strong pragmatic and constructivist worldview. Rooted in this worldview, my research co-creates praxis-driven insights by foregrounding the voices of participants-practitioners, as well as meeting their interests and needs. A participatory action research (PAR) approach facilitated this process. As a people-centered and community-based approach, PAR puts participants and researcher(s) working together as co-investigators for reciprocal knowledge exchange (Sandover, 2020).[11] Even though PAR has many interpretations, it is overall a collaborative approach that incorporates democratic bottom-up participation of stakeholders from the beginning of the research endeavor, with the aim of encouraging critical, actionable co-creation of knowledge through respectful "*dialogo de saberes*" [wisdom dialogues] that can lead to positive change and emancipation. PAR interweaves research, reflection, and action, as well as theory and practice in a non-lineal but progressive iterative cycle to empower participants and find practical solutions to specific situations, with a focus on locally defined priorities and perspectives. Also, PAR pays special attention to the diversity of opinions, especially the voices of those who are usually marginalized (People's Knowledge Editorial Collective, 2017; Méndez et al., 2016, 2017; Kindon et al., 2007a, 2007b, 2007c; Reason and Bradbury, 2006; Bacon

[11] The Agroecology and Livelihoods Collaborative (ALC) of the University of Vermont, where I worked as a Research Associate while doing my research fieldwork, uses a PAR research approach in most of their projects.

et al., 2005; Cornwall and Jewkes, 1995). Furthermore, since agroecology is also defined as a transdisciplinary field with a participatory and action-oriented approach for the integration of different type of knowledges (Méndez et al., 2016), the use of PAR in my research was paramount.

My research was fortuitously part of a larger agroecological, and also PAR-driven research project conducted by a team from the Agroecology and Livelihoods Collaborative (ALC) of the University of Vermont. The research project, entitled *Performance of Agroecological Principles in Urban/Peri-Urban Agriculture in Burlington, Vermont* (UPAE project), sought to identify and analyze how selected agroecological principles are applied within the context of urban/peri-urban agriculture in Burlington, Vermont. The Intervale Center was one of ALC's many research partners in this project. Thus, our collaborative interest resided in using PAR to advance agroecological research for urban agroecology. My goals and those of the ALC align in that we both seek to better understand how agroecological design and management can support farming initiatives in urbanized contexts across North America. As part of this ALC's larger UPAE project, my research in the PAR iterative cycle serves a baseline diagnosis to understand the potential the Intervale may have as a peri-urban agroecological endeavor and example.

This chapter is divided in four sections to explain my qualitative multimethod research. The first section, **Visual Material Methodology**, describes the primary visual tool I used to lead my research and engage participants in the PAR process. The second section, **Participants Sample and Subsample,** describes my purposive sample and subsample, and the criteria for their selection within the case study. In the third section, **A Multimethodological Approach,** I provide a description of my data collection methods, including the rationale behind the use of PAR with engaging visual materials and exercises, in addition to my participatory observation process. The fourth section, **Data Analysis Process,** describes how I conducted the analysis of data using coding as well as document analysis.

Visual Material Methodology

To frame and guide my research, I used the fifteen agroecological principles as synthesized and proposed in 2018 by the international non-for-profit organization *Coopération Internationale pour le Développement et la Solidarité* (CIDSE) (see Figure 4.1). CIDSE is a network organization (based in

Brussels, Belgium) that facilitates the collaboration of Catholic development agencies in Europe and North America. They work an array of countries and territories worldwide, and their mission is to "serve the poor, promote justice, harness the power of global solidarity, and create transformational change to end poverty, inequalities, and threats to the environment both global and local" (CIDSE, n.d). CIDSE' infographic presents fifteen agroecological principles organized along economic, political, ecological and socio-cultural themes.[12] I assigned a number to each principle to facilitate identification and discussion with participants during my fieldwork.

The selection of CIDSE principles as the basis for my conceptual and analytical frameworks is based on an extensive review and discussion of different proposed frameworks of agroecological principles. Using the CIDSE's framework was 'tested' with the Intervale's managerial staff in a PAR "preflection" phase and selected to continue with the research. "Preflection", as explained by Méndez et al. (2017), is a term use by researchers in experiential learning processes and adapted by ALC to describe the first phase of the PAR iterative cycle where the researchers and participants discuss the research topic(s) of mutual interests, establish expectations, discuss limits (e.g., time, availability, budget), build trust, refine the research questions and framework to be used, and plan and prepare to start the research. In this "preflection" phase, it was decided that CIDSE's principles-based framework facilitated a comprehensive discussion and analysis of agroecology as a multidimensional field around an easy-to-understand visual representation of such principles attractively synthesized to engage the different actors in the research process. As Kapgen and Roudart (2020: 12) posit:

> "A negotiated and agreed-upon set of principles could provide a framework within which to assess and compare agroecological experiences (at least for those agreeing on the principles), and also to evaluate their effect, meaning that agroecological projects could better be held responsible for their impact. Knowing which principles have been adopted, how they have been interpreted and implemented and by whom, can help in retracting the decision-making process, and evaluating the 'degree of agroecology' met by a given project."

[12] See Table 2.3 which has a brief explanation of the 15 CIDSE principles (CIDSE, 2018).

Figure 4.1: CIDSE infographics of Agroecological Principles (CIDSE, 2018)

Participants Sample and Subsample

I divided my purposive sample of participants into two groups: an initial group of 30 participants and a subsample of 15 participants. The purposive sampling scheme (i.e., non-random and non-probabilistic) was centered on the research questions and the selected conceptual framework of agroecological principles to augment relevant data collection at the Intervale site. I wanted to draw rich information from a critical case and criterion-driven category of actors to be able to obtain empirical data and maximize insights on my research topic (Patton, 2015b; Onwuegbuzie and Collins, 2007; Onwuegbuzie and Leech, 2007a, 2007b; Curtis et al., 2000), especially in relation to the Intervale's particular practices within its bounded agroecosystem/socioecological system, and as a possible exemplification of urban agroecology.

This first group of 30 participants included 15 men and 15 women within a wide variety of ages, ranging from 25 to 80. Twenty (20) people were initially recommended by the Intervale's Land Manager. Some of the suggested people did not respond to my communications. As I started my fieldwork in the late spring of 2019, reasons for not responding might have been related to the fact that my fieldwork corresponded to their busy growing and harvesting seasons, and some likely did not see the benefit of participating in a research project when they needed to focus on their production and businesses. As my fieldwork progressed, I was able to find other participants using a combination of snowball (i.e., with the help of participants) and convenience (i.e., individuals who showed interest and willingness to participate) sampling methods (Onwuegbuzie and Collins, 2007; Onwuegbuzie and Leech, 2007a, 2007b). Nevertheless, I made sure that the mix of participants was information-rich and strongly involved (past or present) with the Intervale. Participants identified and selected in this first and larger group included: 14 employees and one recent former employee at the non-profit, as well as 15 community members that use the agroecosystem for business activities, leisure, or as collaborators in different activities. The 15 community members were comprised of 4 farmers from different independent farms that currently lease farmland at the Intervale but run their own enterprises, 1 farmer that used to lease land for more than 10 years but moved their farming enterprise to Charlotte (a town in Chittenden County), 6 community gardeners that grow food and flowers for their families and friends at the Tommy Thompson Community Garden located inside the property, and 4 other community members that collaborate in different

community-related activities within the non-profit's socioecological system under at least one of their main programmatic areas: Farms, Land and People. Among the 14 employees interviewed, 3 worked outside the Intervale's agroecosystem to strengthen farm businesses and land conservation initiatives across Vermont. It is important to highlight that the people who are not on the non-profit payroll but that use the property constantly (i.e., the farmers) or frequently (i.e., the community gardeners and other community collaborators), as well as the former independent farmer and non-profit employee, add to a total of 16 participants. This group of non-employees were able to provide different and more objective perspectives and opinions of their experiences and of the practices at the Intervale's socioecological system. This sample of informed and experienced interviewees was necessary and best-placed to assess agroecological principles.

The second group is a subsample of fifteen key participants/informants (n=15) selected to engage in additional visual exercises (see below). My objective with this subsample was to attain more in-depth insight and data redundancy or saturation of my case study from which the sample was drawn (Onwuegbuzie and Collins, 2007; Onwuegbuzie and Leech, 2007a, 2007b). This subsample was selected based solely on their eagerness (and availability) to further engage in the research process. Their responsibilities and activities, however, represented at least one of the main programmatic areas at the Intervale, including the members of the Administration and Development (A&D) team.

All participants were white people born in the United States, except for two 'New Americans', both beneficiary of the 'New Farms for New Americans' program of the Association of Africans Living in Vermont, a social service agency for refugees and immigrants living and working in Vermont. One of the 'New Americans' was from Burundi, Africa, and the other requested anonymity. More than half of the white participants were natives of the Northeast region of the United States. The subsample was composed of nine men and six women. Except for a New American, all participants waived confidentiality.

The Intervale's main component areas as a socioecological system, and the respective roles of the participants (of the sample and subsample groups) are presented in Figure 4.2. The list of the participants with additional demographic information collected from the interviews is provided in Table 4.1.

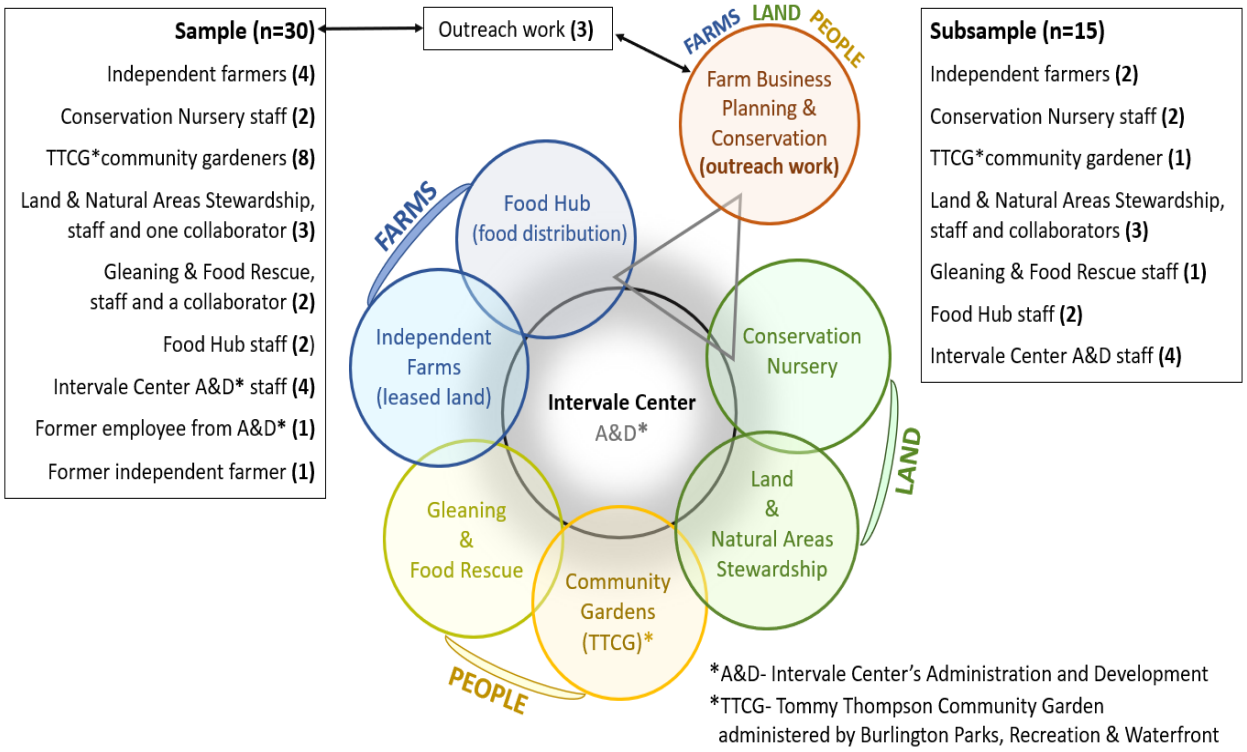


Figure 4.2: The Intervale Socioecological System's Components
with Sample and Subsample of Participants

Programmatic Areas	**Participants** (and birthplace)	**Job position/activities at Intervale (as of 2019-2020)** (yrs. Of work/relationship with Intervale)	**Educational Background**
FARMS	**Andy Jones** (Washington State)	Farm Manager, Intervale Community Farm (lease land) (16 yrs.)	Geology
	Hilary Martin (Vermont)	Co-owner and farmer, Diggers' Mirth Collective (lease land) (17 yrs.)	Environmental Studies
	Eric Seitz (Ohio)	Co-owner and farmer, Pitchfork Farm (lease land) (14 yrs.)	Forestry, Development and Applied Economics (International Community Development)
	François Gasaba (Burundi)	Farmer, New Farm from New Americans (lease land) (12 yrs. In USA)	Agricultural school in Burundi, 2 years in technical mechanical school
	Adam Hausmann & Jessica Sanford (n/a)	Former farmers (leased land), own Adam' s Berry Farm, Charlotte VT (12 yrs.)	Environmental Studies, Biology, Education and Environmental Studies (graduate).
	Keith Drinkwine (New York)	Purchasing and Quality Assurance Manager, Intervale Food Hub (7 months)	Environmental Studies, Public Policy

	Brian Teed (Connecticut)	Operation Lead, Intervale Food Hub (3 yrs.)	Environmental Studies
LAND	**Patrick Dunseith** (Connecticut)	Land Manager, Intervale (1.5 yrs.)	Plant and Soil Science, focused Ecological Agriculture
	Duncan Murdoch (Vermont)	Natural Areas Stewardship Coordinator, Intervale (4 yrs.)	Studio Art, Certification in Nature and Forest Therapy
	Dan Cahill (Ohio)	Land Steward, BPRW[13] (18 yrs.)	Public Outdoor Recreation Management
	Mike Ingalls (Vermont)	Manager, Intervale Conservation Nursery (11 yrs.)	Applied Sciences, Horticulture and Landscape Design
	Maddie Cotter (Massachusetts)	Production and Volunteer Coordinator, Intervale Conservation Nursery (3 yrs.)	Environmental Studies
PEOPLE	**Hanna Baxter** (New Hampshire)	Manager, Intervale's Gleaning and Food Rescue Program (new, 2019)	Environmental Studies
	Fred Schmidt (New Jersey)	Community gardener and volunteer coordinator/educator, TTCG[14] (10 yrs.)	Community Development (PhD)
	Andrea Solazzo (Florida)	Agriculture and Community Outreach Manager, Vermont Foodbank (3 yrs.)	Political Science
	Carolina Lucak (Mexico)	Garden Education Manager, Vermont Community Garden Network (4 yrs.)	Environmental Studies, minor Art History
	Megan O'Brian (Vermont)	Community Outreach Coordinator, Burlington Area Community Garden Program, BPRW (3 yrs.)	Anthropology
PEOPLE	**Wendy Coe** (Connecticut)	Head Volunteer Site Leader and community gardener, TTCG (34 yrs.)	Clothing, Textiles and Design
	Ron Krupp (Kentucky)	Community gardener and volunteer coordinator/ educator, TTCG (20-25 yrs.)	Teaching and Sustainable Agriculture
	Bob Kiss (Wisconsin)	Community gardener and former Mayor of Burlington (2006-2012), TTCG (more than 30 yrs.)	Political Science
	Anna Stevens (Vermont)	Community gardener, TTCG (2 yrs.)	Sociology, Gender Studies
	New American (n/a)	Community gardener, TTCG. Only participant that preferred anonymity.	
ADMINISTRATIVE & DEVELOPMENT	**Carolyn Zeller** (Colorado)	Administrative Coordinator, Intervale (3.5 yrs.)	Animal Science (2 years of college)
	Travis Marcotte (Vermont)	Executive Director, Intervale (14 yrs. As employee, 10 yrs. As Executive Director)	Community Development and Applied Economics, International Agricultural Development
	Mandy Fisher (Delaware)	Director of Development and Special Projects, Intervale (13.5 yrs.)	Anthropology

[13] Burlington Parks, Recreation & Waterfront (BPRW)
[14] Tommy Thompson Community Garden (TTCG) at the Intervale.

	Abby Portman (New Jersey)	Community Relations Coordinator, Intervale (3 yrs.)	Sustainable Food Systems
	Chelsea Frisbee (New York)	Former Development Manager, Intervale (7 yrs.)	International Studies

OUTREACH: FARM BUSINESS AND CONSERVATION	**Sam Smith** (Vermont)	Farm Service Director, Intervale (6.5 yrs.)	Environmental Studies, focus Land Conservation, MBA in Sustainable Innovation
	Annalise Carington (Texas)	Conservation Specialist, Intervale (2 yrs.)	Biology, Ecology and Conservation
	Stacy Burnstein (New York)	Community Agriculture Specialist, Intervale (5 yrs.)	Political Science, Education

Table 4.1: Participants: Purposive Sample (White) **and Subsample** (Green)
(Note: Three of the participants work mostly outside the Intervale's property (outreach work), thus, there are considered separately)

For the purpose of the qualitative analysis of the interviews with coding and the triangulation phase, as I explain later in the Data Analysis section, I did not include the three employees that work outside the 340-acre property as part of the outreach work done by the Intervale to support other farmers in Vermont. Even though the information they provided is important to understand the Intervale's role and influence in the surrounding community and the state, I focused my analysis on the participants and examples they provided on the property they manage in Burlington. Also, one of the participants, a New American that did not want to be identified or voice recorded, was not included since I was not able to transcribe the interview. Thus, for the data analysis phase my sample was reduced to 26 participants.

A Multimethodological Approach

My multimethodological approach was three-prong and included one-to-one semi-structured interviews, a focus group which I called a "Reflection Meeting", and participant observation. My case study design consisted of two parallel streams of inquiry with these surveying methods. One stream was conducting the interviews with all the participants as part of the PAR process to examine, map, and take pictures of the expression of the agroecological principles within the Intervale. I called this stream the practitioners' stream of investigation while I refer to the second

stream as the theorist's stream, the one I did by myself, engaging in participant observation (Figure 4.3).

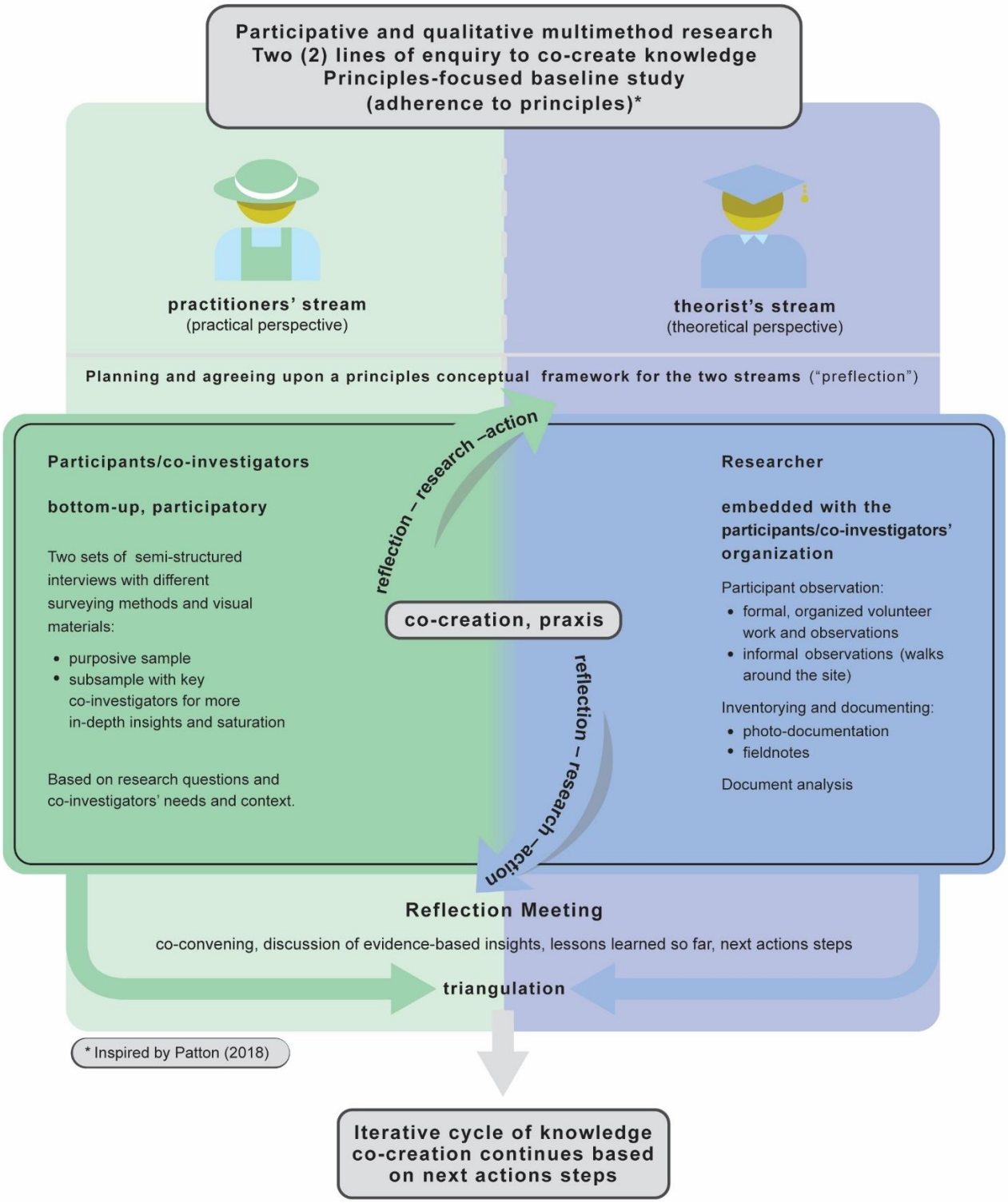


Figure 4.3: Visual Synthesis of Research Design
(with the two streams of enquiry for the intermix and co-creation of knowledge)

The idea for the two streams or lines of inquiry was inspired from what has been termed as "systemic action research" (SAR) following Flood (2006, 2010), Ison (2008), and Burns (2014, 2012, 2007). The mixing of these two perspectives, both important constituent parts of my research process, served for sense-making, identifying resonance or convergence, and revealing praxis. It provided a much more comprehensive and richer study in relation to the principles. Also, it helped to reduce knowledge hierarchy between the "thinker" (me as researcher/theorist) and the "doers" (participants/practitioners/co-investigators). By "blurring the boundaries between thinking and doing", the "great divide" between scholarly and popular knowledge was broken for synergy and "coproduction" (Ostrom, 1996: 1073), which is "an essential step for understanding the situated experiences of placed-based communities" of practice (Sandover, 2020: 14). As Paulo Freire (2001: 10) asserts, "critical reflection on practice is a requirement of the relationship between theory and practice. Otherwise, theory becomes simply 'blah, blah, blah,' and practice, pure activism".

Under the practitioners' stream, the research took the form of a PAR iterative research-reflection-action approach with representatives of the Intervale's farming community acting as co-investigators. The process facilitated the co-creation of understanding and knowledge as we, together, discovered new information and learned as the fieldwork progressed. Furthermore, PAR provided a comprehensive perspective of the agroecology principles by interweaving critical reflection with theory and praxis-driven information. Such an approach also helped me to collect a diversity of opinions based on participants' particular and contextualized interpretations of the different agroecological principles through their practices at the Intervale. The respectful acknowledgment and integration of the local and unique knowledge of community members, as co-investigators in the process, is an integral part of the PAR iterative cycle and is at the heart of educating about and practicing agroecology. As stated in the Declaration of the International Forum for Agroecology in Nyéléni, Mali (International Forum for Agroecology, 2015: 164-165), agroecology "is not a mere set of technologies or production practices. It cannot be implemented the same way in all territories. Rather it is based on principles that, while they may be similar across the diversity of our territories, can and are practiced in many different ways**,** *with each sector contributing their own colors of their local reality and culture*" (my emphasis).

Furthermore, the ontological underpinning of PAR is that all human beings are "dynamic agents capable of reflexivity and self-change" and, epistemologically PAR "accommodates the reflexive capacities of human beings within the research process" to inform action for positive change (Kindon et al., 2007c: 13). As a qualitative researcher, I acknowledge the complexity of the human appreciative apparatus and the activities they create around them. Thus, the engagement of the Intervale's diverse and pivotal community members since the beginning of my fieldwork was uppermost. Again, departing from my pragmatic and constructivist standpoint, this "soft" approach (Flood, 2010; Cabrera et al., 2008; Bunch et al., 2008; Ison, 2008; Checkland and Poulter, 2010, 2006; Wilson, 2001; Checkland, 1999; 1985; Jackson, 1985), grounded in PAR to deal with the "appreciative system" (Vickers 1983) and "organized use of rational thought" (Checkland, 1985) of the participants was the perfect way to investigate and comprehend the Intervale's unique and intricate socioecological farming community. Moreover, PAR allowed me to examine the particular cognizance and possible use of agroecological principles in their daily practices (i.e., the expert practitioners).

In the second stream of inquiry, the theorist's stream, I engage in the activities of the participants at the Intervale as an active participant-observer. I did so because, as Lindlof and Talyor (2011: 136) state, "[t]he value of participatory observation derives from researchers *having been there and done that*" (original emphasis). As a qualitative researcher, I know that I am not a value-neutral observer since it is impossible to stay completely objective and detached when dealing with social interactions in a research project. As part of their progressive political stance, most PAR practitioners acknowledge this reality and turn away from positivistic interventions in communities. Thus, by practicing PAR not only did the participants became co-investigators in the reflection-research-action iterative dynamic, but I became a participant in the whole experience (Burns et al. 2012; Kindon et al., 2007a, 2007b, 2007c; Reason and Bradbury, 2006; Fals-Borda, 2006; Checkland and Poulter, 2006; Beacon et al, 2005; Checkland, 1999; Cornwall and Jewkes, 1995).

Assessing, Mapping and Photovoicing Principles

The practical strand of inquiry with the participants consisted of two sets of one-to-one semi-structured interviews for a total of 41 interviews (26 in the larger sample and 15 in the subsample). Each interview lasted on average one and a half hours and were voice recorded. Interviews were conducted during weekdays from 8:00 a.m. to 7:00 p.m., according to the availability of participants. In the first set of interviews, all 26 participants from the purposive sample were asked about their professional background and length of time involved in the Intervale. After reviewing the goals of this research and the CIDSE principles, participants shared their background and were allowed to ask questions about the research and the principles. They were also given a copy of the CIDSE's infographic with the agroecological principles. Interviewees were then asked to select (and mark with color markers) the CIDSE principles they followed in their daily practices and perceived as present or manifested at the Intervale. I also asked them to explain the reason for their selection and provide at least one concrete example per principle marked. This first exercise with CIDSE's principles as framework provided a mental image or "visual narrative" (Barrios et al., 2020) of the socioecological system with its different components at the Intervale. Participants were encouraged to use their lay and professional insights based on their personal observations and work experiences, as well as mark the principles they thought were areas for opportunity and improvement at Intevale. The data provided by this group constitute the bulk of the primary data for my evaluative analysis.

To complement and enrich the analysis around the CIDSE principles, I also conducted a mapping exercise with the subsample of 15 key participants. I provided to this subgroup a 2016 satellite image of the Intervale site (the most recent satellite image available from the National Agriculture Imagery Program [NAIP] of the United States Department of Agriculture at the time of research) alongside a modified landcover/land use map (Figure 4.4). The NAIP 2016 satellite image was georeferenced with the Lovell et. Al. (2010b) land features/land use map of the Intervale with some minor but key 2019 updates. The mapping exercise allowed an aerial view of the property's bounded agroecosystem. It facilitated a visual ground-truthing or 'scouting for evidence' exercise by locating and marking on the map where the agroecological principles are

manifested or practiced at the Intervale. Participants used CIDSE infographic as reference (Figure 4.1).

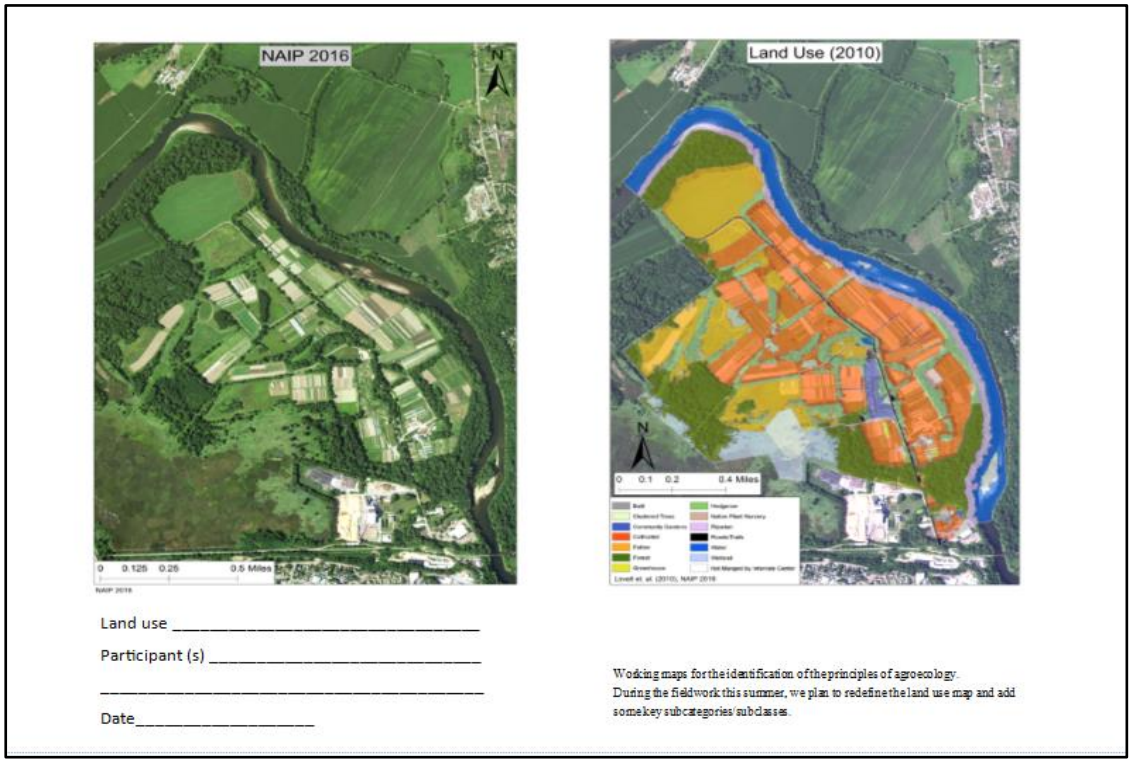


Figure 4.4: Mapping the Intervale's Land Cover/Land Use
(NAIP, 2016; georeferenced Lovell at al., 2010b)

To gather more empirical data from the participants' perspectives and for data saturation purposes, I conducted a second set of one-to-one semi-structured interviews with the subsample to practice a photovoice exercise, adapted from Wang and Burris (1997). Photovoice is a qualitative method created by Caroline C. Wang and Mary Ann Burris in the 1990s and used for community-based participatory research. Community members take and share photos to document and reflect on their realities, strengths, challenges, and concerns as part of the participatory research process. The purpose of photovoice is to promote awareness, critical analysis, and dialogue among participants with the help of visual images of their community, produced and shared by the community members themselves, and to help diagnose important issues and stir collective grassroots action for change. Wang and Burris (1997) developed this creative method for participatory needs assessments. This subgroup of 15 participants was given a

one-page instructions for the photovoice exercise as well as an email address to send the photos. Participants were asked to take at least 10 photos (with their cellphones) of their daily practices or particular activities, or property features at the Intervale that exemplify the agroecological principles. They were also allowed to use pictures they had taken in the past. About a month later, I met with each of the 15 participants to discuss the photos they sent me via email. I printed their photos with a caption space. During the interview, participants explained their photos as visual evidence of the expression or practices of the principles and connected their explanations with one or more principles. In addition, participants wrote in the caption area of each photo the principle(s) they depicted by using as reference, again, the same CIDSE infographics (Figure 4.1). Lastly, they used the satellite image and landcover/land use map of the site to mark where photos were taken.

The three visual identification exercises (CIDSE infographics of agroecological principles, the landcover/land use map, and the photovoice) facilitated "seeing" the socioecological system as well as the agroecosystem with their interrelated constituent parts to facilitate a systemic perspective for change (Burns, 2007, 2012, 2014). The aim was to cover a larger ground to later facilitate interventions in as many components as possible if the Intervale wanted to follow the path of agroecological transformation (Gustavsen, 2003; Anderson et al., 2019, 2021). Figure 4.5 provides a clear step-by-step synthesis of the visual exercises with the subsample of participants.

I completed my fieldwork with a 'Reflection meeting' with the subsample of 15 key participants on February 14, 2020. In this focus group, I collected the experiences of participants as co-investigators and provided a final opportunity to reflect on the principles as a group. The session was facilitated with the support of members of the ALC team, who also know the Intervale staff well. For that meeting, I prepared an exhibit with poster boards, showing some examples of the visual materials collected through the interviews. This exhibit helped participants to recall how they had contributed to the research process over time (Figure 4.6).

The poster provided space to gauge each principle using three basic ordinal scales to facilitate an easy and fast reflective exercise: 'super' as in "we believe we are doing excellently with this principle"*;* 'good' as in "we are doing OK with this principle, but there is always some room for improvement" and 'opportunity' as in "we have the opportunity to work on improving this principle." Participants used dot stickers to gauge the principles using these ordinal scales. After

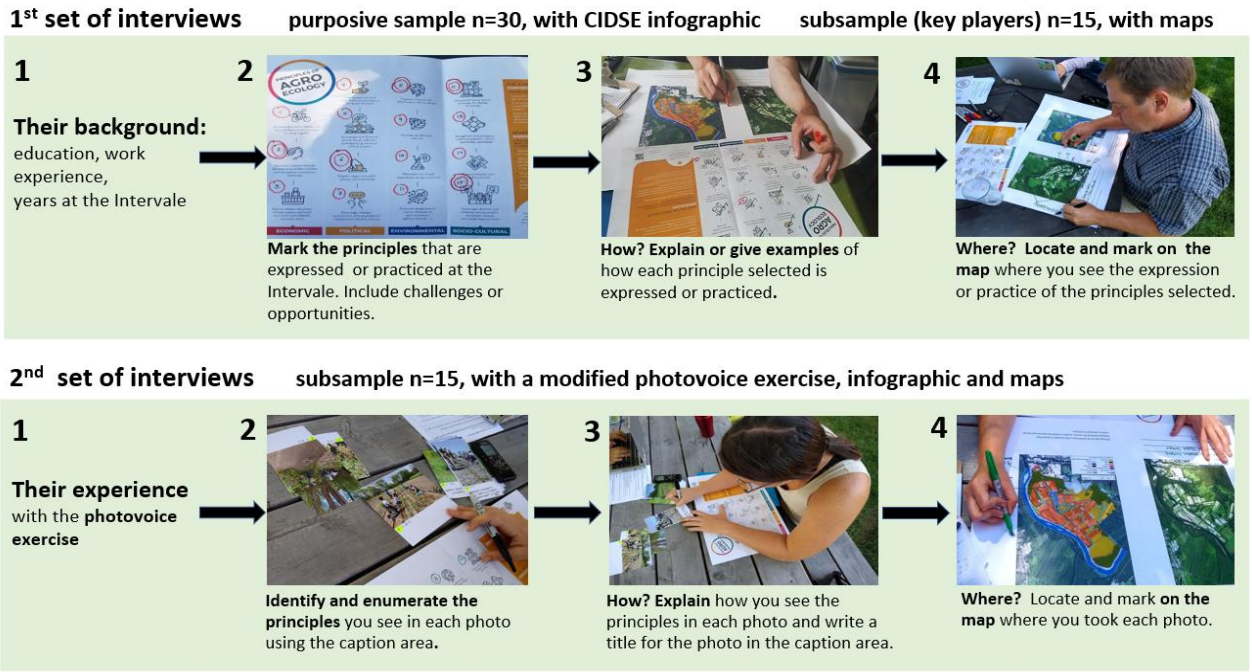


Figure 4.5: Participants Engaging Exercises with Visual Materials

Figure 4.6: Reflection Meeting's Exhibit with Participants' Inputs on Visual Materials

this exercise, I briefly shared the general observations of my participant-observer fieldwork using preliminary and simple graphics. The graphics showed both the total frequency of responses on the visual materials collected as well as the total frequency of my observations per principle based on my fieldnotes. The objective was to generate additional discussion and collective deliberation in a brief plenary session by making an initial cross-validation of their inputs with my observations. Participants were finally asked to identify at least three principles representing areas of opportunities to reflect on and to recommend the next action steps for

the Intervale. The group was divided into three smaller subgroups based on the principles they were most interested in. The reflection meeting concluded with the subgroups presenting their recommendations on the next action steps needed to advance the principles they selected at the Intervale (Figure 4.7).

Figure 4.7: Reflection Meeting's Final Collective Assessment

Participant Observation

Parallel to the interviews, I spent time inventorying and photo-documenting the Intervale's practices through participant observation. I engaged in the Intervale's volunteer program from June to October 2019 (at least once or twice a week during the busiest time) and once a week in in the summer months of June and July 2020 (under COVID-19 pandemic public health measures). I volunteered in most of the organization's programmatic areas and activities organized by the Intervale. I completed 81 hours of volunteer work mostly during weekdays and work hours, and sometimes Saturdays for the Intervale Conservation Nursery. My main volunteer tasks included: packing fresh produce in the Intervale Food Hub's baskets to distribute to the local community; weeding manually at the Gleaning and Food Rescue program's People Gardens and at Digger's' Mirth Collective Farm; watering native plants at the Conservation Nursery's greenhouse on Saturdays; building live fascines (with long wood branches that are cut and bound together cylindrically) to fill shallow trenches, marshy grounds, and also build retaining walls or embankment to help reduce erosion and restore eroded riverbanks; serving as trail steward to help clear and maintain the trail in the forest along the river and provide information to people

walking on the trail; and supporting the Intervale's staff with logistics for Summervale, the organization's local food and summer music festival celebrated every Thursday evening in July and August (Summervale is part of the organization's community-building and fundraising activities, a percentage of the proceeds from the food vendors go to the entity). Additionally, I walked the property during workdays to observe the activities unfolding at the Intervale and their possible connections to the principles. I spent around 40 hours documenting the case study with photos and fieldnotes (at a non-intrusive distance) following the daily practices at the different land cover/land uses of the property (Figure 4.8). For example, I was able to observe and document the activities of the gardeners/farmers at the Tommy Thompson Community Garden and at the different independent farms. I visited several times the Intervale Community Farm's community supported agriculture (CSA) on pick-up days to watch members of this community cooperative meet and pick-up weekly produce. I also visited the Intervale's Fair Share pick-up day on Monday that gives away around 6-8 pounds of fresh, locally-produce vegetables every week to income eligible individuals and families as part of the organization's Gleaning ad Food Rescue program. I explored the trails and forested areas in mornings and afternoons, watched the operational and business-related activities at the Intervale Food Hub, attended some of the Summervale events to experience the local food and music with other community members, and participated in some public tours of the property. Every evening I reviewed, edited, and transcribed my fieldnotes, and selected the best photos of that particular day, organizing them by day and activity, and annotating the relevant principle(s).

Geomatics

For the development of the maps used in my dissertation, I worked directly with two colleagues of the University of Vermont, both with previous experience with mapping and geographic information systems (GIS). The output 0.5-m resolution land use / land cover map shown in Figure 4.8 was produced by reclassifying the 2016 high-resolution Vermont land cover dataset (UVM Spatial Analysis Laboratory, 2019; State of Vermont, 2021b) and merging GIS field data. We worked off the high-resolution (0.5 m) base land cover raster and reclassified combining, first, information from the rasterized layers of agriculture, shrublands, and wetlands. We then merged

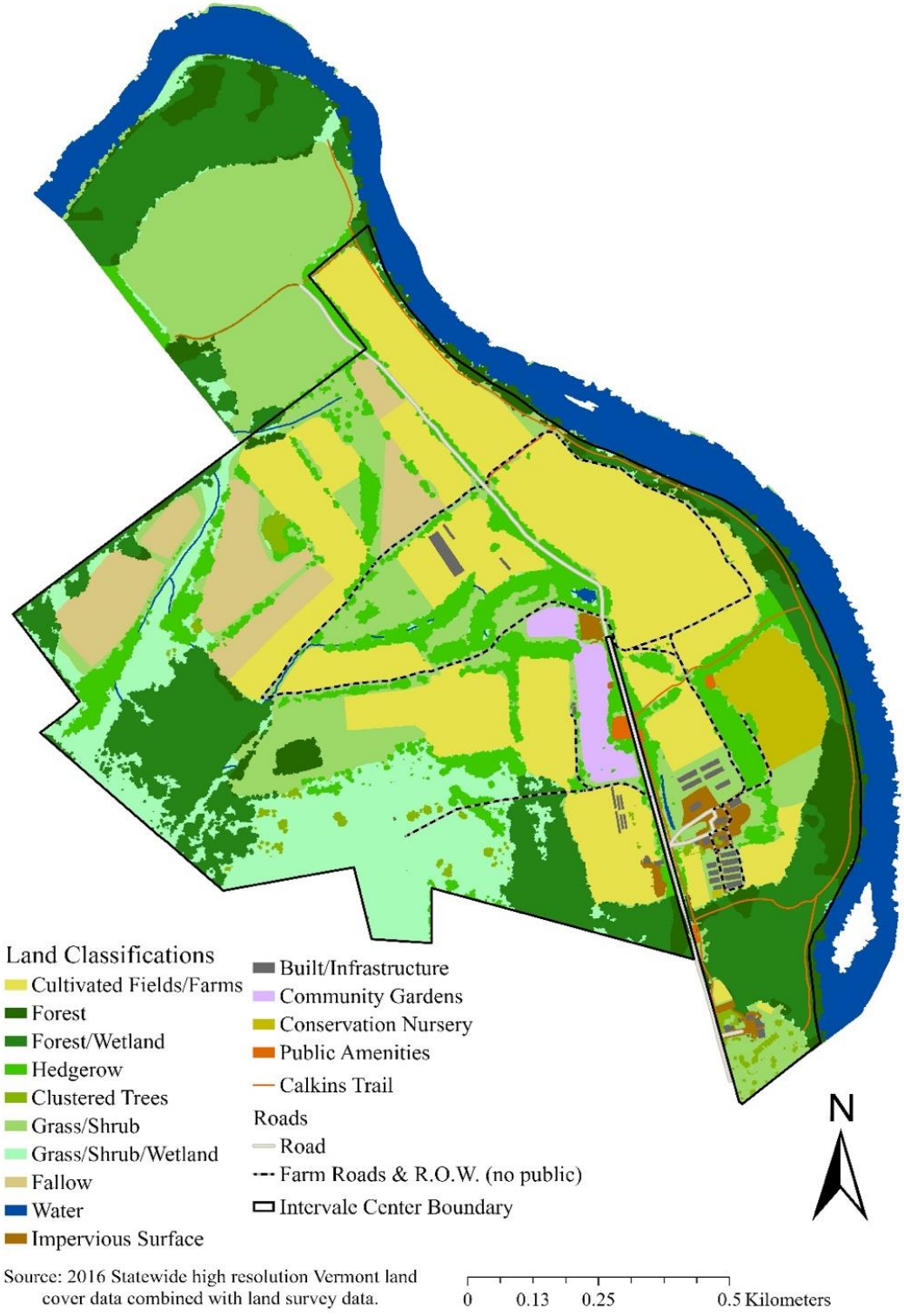


Figure 4.8: The Intervale Land Cover/Land Use Map (2020)

rasterized vector data created during our 2020 summer field survey where we delineated current land features using a GPS. These included impervious surfaces (for example parking lots), built/infrastructure (for example buildings and greenhouses), the Intervale Conservation Nursery field, community gardens, trails, and other public amenities. A majority filter was applied to this layer to remove noise and spurious data such as sharp edges in natural features. In the final reclassification process, we aimed at harmonizing the classification scheme with that of Lovell et al. (2010) while including new classes relevant for the agroecological assessment work.

Supplementary Sources

I also reviewed key supplementary sources to look for additional evidence of the Intervale's adhering to the agroecological principles. In addition to published articles, theses and dissertations by students from the University of Vermont, other secondary sources also included: key internal operational guidelines of the non-profit, both for the Intervale staff and the farmers that lease the land (e.g., the Land Use Protocols, land and forest management plans); the conservation easement agreement with the Vermont Land Trust and other local entities; the 2018 and 2019 general economic impact reports; and educational and informative materials about the Intervale's different component areas available to the general public in numerous booklets and handouts, and on their website.

As part of the participative and collaborative process, the Intervale's Executive Director requested an annotated bibliography of the research done so far by UVM and other universities in Vermont about the Intervale. Ergo, I and a Vermont-based graduate student also researching the Intervale completed a comprehensive annotated bibliography as part of the process.

Data Analysis Process

My principles-focused analysis was inspired on the comprehensive decision framework of a utilization-focused evaluation (Patton, 2015a, 2015b; 2018) because I wanted to assess the Intervale's adherence to this selected set of agroecological principles according to their contextualized experiences and practices. The design of a utilization-focused evaluation depends on the "*intended use by the intended users"* (Patton 2015a: 458, original emphasis). Consequently,

utilization-focused evaluations fulfill particular situated evaluative needs in agreement with the primary intended users. The effectiveness of a utilization-focused evaluation depends on the working relationship developed with the intended users (i.e., the participatory approach), the learning experience the evaluation process offers, and the usefulness of the findings to plan and implement interventions for change by the participants involved (Patton 2015a). Additionally, based on the different types of evaluations (Patton, 2018), my data analysis process also has a combination of formative (to identify strengths and weaknesses), accountability (to assess if/how the principles are being followed), and knowledge generation (to inform other similar initiatives) evaluative approaches.

Moreover, I also used content and thematic analysis strategies (based on Vaismoradi et al., 2013) for an in-depth understanding of the data collected around the selected set of principles across the different surveying methods to facilitate triangulation: the full transcripts of the first set of interviews with the larger purposive sample; the mapping and photovoice exercises with the subsample participants; and the supplementary sources of information.

Using NVivo 12 Pro Windows for coding the qualitative data in the first and larger set of 26 interviews, content and thematic analyses facilitated meaningful categorization and synthesis of the data collected to find patterns, frequency and relationships in the perceptions and narratives of the participants around the principles. I developed a codebook with a first set of 30 provisional codes (Saldaña, 2016; Bazeley and Jackson, 2013; DeCuir-Gunby, 2011) from the pre-existing set of fifteen principles by CIDSE (Table 4.2). As referenced before, Table 2.3 presents a brief explanation of the principles used as provisional codes based on agroecology-driven theory and praxis from literature reviewed to guide my content and thematic analysis as I coded.

My codebook had as main categories CIDSE's economic, political, environmental, and socio-cultural domains that frame the 15 CIDSE principles as main broad themes. Some principles only had one provisional code if they communicated only one criteria or value. For example, I only used the code "organic" for the CIDSE principle 10 "Eliminates use of and dependence on agrochemicals". Nonetheless, most principles are comprehensive and compounded (i.e., they incorporate more than one related criterion or value), so I used more than one provisional code to capture additional information for a thorough analysis. For example, for the principle 4 "Aims

MAIN CATEGORIES	CIDSE's 15 principles as broad themes (from agroecology-related praxis)	provisional codes (nodes in NVivo)	
ECONOMIC	1. Promotes fair, short, distribution webs, producers and consumers working together	1. short distribution	
	2. Increases resilience through diversification of farm incomes and strengthens community autonomy	2. diversification of income	
		3. economic reslience	
		4. community autonomy	
	3. Aims to enhance the power of local markets and build on a social and solidarity economy vision	5. power of local market	
		6. social and solidarity economy	
POLITICAL	4. Aims to put control of seeds, land and territories in the hands of people	7. seeds (acces/control)	
		8. land (acces/control)	
	5. Encourages new forms of decentralized, collective, participatory governance of food systems	9. decentralized	
		10. collective	
		11. supportinve, collaboaritve goverance	
	6. Requires supportive public policies and investments	12. public policies (gov.support)	
		13. investments	
	7. Encourages new forms of decentralized, collective, participatory governance of food systems	14. producers and consumers participation	
ENVIRONMENTAL	8. Supports resilience and adaptation to climate change	15. climate change	Very closely related and interdependent!
		16. climate reslience	
	9. Nourishes biodiversity and soils	17. biodiversity	
		18. soil	
	10. Eliminates use of and dependence on agrochemicals	19. organic	
	11. Enhances integration of various elements of agro-ecosystems (plants, animals, trees, soil, water, etc.)	20. agro-ecosystem	
SOCIO-CULTURAL	12. Promotes farmer-to-farmer exchanges for sharing knowledge	21. farmer-to-farmer	
	13. Strenghthen food producers, local communities, culture, knowledge and spriritуality	22. local producers	
		23. local community	
		24. local knowledge	
		25. spirituality	
	14. Promotes healthy diets and livelihoods	26. healthy diets / local food	
		27. livelihoods	
	15. Encourages diversity and solidarity among peoples, encourages women and youth empowerment	28. solidarity among peoples (diversity)	
		29. women empowerment	
		30. youth empowerment / inclusion	
Other categories considered and used as provisional codes	Challenges / opportunities with the principles		
	Other interesting topics for the analysis / discussion		

Table 4.2: **Research Codebook**
(with provisional codes based on the principles of agroecology by CIDSE, 2018).

to put control of seeds, land and territories in the hands of people" I used two provisional codes, "seeds (access/control)" and "land (access/control)" because most participants explained each criterion distinctively, even thought they were referring to the same principle. With this strategy, I started my coding process using this first set of provisional codes for the codebook (Table 4.2). As I coded, I added some subcodes if I found rich specific information I wanted the segregate for further consideration later in the coding process or if I found the data was important for the discussion of the results (e.g., good examples of the principles).

Even though my codes are principles-focused (Patton, 2018) and theory-driven (DeCuir-Gundy et al., 2011) from the academic literature on agroecology, I also used a combination of methods while coding interview transcripts (as proposed by Saldaña, 2018): structural (categorization of segments of data associated to my fieldwork questions as separate areas for analysis); descriptive ('labeling' the topic of a data passage using the CIDSE principles, as indexed in the codebook to facilitate inventorying and categorization); and evaluative (focused in deducing and judging if the Intervale is or is not adhering to the principles, as framed in their unique place-specific situation). Using the combination of these coding strategies, the data collected from the interviews was organized into manageable smaller units around the selected set of principles as themes or nodes. With these smaller units, I was able to identify and compare common threads and the prevalence of thematic patterns to contextualize the participants' particular experiences in relation to the agroecological principles (Elliot, 2018; Saldaña, 2016; Bazeley and Jackson, 2013; Vaismoradi et al., 2013; Sparker, 2005; DeSantis and Ugarizza, 2000).

While the coding process involved mostly deductive reasoning, I was open to the possibility of obtaining new information about participants' particular expression and operationalization of the principles. I therefore used some inductive reasoning to examine new information that emerged from the interviews, notwithstanding always focusing on how the new information evidenced the presence of and adherence to the principles.

The coding proceeded in four steps. The first step was a pre-coding phase where I reviewed and cleaned the transcribed interviews from chatter and structured each transcript into four main segments or units of analysis (i.e., the structural method), based on Saldaña (2018). I

extracted these segments from the main questions that guided the semi-structured interviews as follows:

1. interviewee's background (e.g., job position, education, years of experience at the Intervale);
2. presence or use of the agroecological principles (including explanations and examples using all the visual materials I provided);
3. opportunities for improvement or challenges (related to agroecological principles, with the explanations and examples around these opportunities or challenges);
4. experience as a co-investigator in this project (i.e., what they learned).

In this pre-coding step, I also started to code data manually as an initial exercise based on my first impressions. I highlighted relevant sentences or paragraphs related to the principles and inserted comments for my first observations. I also developed the codebook using the pre-existing set of CIDSE's agroecological principles and important new information emerging from the data collected. The second step consisted of the actual coding with NVivo 12 Pro Windows. I used the codebook and segments or units of analysis as my main framework to code the transcripts of the 26 interviews. The third step of data analysis consisted of assessing and validating the coding results of the interviews. The results were reviewed by two separate paid auditors to reduce any possible bias on my part and enhance confirmability. The first auditing process was performed by a doctoral student from the University of Vermont's Rubenstein School of Environmental and Natural Resources, who is familiar with the Intervale and the research topic. This auditor reviewed my coding results using the Teams function in the NVivo 12 software and served as an informed and attentive examiner of the researcher's coding selection and process. After this auditor reviewed my coding results, we discussed those coding references in which the student auditor disagreed with my coding. This approach yielded a total of 99 suggested changes. Of the recommended changes, I agreed with 61 and made the corresponding changes (2.20% of the total coded references) and disagreed with 38 (only 1.37% of total coded references). For my particular coding process with NVivo, coded references refer to all the contents or passages in the different interviews identified and marked as representing one or more of the agroecological principles under a code or subcode. After this first auditing, I further refined the coding scheme, a recursive process that resulted in the clustering or merging of some

codes and subcodes to facilitate a more concise visualization of the results around the 15 CIDSE principles. Then a second recruited auditor, an anthropologist and qualitative data analyst with more than ten years of experience using NVivo, did a second and final auditing to further polish up the coding results prior to performing the final analysis and writing up. This second auditor had no prior knowledge of the case study, my methodological approach or research questions. This second auditing process resulted in 206 recommended changes to the coded references. I agreed with 150 of the recommendations (5.60% of the total coded references) and made the corresponding changes and disagreed with 56 (2.09% of the total coded references). In both auditing processes, the proportion of agreement between the auditors and me as researcher was over 90%. According to Elliot (2018) and DeCuir-Gunby et al. (2011: 149), 90% (or better) represents "maximum consistency of coding" translating into reliability. The idea of incorporating other perspectives as additional levels of scrutiny in the coding process was taken from Saldaña (2018) but is also encouraged by qualitative data analysts based on other literature reviewed (i.e., Church et al., 2019; Elliot, 2018; Bazeley and Jackson, 2013; DeCuir-Gundy et al., 2011). Performing two different auditing processes by two separate auditors, each with different strengths and perspectives, the first at the beginning and the second at the end of the coding process, provided two deliberative phases to think critically about the qualitative data coding decisions. It also enabled a more rigorous analysis to reduce subjectivity and bias and increase the robustness of the research conclusions. As Bazeley and Jackson (2013: 290) assert, "[t]hese kinds of checks are seen by some as indicators of the reliability (or trustworthiness) of the coding process, and as contributing to the validity of the conclusions drawn from the codes." During this third step I also reviewed and hand coded the results of the mapping and photovoice exercises with the subsample of 15 participants. Additionally, I organized and condensed the notes taken during the wrap-up reflection meeting, my fieldnotes supported with photo-documentation, and the supplementary documents reviewed using the codebook with the principles of agroecology as guideline.

The fourth and last step was integrating and triangulating all the above data collected throughout my fieldwork following the content and thematic analysis process I started with the

first set of interviews with the larger group. Figure 4.9 illustrates and synthesizes the three important components of my research design framework for a rigorous final triangulation phase:

1. Practitioners' practical perspective using Figure 4.1 with the set of 15 principles as visual compass:
   - The results of the coding process of the interviews with the larger sample of participants (n=26) using some of NVivo's Explore functions.
   - The results of the mapping exercise with the subsample of participants (n=15) where they identified and marked where the principles were practiced or manifested on the land cover/land-use map of the property.

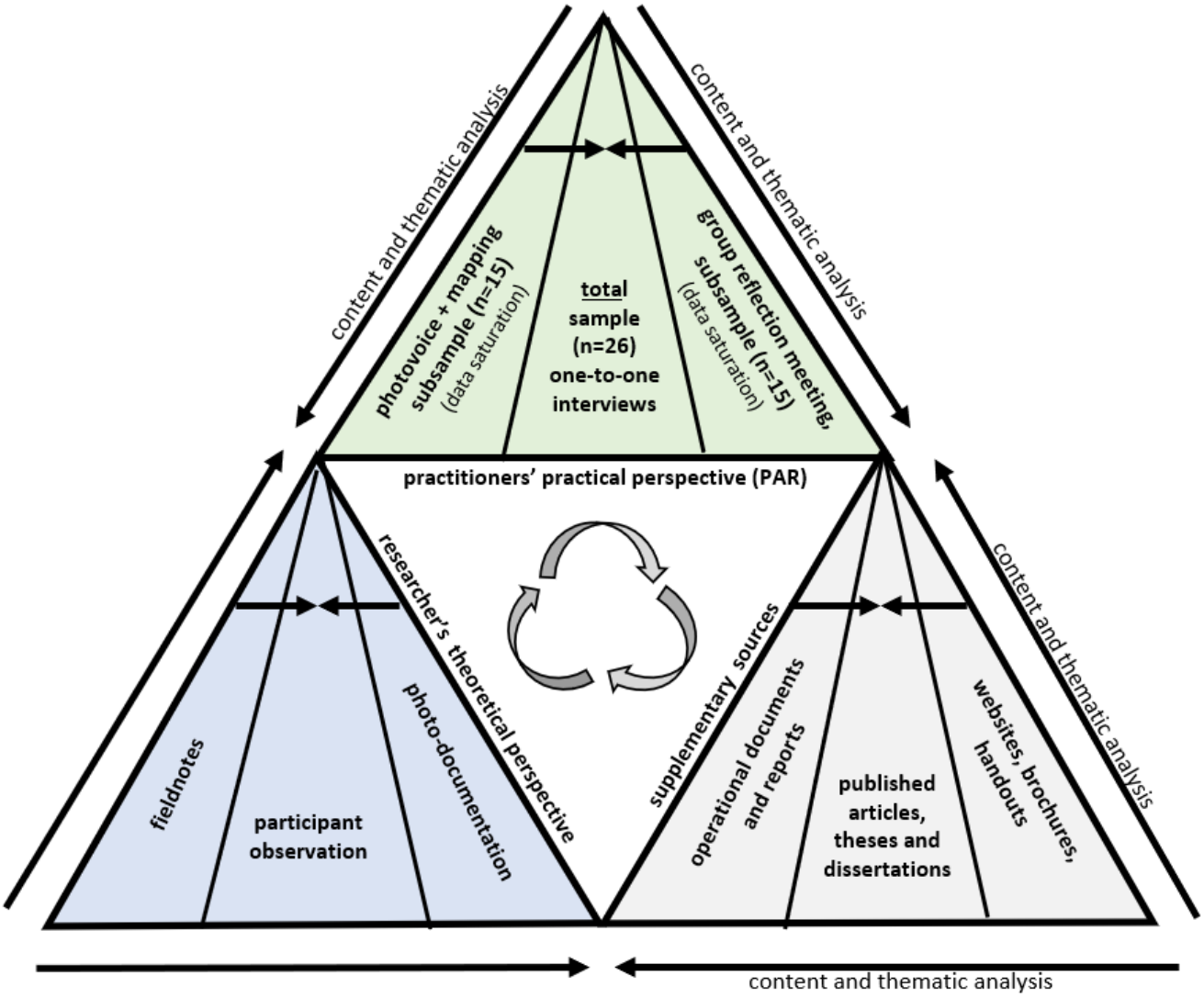


Figure 4.9: Triangulation of My Research Design Framework

- The results of the photovoice exercise in the second subset of interviews where the subsample of participants evidenced the practice or manifestation of the principles in their day-to-day work and at the property with photos. Using the same coding process and codebook used for the first set of interviews, I focused the qualitative analysis of the photovoice exercise on the principles they depicted in the photos based on their captions. This data was complemented with the rich description or explanation they provided around their depiction of the principles in the interview transcripts.
- My notes from the participants' final feedbacks collected using post-it easel pads during the group reflection meeting with the subsample.

2. Researcher's theoretical perspective
   - My participant observation fieldnotes and photo-documentation.
3. Supplementary secondary sources about the case study
   - The results of the content and thematic analysis (using the codebook as guideline) of published articles, theses, dissertations, operational documents and reports, websites, informative brochures, and handouts for the public about the Intervale and its different operations.

My robust triangulation process first integrates different lines of data collection for evidence. Also, it consolidates four different community-based participatory diagnostic tools with a sample and subsample of participants to incorporate their practical perspectives and for data saturation. Furthermore, it intersects participant observation with photo-documentation as part of my immersion in the case study to understand better participants' viewpoints and contribute with my theoretical perspective in the assessment. Last, it analyses supplementary secondary sources that cover a longer span of time for background information, understanding context, filling gaps, shedding light on some issues when needed, and corroborating results from the participatory process in a nonreactive way. The subsequent chapters provide the results from this elaborate and sound triangulation process.

5.

GROWING AGROECOLOGICAL PRINCIPLES AT THE INTERVALE

The fifteen principles of agroecology as presented by CIDSE in 2018 are all found in the Intervale Center's 340-acre socioecological system and cover a range of expressions. Certainly, some of these principles are well established and all-encompassing while others are yet areas of opportunities for the Intervale's particular and continuous process of agroecological transformation (Anderson et al., 2019, 2021). Nonetheless, the Intervale, as an organization and site, appears on the right path to becoming a model case of locally based peri-urban agroecology.

Since its foundation as a non-profit in 1988, the Intervale's central mission has been "strengthening the community food system" and safeguarding productive farmland at the edge of Burlington in service to their mission. Their programs and strategic approaches have been systemic and focused on providing a healthy food system for the community by guaranteeing the viability of local farms and the adequate production and distribution of fresh organic food for local consumption. Their tagline "Farms, Land, People" encapsulates this systemic perspective which agroecology supports to advance the 'ecology of food systems' (Francis et al., 2008). The aim of this systemic perspective is to interlace ecological and social aspects that go beyond the short-term economics of food production. Considering their role as a non-profit in the social economy,[15] and their mission for the benefit of the local community, it is no wonder that CIDSE principles of agroecology are expressed in their practices. Although the use of ecological science, an inherent part of the field of agroecology, can be evidenced in many of the farms' practices located at the Intervale, the organization stands out in key social and economic aspects important in agroecology, especially as a field of study embracing the complexity of agroecosystems. Then, in this context, what are the most important insights that answer my first research question to affirm that the

[15] The social economy generally comprises third-sector organizations with commercialized as well as uncommercialized undertakings that prioritize meeting specific social and/or environmental goals or needs before profit maximization (Amin, 2009).

Intervale Center is indeed on the right path as a peri-urban agroecological organization and site? What does this principles-based and utilization-focused assessment (Patton, 2018) reveal of the Intervale as a potential model for peri-urban agroecology? And to respond to the second research question, what are the main challenges and opportunities shared by participants and observed that can be addressed to strengthen agroecology at the Intervale?

This chapter focuses on the overall results of the multimethod and triangulation that support the fundamental finding that the Intervale is practicing CIDSE principles of agroecology. The chapter is divided in two main sections. The first section **Overall Results with Participants** serves several purposes. First, it presents an overview of the method-specific results underpinning the triangulation process that distills the pivotal findings. The findings are then fully elaborated and interpreted in the subsequent section and in the next four chapters. Second, this section also serves to emphasize the importance of the participatory process as part of the horizontal communication and learning that agroecology promotes for the multi-actor *diálogo de saberes* [wisdom dialogues] which includes popular forms of knowledges (Martinez-Torres and Rosset, 2014; Anderson et al., 2019, 2021). Participants engaged as co-investigators and their contribution as knowledgeable practitioners is at the heart of my research with the iterative process combining practical and theoretical perspectives. My co-investigators' perspectives through the different surveying methods provided valuable wisdom into the expression of the principles of agroecology at the Intervale and reveal the possible reasons some principles may be expressed or practiced more than others as part of the participatory principles-based assessment. The mapping and photovoice allowed spatial awareness and application exercises to explore with a subsample of key co-investigators the concepts behind the agroecological principles and their related practices at the site. Presenting and describing the results of these two visual surveying methods provides a more insightful and transparent reporting on how data saturation is conceptualized and inferred across the different surveying methods (i.e., the extent to which the principles, as priori-determined themes, are adequately instantiated in the data), including possible inconsistencies and contradictions (Saunders, et al., 2018). Notwithstanding, this section does not aim to provide an interpretation of the precise quantification of my qualitative data. My research is qualitative and as Patton (2015b: 559) recommends, I am keeping my "qualitative analysis first and foremost

qualitative." What is meaningful in these method-specific results is how ubiquitous some principles are across the qualitative data collected via different methods (Elliot, 2018).

The second section **Contextualized Significance and Discussion** probes into the three principles with most substantive significance across the different surveying methods, including their contextual relevance by interpreting and providing examples. I interweave findings from the responses of the larger sample of participants during the first set of interviews (n=26) with my own observations and document analysis. By interweaving these findings, which include different perspectives and surveying methods, I am integrating "different types of knowledge systems" (Méndez et al., 2016: 5) for a well-balanced and encompassing analysis of the results (i.e., local practitioners-generated knowledge and my academic or theory-based knowledge). The integration of these knowledges via different means provides the evidence and praxis.

Before I proceed, I reiterate that most agroecological principles are multi-dimensional and cross-disciplinary, and therefore quite comprehensive and compounded. Accordingly, these principles do not constitute an independent "pick-and-choose list" but rather they "constitute an interrelated, mutually reinforcing, dynamically interconnected whole" and convey "a systemic way of thinking" (Patton, 2018: 85). This interrelatedness among the principles was an evaluative challenge throughout the content and thematic analysis process. In many instances, examples and explanations provided by the participants applied to more than one principle. The same holds true of my own observations. This complexity, common and perhaps inevitable in agroecology, is mirrored in any study of agroecosystems or socioecological systems when using an agroecological lens. Nonetheless, each of the fifteen principles provided separate relevant results, but at the same time, these separate results take into consideration the combined impact of their expressions and practices for a coherent whole (Patton, 2018). As Aristotle once said, "the whole is greater than the sum of its parts."

Also, to help center the attention on content and meaning, I hereafter refer to the principles using the abbreviation 'P' for principle followed by the number assigned to each principle (e.g., P14 *Nurture healthy diets and livelihoods*). The numbers were initially assigned to unnumbered CIDSE principles to facilitate the identification of the principles in the research process (see Figure 4.1).

Overall Results with Participants

The results of my multimethod study with the Intervale participants are organized in two parts: 1) individual interviews with 26 participants and 2) mapping and photovoice exercises with the subsample of 15 key players (out of the 26). During the interviews, participants marked on a copy of CIDSE agroecological principles infographic the principles that apply to their daily experiences and activities at the Intervale (see Figure 5.1). As a participatory visual tool, the infographic was meant as a reminder of the CIDSE principles being evaluated and to help participants to 'see' the agroecological principles and their connections.

Figure 5.1: CIDSE's Agroecological Principles Infographic Marked by Participants

The vast majority of the participants agreed that the principles of agroecology as proposed by CIDSE (2018) are expressed or practiced at the Intervale – as shown in the examples of marked infographics above and compiled in Table 5.1 below. Table 5.1 show the results of the interviews with the total coded references using NVivo 12 Pro Windows. The table is organized from most to least referenced. Two principles emerged with indisputable frequency in the responses and examples provided by participants about the Intervale's role: P13 *strengthening local communities (producers, knowledge, culture…*) and P3 *empowering local markets* as well as *building on a*

social/solidarity economy. The practice of P15 *fostering diversity and solidarity among people* was signaled as present at the Intervale by all participants, however, it was not as referenced or exemplified in their responses as, for example, the practice of P9 *nourishing biodiversity and soil*. All the same, even P7 *encouraging participation of producers and consumers*, which was recognized by the least number of participants was signaled as practiced by 65% of the participants (i.e., 17 participants out of 26). This is likely explained by the fact that some interviewees spoke dominantly of their day-to-day applied practices and did not extend to principles outside of their area of work. However, participant holding directive or managerial positions were generally willing to comment on a more all-encompassing viewpoint of the Intervale's different component areas using all the principles.

		Interviews with full sample (n=26)			
Principle #	**Principles** *(adapted from CIDSE, 2018)*	**Coded references (frequency)[1]**	**Relative frequency (%)[2]**	**Average # references per participant[3]**	**# Participants who referenced principle[4]**
13	Strengthens local communities (producer, knowledges, culture…)	**230**	15.25	8.85	26
3	Powers local markets; builds on a social/solidarity economy	**188**	12.47	7.23	25
9	Nourishes biodiversity and soils	**132**	8.75	5.08	23
14	Nurtures healthy diets and livelihoods	**100**	6.63	3.85	25
8	Advances resilience and adaptation to climate change	**100**	6.63	3.85	22
15	Fosters diversity and solidarity among peoples	**97**	6.43	3.73	26
5	Fosters decentralized, collective, participatory governance	**87**	5.77	3.35	23
4	Supports access to and control of resources (land, seeds …)	**84**	5.57	3.23	25
11	Integrates agroecosystem's elements (plants, animals…)	**84**	5.57	3.23	22
1	Builds transparent short distribution webs	**82**	5.44	3.15	18
2	Increases economic resilience and autonomy	**79**	5.24	3.04	22
10	Eliminates the use of agrochemicals	**72**	4.77	2.77	24
6	Has supportive public policies and investments	**63**	4.18	2.42	21
7	Encourages participation of producers and consumers	**59**	3.91	2.27	17
12	Promotes farmer-to-farmer exchanges	**51**	3.38	1.96	23
	Total number of coded references	**1,508**			

[1] One reference is a separate instance a principle was coded (i.e., mentioned or used by a participant during the interview to provide at least one example of the expression or practice of that principle).
[2] The percentage of references for each principle out of the total number of coded references (1,508).
[3] Coded references per principle divided by the total number of participants (mean).
[4] Number of participants who referenced the principle at least once.

Table 5.1: Frequency of References to Agroecological Principles in Interviews

Using an agroecological lens and CIDSE's infographic as a compass, the subsample of participants (n=15) further reflected about the theory behind the principles and acted accordingly. Participants were asked to apply their understanding of the agroecological principles by providing a combination of reflection and action. They mapped the principles of agroecology in the 340-acre property and shared photos about their particular realities and daily practices around these principles. Spatializing the principles on the map and in pictures facilitated an aerial perspective to locate where and observe how the principles are practiced or expressed at the socioecological system.

Examples of the responses by the subsample of participants (n=15) on the mapping and photovoice exercises are presented in Figures 5.2 and 5.3. In the captions of the photographs are the titles participants assigned to each photograph with the number(s) of the principle(s) they portrayed using CIDSE's infographic with the numbered principles as reference. Each participant shared approximately 10 photographs with 'observational cues' or 'evidence' of the principles. Overall, I received a total of 148 photographs directly related to the 340-acre socioecological system.

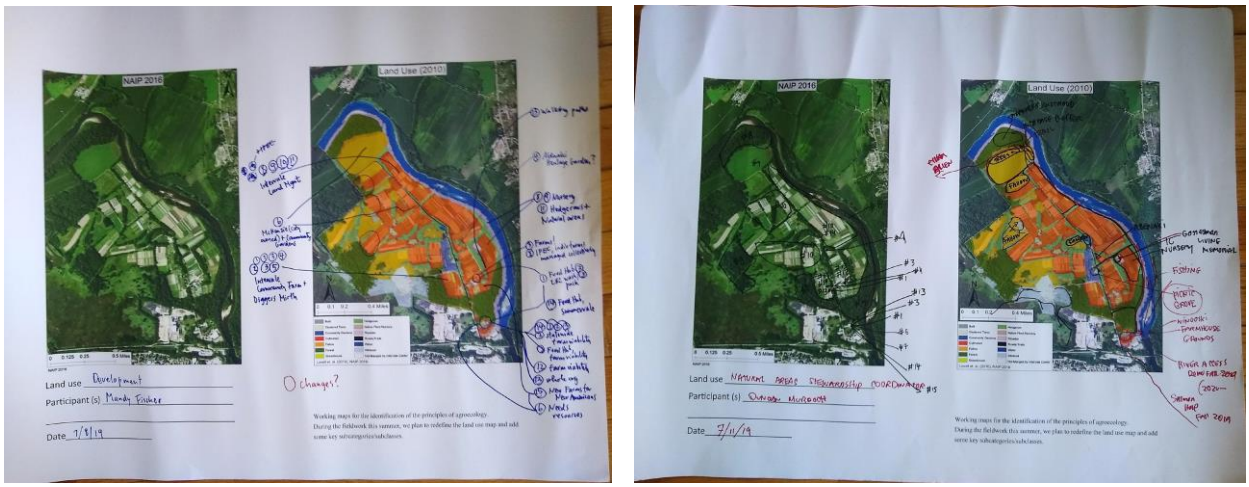


Figure 5.2: Participants' Mapping of the Agroecological Principles at the Intervale.

The mapping and photovoice exercises provided a 'pictorial testimony' of the presence of the principles at the Intervale based on participants' perspectives. Participants also had the opportunity to have a bird's-eye view of the component parts of the socioecological system

Figure 5.3: **Photo-examples of 'Observational Cues' of Agroecological Principles**

which resulted in a positive educational experience. As Hanna Baxter (2019), Manager of the Intervale's Gleaning and Food Rescue program, contends:

> "Sometimes I feel I get caught up in the grind and I'm just going from one step to the next. It's so nice for me to take a step back and think more of the big picture of the work we're doing."

The Intervale's Director of Development and Special Projects Mandy Fisher (2019) also attested to the positive learning outcome of the photovoice exercise when she was able to 'see' the expression of one of the principles at the Intervale:

> "I have now a really good understanding of this framework and I can see it in the work that we do. Before I didn't…. When I was out walking around and I would think like, 'okay, here's is actually an example of how we promote farmer-to-farmer exchanges and it's happening right here, in front of me.' Before I didn't know the agroecology principles well enough to be able to go out and identify that."

Most principles were marked and mapped more than once given that a single principle applied to multiple locations within the Intervale according to participants. Therefore, some of the principles are expressed across most of the property, and others are more site-specific in practice or manifestation. For example, the Intervale's contribution to P1 *building short transparent distribution webs* was mostly noted in the site of the Food Hub and the Community

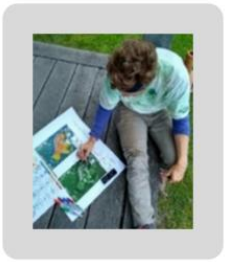
Supported Agriculture (CSA)[16] pick-up area at the Intervale Community Farm. However, the practices of P9 *nourishing biodiversity and soils* were noticed throughout most of the 340-acre landscape, in the cultivated fields as well as the forested areas. The same holds true for participants perceiving that P13 *strengthening the local community (producers, knowledge, culture)* and P14 *nurturing healthy diets and livelihoods* apply across all the organic farmland and the jobs they provide to community members. Nevertheless, most other principles were noted with lower but still significant frequency on the map.

The results of the coded interviews are juxtaposed with the mapping and photovoice exercises (see Figures 5.4 and 5.5) to identify patterns of interest in the data and focus on substantive significance (Patton, 2018, 2015b) within and across the different surveying methods with participants. Figure 5.4 provides the average number of times each principle was referenced, mapped, or portrayed per participant; Figure 5.5 provides the relative frequency per principle. Both Figures allow different ways of 'seeing' the general trends of the data collected with my co-investigators and facilitate comparison with my observations and document analysis for substantive insight (i.e., triangulation).

Figure 5.4 shows the average number of coded references per participant for each principle is much higher for the interviews than on the map or photovoice methods. There are two reasons for these differences. The first reason is that the mapping and photovoice exercises only engaged a subsample (n=15) from the larger sample (n=26) interviewed. Hence, the interviews with the larger sample provided more opportunities to reference the principles than the mapping and depiction activities with the subsample. Second, I noticed that it was easier to verbalize the expressions of the principles than trying to evidence these expressions on a map or in pictures. Particularly, I noticed that the subsample of participants had a harder time evidencing on the map and with photos the principles related to carrying out specific social or educational activities (e.g., P7 *encouraging participation of producers and consumers*, P12 *promoting farmer-*

[16] Community Supported Agriculture (CSA) is a direct marketing and distribution support system between consumer and producer of a near-by community farm. Consumer from the community buy 'shares' of the farm's harvest before each growing season to consume these 'shares' of crops as they are harvested. Consumers obtain fresh produce directly from their community farm, and farmers receive advance working capital for the production season as well as a guaranteed market for their produce.

Darker color bars: Interviews with infographic of the principles (sample, n=26)



Lighter color bars: mapping the principles on Intervale's map (subsample, n=15)

Mid-toned color bars: evidencing the principles with photovoice (subsample, n=15)

PRINCIPLES OF AGROECOLOGY
(ADAPTED FROM CIDSE, 2018)

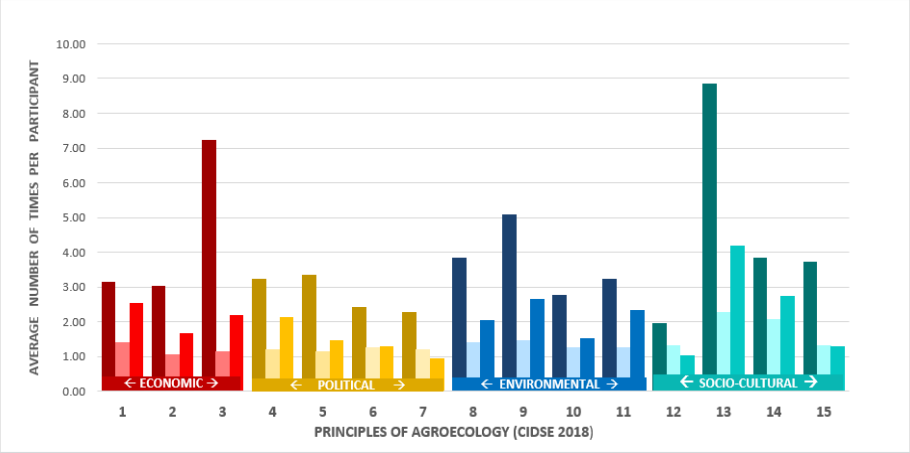


Figure 5.4. Frequency of References per Principle

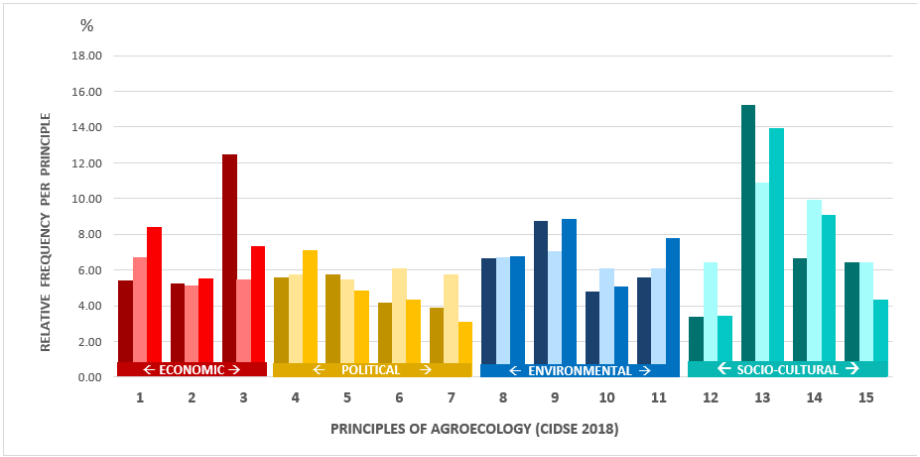


Figure 5.5: Percentage of References per Principle

1. Builds transparent and short distribution webs
2. Increases economic resilience and autonomy
3. Powers local markets; builds on a social, solidarity economy

4. Supports access to and control of resources (land, seeds…)
5. Fosters decentralized, collective, participatory governance
6. Has supportive public policies and investments.
7. Encourages participation of producers and consumers

8. Advances resilience and adaptation to climate change
9. Nourishes biodiversity and soils
10. Eliminates the use of agrochemicals
11. Integrates agroecosystems' elements (plants, animals…)

12. Promotes farmer-to-farmer exchanges
13. Strengthens local communities (producers, knowledges, culture…)
14. Nurtures healthy diets and livelihoods
15. Fosters diversity and solidarity among peoples

to-farmer exchanges, and P15 *fostering diversity and solidarity among peoples).* Nevertheless, there is a similar trend with these principles in the responses and examples provided by the larger sample during the interviews as it can be appreciated in both Figures 5.4 and 5.5. The relative frequency per principle within each surveying method shown in Figure 5.5 helps to substantially reduce the difference from the interviews with the larger group and the visual exercises with the subsample, though, the trends with most of the principles prevail. What is interesting from the combined results as evidenced in both Figures 5.4 and 5.5 is the fact that the principles with more substantive significance are the most overreaching ones in the socio-cultural, economic, and environmental domains:

- P13 *Strengthening local communities (producers, knowledge, culture…)*
- P3 *Powering local markets; building a social/solidarity economy*
- P9 *Nourishing biodiversity and soils*

In general, P7 *encouraging participation of producers and consumers*, P12 *promoting famer-to-famer exchanges*, and P6 *having supportive policies and investments* had the lowest number of occurrences in the responses and examples of participants. Two of these principles, P6 and P7, are under the political domain. Most participants signaled that these principles are expressed at the Intervale and provided a few examples but had a harder time-sharing recurring examples and were not as engrained in their narratives or stories. The other principles, in general and with some variations, followed the most significant ones P13, P3 and P19. It is also interesting to note that environmental principle P8 *advancing resilience and adaptation to climate change* has almost the same relative frequency across the different surveying methods. Moreover, across all the surveying methods, and on average, the principles under the socio-cultural and environmental domains predominated in the participants' responses and examples. Nonetheless, in general, other principles in the economic and political domains also showed notable presence at the Intervale.

The overall results of the different surveying methods confirm that, based on participants' practical perspectives, the Intervale's 340-acre socioecological system is expressing and practicing the fifteen agroecological principles proposed by CIDSE (2018). Some principles are all-pervasive in their expression and practice across the different components of the socioecological

system. Other principles, even though somewhat practiced and expressed, provide opportunities for growth and transformation as I explain later. My observations as a researcher, which I interweave in the content of the next sections, attest to this finding as well. In a context-sensitive way, the next subsection expands upon this main finding.

Contextualized Significance and Discussion

The most evident application of CIDSE agroecological principles to the Intervale rests in the fact that the Intervale is seen by most participants as *strengthening Burlington's local community (producers, knowledge, culture, spirituality)* (P13), *powering the local market, building on a social/solidarity economy* (P3), and *nourishing biodiversity and soils* (P9). Overall, these principles were the most highly referenced, mapped and portrayed.

This section focuses on these three principles, specifically in how they are cemented in the different activities carried out by the Intervale within its different component areas as an organization and socioecological system in Burlington. Participants' testimonies drawn from the first set of interviews with the larger sample (n=26), blended with my observations and document analysis provide a robust support of this finding. Nevertheless, these principles may encompass other principles in the same socio-cultural, economic, and environmental domains, and may be interlinked to the political principles as well. For example, to be able to *empower the local market* and *build on a social/solidarity economy* (P3), the Intervale has to support *short transparent distribution webs* (P1) and it is doing so through the Intervale Food Hub. Also, an *empowered local market built on a social/solidarity economy* (P3) is tightly related to having *decentralized, collective participatory governance* (P5) and the Intervale expresses this principle as a socioecological system in the Intervale Community Farm's CSA's cooperative structure. A CSA cooperative structure embodies the *social and solidarity economy*[17] *which empowers the local market* (P3) not only by facilitating the *collective governance of the local food system* (P5) but

[17] Cooperatives are part of the social and solidarity economy (SSE) because they are autonomous and voluntarily associations of people (people-centered) interested in meeting some common economic, social, and cultural needs and aspirations through a jointly owned and democratically controlled endeavor (International Cooperative Alliance, 2018). A CSA (consumer supported agriculture) coop is a social enterprise, a form of social ownership that directly empower consumers by having a direct cooperative relationship with their food producers.

also doing so with the direct *participation of food producers and consumers in decision making* (P7). To *empower the local market* and *build on a social/solidarity economy* (P3), *farmers-to-farmers exchanges* (P12) are also important, and it can be evidenced in the camaraderie of the farmers as neighbors in the same farmland and as collective managers of the Intervale Farm Equipment Company.

P13. *Strengthening local communities (producers, culture, knowledge, spirituality)* gives priority and respects the unique identity of local producers, their farming communities, food systems and means of subsistence. P13 regards context-specific skills and knowledges for innovation and context-sensitive solutions and honors farming communities' historical and cultural traditions along with their local value chains based on distinctive social bonds, networks of collaboration, and trust. It also exalts, from a spiritual and material standpoint, a sense of place by protecting and reinforcing the relationship and connection to the surrounding land and nature (CIDSE, 2018; FAO, 2018; Shiva, 2016; International Forum for Agroecology, 2015). This principle relates to three of the Food and Agriculture Organization's (2018) elements of agroecology: *Human and social values*, C*ulture and food traditions*, and C*o-creation and sharing of knowledge*.

This socio-cultural principle (P13) *strengthening local communities (producers, culture, knowledge, spirituality)* has substantive significance at the Intervale not only because of its comprehensiveness and conspicuous connection to the intent of the other principles in the same socio-cultural domain (e.g., P15 *fosters diversity and solidarity among people*) and principles in other domains (e.g., P7 *encourages participation of producers and consumers* in the political domain), but also because it centrally relates to the Intervale Center's (n.d.-a) mission "to strengthen community food systems."

The Intervale's mission is well-recognized by all the participants. Ergo, this particular principle was manifested in a myriad of ways. Capturing and communicating participants' stories from different perspectives (which according to Patton, 2015b, are particularly relevant in case-study evaluations), is crucial, especially when participants are directly involved in a participatory action research iterative process. The Intervale's Community Relations Coordinator Abby

Portman (2019) clearly explains how P13 *strengthening local communities* resonates with the Intervale's mission:

> "I think that is pretty much the mission of the organization. I think that we empower by increasing farm viability, bringing the community together in celebration of local food, engaging more people in the food system, creating a stronger food culture in Burlington and statewide around the support of local food, and increasing the knowledge. Similarly, this is a more holistic approach to food which is how I describe what we do at the Intervale Center where you're not just looking at one component, you're looking at all of these components that go into making a more sustainable food system… I think that there is a certain amount of spirituality that people experience with just being in nature and providing that resource to people so close to the Burlington city center."

Irrespective of the various component areas at the Intervale's socioecological system, participants' responses evidence that most practices at the Intervale revolve around *strengthening local communities* (P13). The predominance of P13 was also evident in the perceptions of farmers representing the independent farms embedded in the NGO's agroecosystem. For example, Andy Jones, Intervale Community Farm (ICF) Manager and farmer of this CSA-supported farm, also links this specific principle to the Intervale's mission:

> "That's part of our mission, to get people out. Not just to get the food to people, but to get people to actually have some connection with each other and some opportunity to connect with the land and the place. I think that's one of the things that urban and peri-urban farms have... So, for us it's really been an important part of who we are, is to bring people together."

Jones was referring not only to the Intervale's, but also to Intervale Community Farm (ICF) and its CSA's objectives, which include cultivating "a thriving farm ecosystem", fostering "a vibrant and interactive community of farmers and eaters", providing "sustainable and fulfilling jobs for staff", benefiting "the wider community through partnerships, donations, and services", as well as "making ICF accessible to an economically-diverse membership" (ICF, 2019a).

Even Dan Cahill (2019), Burlington Parks, Recreation and Waterfront's Land Steward, in charge of overseeing the 6-acre Tommy Thompson Community Garden under their Burlington Area Community Gardens program, attests how community gardening typifies P13 when he states that "the community gardens are founded upon peer-to-peer, city volunteers, and gardeners supporting each other through community." The gardeners I interviewed considered gardening at the Tommy Thompson Community Garden as the epitome of this principle. As Bob Kiss (2019), Community Gardener and former Mayor of Burlington, expresses:

> "I do think gardening does all these: strengthen food producers, local communities, culture, knowledge, spirituality. I think there is a connection that, by being here, you get the benefit of it and then it's shared by all the people who are part of the garden. Meaning it's hard to imagine not having this opportunity in the city of Burlington… Native Americans definitely worked and lived along the Winooski, so there's a long historical connection. I think that this land meets people's needs. So, there's tons of room for people to have a spiritual connection to the area."

P13 *Strengthening local communities (producers, culture, knowledge…*) also underpins the Intervale's tagline *Farms*, *Land*, *People*. As the Intervale Center's (n.d.-a) website propounds: Farms "to enhance the viability of farming", Land "to promote the sustainable use and stewardship of agricultural lands", and People "to ensure community engagement in the food system". Even participants who no longer work at the Intervale had memories of their years working at the property that coincided with this systemic perspective of *Farm, Land, People*. Former farmer at the Intervale, Adam Hausmann (2019), from Adam's Berry Farm, remembers:

> "[P13] is part of their goal and mission, is how do they take what we're doing and make it accessible… not just the farming community, but the greater community. How do we bring that community into what's happening here [at the Intervale]? Local communities, cultural knowledge, exchange of knowledge, I suppose, and spirituality. And that was something that I always talked about with pick-your-own... Pick your-own in an urban area serves so many different roles. One of them was just providing a space for families and people to have open space and to come down and commune with the natural world. And

> that was really positive... There's just the connection to your food source, and seeing how something grows, and understanding how something grows so you have a respect for the plants."

The Intervale also has the Abenaki Heritage Garden initiative that has a lot of potential for growth and manifests the non-profit's concern and commitment to *strengthen local communities, producers, culture,* and *knowledge* (P13) by also *encouraging diversity and solidarity among people* (P15), as I elaborate in a subsequent chapter. The Abenaki Heritage Garden started as a collaborative project at the Intervale in 2009 with the St. Francis/Sokoki Ban of the Abenaki Nation at Missisquoi (part of Vermont's Abenaki community), Burlington Parks, Recreation & Waterfront (through their Burlington Area Community Gardens program), University of Vermont's Environmental Program, the Natural Resources Conservation Service of the U.S. Department of Agriculture, Friends of Burlington Gardens, Sacred Seeds Network, and Gardener's Supply. The idea of the garden is to recognize and honor the heritage of the Abenaki people, original inhabitants of the land, by planting and growing with traditional methods the crops the Abenakis used to plant and grown at the site. Using as reference archeological remains and historical records, the garden showcases heirloom seeds of the 'three-sisters' planting (i.e., a variety of corns, squash, and beans) (St. Francis/Sokoki Ban of the Abenaki Nation at Missisquoi et al., n.d.; United Plant Savers, 2018; Doering, 2013). The collaborative partnership with a group of the Abenaki Nation and different entities from the public and private sectors to initiate the Abenaki Heritage Garden evidence that the Intervale has the interest, capacity and connections to *strengthen the local community,* its different *food producers, culture, knowledge,* and even *spirituality*. (P13). As the former Development Manager of the Intervale, Chelsea Frisbee (2019), who worked at the non-profit for seven years, expresses:

> "Specifically working with the Abenaki, the original inhabitants of the Intervale, to grow Indigenous seeds on that same land. It is a project that Patrick [the Land Manager] manages and it has been going on for many years. He works with a group of about ten people in the Abenaki community to help us grow Indigenous beans. They are heirloom Indigenous varieties that are in danger of going extinct. We want to make the land available for the Abenaki to use however they want. We

have hosted a seasonal blessing ceremony for the past two years now. We use volunteers and our land stewardship staff to grow the seeds."

Presently, the Abenaki Heritage Garden occupies less than half an acre and it is located behind the Intervale Food Hub. Based on my observations, this initiative can receive more attention from the Intervale management team. With proper resources and effort, the Abenaki Heritage Garden has the potential to grow into a more significant component of the Intervale's socioecological system (as I explain later).

Like the Abenaki Heritage Garden, there are two additional initiatives at the Intervale that simultaneously *strengthen the local community* (*producers, culture, knowledge, spirituality)* (P13) and *encourage diversity and solidarity among people* (P15): the collaboration with the New Farms for New Americans program of the Association of African Living in Vermont (known as AALV)[18] and the Intervale's Gleaning and Food Rescue program. This first focuses on *providing access to land* (P4) for subsistence farming for New American. The second centers on reducing food waste (related to the resource-efficient circular economy the FAO promotes in one of their ten elements of agroecology), as well as increasing access to fresh nutritious food to low-income families in the Burlington area. Both initiatives *strengthen community* (P13) and *solidarity among peoples* (P15) with different ethnical, cultural, and socioeconomic backgrounds, including refugees and immigrants, as well as *build on a social and solidarity economy* (P3). I elaborate on these two initiatives when discussing the socio-cultural practice of *fostering diversity and solidarity among peoples (*P15).

[18] New Americans are presently mostly Somalis, Burundians, and Burmese. "New Americans" refer to refugees and immigrants living and working in Vermont and connected to the AALV, a social service agency.

P3. ***Powers local markets; builds on a social/solidarity economy*** boosts and harnesses the power and autonomy of local markets by focusing on using local resources and supporting local small-scale producers around shorter food value chains. Through more direct connections with clients and consumers, it satisfies local needs and demands with fair prices for both producers and consumers and creates local and decent food-based employment opportunities. Also, it advances an equitable economy that prioritizes the welfare/well-being of the people, the communities they live in, and the planet. P3 helps to address the global food waste challenge with shorter resource-efficient and more unwasteful food system circuits. It supports different types of collective, democratic and participatory ownerships, non-profit organizations, charity and philanthropic initiatives, voluntarism, among other socially oriented forms of economic alliances and organizations (CIDSE, 2018; FAO, 2018; Dumont et al., 2016; Shiva, 2016). This principle relates to two of the FAO (2018) elements of agroecology: *Circular and solidarity economy* and *Responsible governance.* Responsible governance refers to having governance mechanisms in place (e.g., legislation, policies, programs) to support local producers, food systems and social economies.

Economic principle P3 for *powering local markets and building on a social/solidarity economy* is also an all-embracing principle that depends on the development of activities and practices around the two other economic principles, P1 *building transparent short distribution webs* and P2 *increasing the economic resilience and autonomy* of local food systems through *the diversification of farm incomes*. To achieve its mission of "strengthening community food systems", the Intervale not only is *empowering the local market* (P3) by stewarding productive farmland for organic agriculture at the edge of the denser urban area of Burlington, but also runs the Intervale Food Hub to build the *short distribution web* (P1) needed for direct delivery of the farmers' fresh produce to the nearby urban community in Burlington. Even within the same 340-acre socioecological system, there are examples of how *transparent and short the distribution web is* between the farms and the Intervale Food Hub (P1) to *empower the local market* (P3), as Brian Teed (2019), Operation Lead of the Hub, explains:

> "Well, first, the Intervale, all the farms are right there, a quarter mile away. I mean, Intervale Community Farm, they actually deliver most of their stuff on the tractor, which is pretty sweet. They just have forks on their tractor and they bring a huge crate of cabbage. In that respect it's kind of as short as it gets… Diggers' Mirth Collective Farm, they usually harvest things and don't even put it down. They just harvest it, wash it, pack it, and drive it right here. So, in that respect it's pretty

> short… They're delivering it to us and then we're only delivering it as far as 10 miles away."

The Intervale's farmland is diverse, with different types of farms with polyculture mixes, which *enhances* the *economic resilience* and *autonomy* (P2) of the Intervale as a socioecological system and this, in turn, *helps to empower the local market* (P3) (I expand on economic resilience in the following chapter). First, it is important to remember that the strong interest *in strengthening local markets and building on a social/solidarity economy* (P3) goes back to the political history of Burlington, a small city that is known for its social democratic leadership and progressive mindset in the United States. As the Intervale's Administrative Coordinator Carolyn Zeller (2019) confirms:

> "An example that I really like to use is back in 1988 when we were founded. Will Rapp [the founder of the Intervale Center] told the mayor at the time, Bernie Sanders, I think I told this anecdote maybe during our tour, that if the organization grew in the way that he expected it to grow, we'd be able to produce 10% of Burlington's fresh food. And we're now producing over $1.5 million worth of food in the Intervale. That's the farmers, not including the Food Hub or anything like that, just our farmers here. And almost all that goes right into the local community. Not to mention jobs that are created, getting to the Farmers' Market, sharing more that way… I'm sure I can keep going."

Burlington, Vermont, provides a unique context that cannot be forgotten in this principles-based assessment. The testimony of farmer and co-owner of Diggers' Mirth Collective Farm Hilary Martin (2019) substantiates Zeller's response above and reveals, as well, the notion of the Intervale as a unique holon existing and functioning within an "ecology of contexts" (i.e., the Intervale as having autonomy in some senses, yet being part of something larger) (Bland and Bell, 2007: 286):

> "Yes, this is very strong in Burlington and in the past I have had feelings like, 'Oh, maybe I should move somewhere else, take my efforts somewhere to some community that needs it more…' Most places really need it. It's definitely a privilege to be a farmer in this community where people just really value, love local food, local farms. It's the support, like literally pours, pours in into our markets and it's great!"

The progressive political history of Burlington, as well as Vermont's overall Farm to Plate policy[19] to strengthen Vermont's food system, provide the perfect 'ecology of contexts' to advance a venture like the Intervale. Farmer and co-owner of Pitchfork Farm Eric Seitz (2019) has been a witness of this unique opportunity for the Intervale's farms, as well as other farms in Vermont:

> "Our business has grown in participation with the local food movement in Burlington and the state in general -meaning it's not like every restaurant opened up saying, 'I'm going to be a farm-to-table restaurant.' And it's not like we had to go to every restaurant and knock on their doors [saying] that 'you should be a farm-to-table restaurant.' It's been symbiotic as new restaurants have opened. They've sort of seen that working with farms is not only providing them the freshest, best produce they can imagine, but it's also a good marketing tool and a good way to get people in their door. And so, it's sort of been hand in hand. We've asked restaurants to carry our produce, restaurants have opened up with the aim to carry our produce, you know what I mean? Everyone has thrived."

The Intervale's social mission, since its inception, aligned with Vermont's in general and Burlington's specific political aim of *empowering the local food-related market* around a *social and solidarity economy* (P3). The Executive Director of the Intervale, Travis Marcotte (2019), summarizes it plainly:

> "The Intervale Center is a non-profit, we're a 501(c)(3) exactly. We own and manage the land base and then we operate a series of programs and enterprises that are designed to achieve our mission of strengthening community food systems. The productive base of what Intervale does is pretty local. All the farmers growing food here, it's pretty close to the community, and I think the community is invited into that. We also run the Intervale Food Hub which is a distribution

[19] Vermont's Farm to Plate is a policy initiated by the Vermont Legislature twelve years ago, in 2009, that authorized the Vermont Sustainable Job Fund to create a 10-year Farm to Plate Strategic Plan (2011-2020). The Plan was updated in February 2021 for 10 more years (2021-2030) and is being implemented by the Farm to Plate Network. The plan main goal is to *increase economic development and jobs in the farm and food sector and improve access to healthy local food for all Vermonter* (Vermont Sustainable Job Fund, 2021a). The Network encompasses farms, food production business, educational institutions, non-profits, government, and financial institutions. Through working teams and task forces, members of the network convene to re-localize the food system.

> company that is operating very close to where the food is produced. From the beginning, the Intervale Center has tried to instill a grow-local approach in the Burlington community: that you could have commercial farms in your city, you can have CSA, you can have vibrant farmers' markets, you can extend that to the grocery stores, to the restaurants. So, really, thinking about your local market and building those close relationships on the economic side. I think these are areas that we've really tried to push hard over 30 plus years now. It has been exciting to think about the alignment here!"

In addition to the Intervale Food Hub (2021a) that mobilizes local resources by buying from local farmers and distributing their fresh produce to the local community (their mission is to "bring more Vermonters into the community food system through their weekly, year-round deliveries of local food to homes in Burlington, as well as pick-ups at their hub", Intervale Community Farm's CSA has been *empowering the local market* by embodying the *social and solidarity economy (*P13). The Intervale Community Farm is a consumer-owned cooperative with over 30 years of successful operations. A CSA consumer cooperative is a social enterprise, a form of social ownership that directly empowers consumers with a direct relationship with their food producers. Consequently, Intervale Community Farm has also *built a transparent short distribution web* (P1) and is *encouraging the participation of food producers and consumers* (P7).

Voluntarism, as a collective effort, is also a major component of *the social/solidarity economy.* Based on my personal experience (of 81 hours of volunteer work between 2019 and 2020) and the responses of participants, volunteers are an integral part of all the component areas and operations at the Intervale, from the community gardens to the Intervale Conservation Nursery. The Intervale had 550 individual volunteers in 2018, mostly during the summer months of June, July, and August (Zeller, 2019). A total of 550 volunteers a year, on average, is about 46 volunteers per month or 11 volunteers per week. Mike Ingalls, Manager of the Intervale Conservation Nursery, explains that the business community in Burlington has a strong sense of social responsibility that facilitates the social power of brigades of volunteers throughout the year. The Intervale leverages this spirit of voluntarism and has a volunteer

program coordinated by staff members. According to Ingalls (2019), the Intervale Conservation Nursery has had the highest number of volunteers per year:

> *"*We have a lot of community local businesses that like to do social responsibility type of volunteer events. So, they'll come down here and they'll help us plant trees. Every year, the Nursery is by far the biggest program at the Intervale Center that has this volunteerism. And we have 8 to 10 businesses or more that come down here a year. So, I'd say that probably two-thirds or so volunteers that come down here are through the Intervale Center Conservation Nursery."

Lastly but not less important is the Intervale's Gleaning and Food Rescue program which is also a clear expression of how the Intervale is fulfilling its mission as a non-profit working under the *social and solidarity economy* (P3). Through the Gleaning and Food Rescue program, the Intervale is aiming at increasing food security[20] in the community by providing some social protection from market failure (i.e., in this case, due to costs, access to purchase fresh and nutritious food). The Intervale is also promoting values that prioritize people's needs for fairness and justice in the local food system. Food justice has been defined in different ways. Nevertheless, in general, the aim of the food justice movement is to achieve inclusive, community-led, and participatory local food systems regardless of class, race, gender, ethnicity, citizenship, ability or religion. The movement is also concerned about communities exercising their right to grow, sell and have access to healthy food without the exploitation of people, land or the environment. Advocates for food justice seek to strengthen local agri-food systems increasing the access to nourishing and culturally appropriate food for healthy, resilient communities (Rowe, 2016). Based on what food justice entails, the Intervale's mission and vision also encompass a food justice aspiration for the community. The Gleaning and Food Rescue programmatic area is a clear practice of the non-profit that expresses their food justice objective. As the Intervale Gleaning and Food Rescue program's website propounds:

> "The Intervale Center recognizes that in order to have a vibrant local food system, we must work to engage *everyone* in our community

[20] Using the official definition from the 1996 World Food Summit, according to FAO (2008) food security "exists when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life."

[emphasis in original]. We believe that all Vermonters should have access to—and be able to afford and enjoy—fresh, locally-grown food… [U]p to 40% of all produce grown in the United States is rejected before it reaches market due to cosmetic imperfections or overproduction. By gleaning and rescuing food, we are providing a way for food insecure people to access fresh food and more fully utilizing the food that is already grown on local farms."

P9 *Nourishes biodiversity and soils*

Biodiversity means the variety of species of animals, plants and micro-organisms that live and interact with each other in a particular ecosystem or habitat. P9 relates to practices that protect, maintain, and sustainably manage local biodiversity (native species), both above and below the ground at different scales (i.e., in the plot, farm, and landscape, in and beyond the boundaries of the cultivated fields) to support natural synergies and recycling functions. It conserves and build the quality of the soil biota (i.e., the life naturally present in healthy soils like bacteria, fungi, earthworms, ants, and beneficial insects) which support functional biological interactions for the decomposition of organic material (soil biotic activity) and the healthy growth of plants. It enhances the recycling of biomass to optimize the availability and flow of nutrients; minimizes losses due to flow of water, air and solar radiation with sustainable microclimate management, soil cover methods, and water harvesting; uses polyculture for species and genetic diversity in the agroecosystem in both time and space to support natural and balanced population of natural enemies and antagonists of plant pests and diseases (CIDSE, 2018; FAO, 2018; Altieri, 2002, 1999, 1995a, 1994; Shiva, 2016; Gliessman, 2004). This principle also relates to four of the Food and Agriculture Organization's (2018) elements of agroecology for imitating natural ecological processes in agroecosystems: *Diversity, Efficiency, Synergy, Recycling* and *Resilience.*

The science of ecology, which is recognized as the main driving force behind the field of agroecology, precedes the principles of agroecology under the environmental domain. As I document key examples of the expression of P9 at the Intervale, I may refer to the other environmental principles as they are part of the "mutually reinforcing, dynamically interconnected" environmental whole Patton (2018: 85), notably P8 *advances resilience and adaptation to climate change,* P10 *eliminates the use of agrochemicals* and P11 *integrates agroecosystem's elements*. An in-depth analysis of how balanced, effective, or self-sustaining the practices at the Intervale are to *nourishing biodiversity and soils* are beyond the scope of the

study.[21] Nevertheless, based on the results of my principle-based assessment, there is enough evidence to assert that the Intervale's plans and practices are well-intended to follow the environmental principle of *nourishing biodiversity and soils* (P9).

P9 *Nourishes biodiversity and soils* is expressed at the Intervale's socioecological system in many areas, notably in the Intervale Conservation Nursery, the Land and Natural Areas Stewardship, the practices of the different independent farms, and the community gardens at the Tommy Thompson Community Garden.

Intervale Conservation Nursery (ICN) was founded in 2002, and as their website asserts (Intervale Center, n.d.-c), it is "dedicated to growing native, locally sourced trees and shrubs for riparian restoration projects" and their "plants are grown in an ecologically sound manner without the use of synthetic fertilizers, herbicides, and pesticides" (related to P8 *advancing resilience and adaptation to climate change*, P9 *nourishing biodiversity and soils*, and P10 *eliminating the use of agrochemicals*). The Nursery's main operations are located at the Intervale where they run a greenhouse and nine acres of production (representing about 3% of the total 340-acre property). Between 2015 and 2019, the Nursery grew 158,500 stems and planted a total 635 acres across Vermont to support sustainable land management practices, and "*protect water resources while also mitigating climate change"* (P10) (Intervale Center, n.d.-c) The Nursery production also includes perennial pollinator plants to increase the population of native bees and other beneficial insects. It is well known that native bees and beneficial insects are vital *nourishers of biodiversity and soils* (P9) for healthy *integrated agroecosystems* (P11) as they furnish a natural method of seed dispersal that also increases the quality of crop yields (Altieri, 1999). The Intervale Conservation Nursery also practices bioengineering with live fascines and stakes[22] to trap sediments and *provide slope stability* by establishing new root networks and clumps of vegetation that eventually *restore bare soils* along streambank contours in farmlands

[21] Further research in collaboration with the fields of conservation biology, landscape ecology, and soil ecology, for example, can be conducted to do an in-depth scientific analysis of how balanced, effective, or self-sustaining the practices at the Intervale are to help protect biodiversity and soils in the long run.

[22] Live fascines are cuttings of dormant and long woody branches, usually from willow or similar species, bound together into long cylindrical bundles. These bundles are buried in shallow trenches on slopes along the banks of streams, rivers, and other water bodies to help hold the soil in place. Live stakes are dormant large cuttings directly installed into the ground. These cutting will eventually grow into new trees with root networks.

to *avoid further loss of soil* (P9) during flooding, rapid snow melts or heavy rains (also related to P11, *advances resilience to climate change*). The Nursery's Production and Volunteer Coordinator, Maddie Cotter (2019), evidences with her reaction to P9 that *nourishing biodiversity and soils* (P9) is a daily practice at the Nursery:

> *"Nourishing biodiversity and soils*, that's just what we do. All we grow, about 35 different species of trees and shrubs, are native to here. So, by planting not just silver maples in a riparian area you are increasing the biodiversity and helping the soil and hopefully helping the water bodies too… We start all of our native trees and shrubs from seeds and cuttings that we go out into the wild and collect and we bring them back to our greenhouse where we propagate them… Just by growing these native trees and shrubs we're increasing the local biodiversity and because we only collect seeds and cuttings from Vermont the genetics of the trees are already really designed to survive here."

Intervale Conservation Nursery's operations are helping to *nourish biodiversity and soils* (P9) by enhancing the functional diversity in the agroecosystem with the use, growth, and propagation of native flora around the cultivated fields. Also, the Nursery is not *using synthetic external inputs* (P 10). By not using agrochemicals, the natural habitats around the cultivated fields can produce, shelter, and feed not only pollinators, but beneficial arthropods that are natural enemies (e.g., predators, parasitoids) of crop pests (Altieri, 1999, 1994; Altieri and Nicholls, 2000). Mike Ingalls (2019), Manager of the Intervale Conservation Nursery explains:

> "We utilize whole acres of the Intervale for seed collection and hardwood collection and softwood collection. It's a great floodplain forest. We grow these species that we are able to collect here at the Intervale and plant these out for restoration projects. We actually utilize the entire landscape as well... It's a great, win-win talking point to say, 'yes, these plants came from Burlington and we're planting them in Burlington. And who planted them? Folks from Burlington'… Everything is local! We're always looking at soils, and the biodiversity aspect is that we're growing a variety of trees and shrubs. So, if you ever get the chance to visit our field, there's a lot of native migrating birds that are out there right now. You'll see a lot of diversity, even

> bees, there's probably over 15 different native bees out there… We don't use any chemicals. It's all certified organic and coming naturally. I'm not spraying herbicides or pesticides or anything like that. We're basically adding local leaf litter from the town that they're looking to get rid of, and we're looking to replenish our soil, it's a great organic matter!"

The **Land and Natural Stewardship**'s 2007 agreement to grant development rights and perpetual conservation easement restrictions at the Intervale[23] identifies two key objectives of the agreement directly relate to *nourishing biodiversity and soils* (P13): to "conserve productive agricultural and forestry lands and soil resources in order to facilitate active and economically viable farm use of the Protected Property now and in the future" and "to conserve the unique working landscape of the Protected Property, including scenic, natural and archeological resources, improve the quality of life for Vermonters and maintain for the benefit of future generations the essential characteristics of the Vermont countryside" (Vermont Land Trust et al., 2007: 1). It is important to highlight that since 2007 the conservation easement has mandated a multifunctional role of the Intervale. This multifunctional role is important (and discussed later). Going back to the appraisal of the ecological function of *nourishing biodiversity and soils* (P9) to achieve the conservation easement objectives, the Intervale was required to develop comprehensive land and forest management plans, which they did in 2009 and 2014, respectively. According to the conservation easement agreement, these plans have to incorporate strategies to minimize "any adverse impact on agricultural soils" Vermont Land Trust et al., 2007, p. 2) and identify and protect natural communities (i.e., they have to adhere to P9, *nourish biodiversity and soils*). Correspondingly, the Intervale is restricted in performing any disturbance of the soil surface such as removal of topsoil, filling, excavation, or any change to the topography or the natural course of surface water drainage. Intervale may perform minimal impact soil disturbances only to improve drainage of agricultural soils or reduce soil erosion after written approval of the conservation easement grantees and by complying with all applicable laws and regulations. Also, in the conservation easement the Vermont Land Trust identifies four

[2323] The conservation easement agreement is between the Vermont Land Trust, the Vermont Agency of Agriculture, Food and Markets, and the Vermont Housing and Conservation Board (grantees) and the Intervale Center (grantor).

Special Treatment Areas (STAs) of approximately 58 acres of floodplain forest, a state-significant and rare natural community. As the conservation easement clearly mandates, the "[p]rotection of the ecological values of the Floodplain Forest shall be Grantors' [the Intervale] highest priority… All forest management activities planned and conducted within the STA … shall focused in the goal of retaining soil integrity, natural hydrology, water quality values, and the natural structure and species composition of the Floodplain Forest and other natural communities present" (Vermont Land Trust et al., 2007: 5).

Under the Land and Natural Areas Stewardship component, coordinator Duncan Murdoch (2019) confirms compliance with the conservation easement mandates described above, which are all related, in one way or another, to *enhancing biodiversity and soils* (P9). Key excerpts from Murdoch's (2019) description of his responsibilities and practices corroborate the expression of P9 at the Intervale:

> "I take care of the natural areas. That includes the trails, the forest, forest health, and any other public park spaces at the Intervale... We actually have a very healthy forest here, fortunately… It's been that the forest has been managed pretty well. There are some areas that have been less managed so we are trying to tackle that as best we can. I also work on the invasive species management here at the Intervale. I do my best at controlling invasives. That involves removal with volunteer force, primarily, and also assessment and keeping track of the health of the ecosystem… The biodiversity I am trying to nourish with keeping our forests healthy, with making sure that invasive species don't overrun. Having a healthy forest and ecosystem sets the stage for more biodiversity… We have hedgerows, for example, that provide a really important service. It's awesome! It's good for wildlife, for connectivity. A lot of species travels along hedgerows. Hedgerows are also good to block wind and to keep trees for carbon sequestration… It's by essence of keeping the forest healthy that helps with fauna. But we are starting to address that regionally so I'm meeting with someone tomorrow about wildlife connectivity and how this area serves as a corridor, as a habitat for various animal species… We're increasing our buffer along the Winooski with the Intervale conservation stock [referring to the Intervale Conservation Nursery]. We're using all native trees and shrubs, some of their conservation

> seed mix. Here at the Intervale we use as much as we can of what they grow… On my end, we don't use any chemicals. You can inoculate an area of knotweed with glyphosate and kill it but then you're also contaminating the soil, so we don't do that."

Altieri (1999) explains that the level of complexity in an agroecosystem for healthy and functional biodiversity depends on the diversity of plant species within and around the cultivated fields, the management strategies at different scales, and the extent of isolation from or integration with the surrounding natural vegetation. Not only is the "planned biodiversity" important (i.e., the "productive biota" chosen by farmers for their production fields), but so is the "resource biota" or "associate biodiversity" (Altieri, 1999: 21) surrounding the production fields for the productivity of pollinators, beneficial animals for pest control, decomposition of organic matter, and all the other ecological processes. The objectives and practices of Intervale Conservation Nursery and the Natural Areas Stewardship are to take care of this resource biota or associate biodiversity. The land cover/land use map (2020) of Intervale (see Figure 5.6) shows how the spatialization and proportions of the different land cover/land use classifications in the agroecosystem may be *integrating* planned and associated biodiversity within Intervale's *multifunctional agroecosystem* (related to P11). What stands out in Figure 5.6 is that the Intervale has approximately 103 acres (~30% of the property) in forested areas (i.e., forest, forest/wetland, and hedgerows). This percentage does not even take into consideration the grass/shrub and grass/shrubs/wetland land cover with a combined percentage of ~25.17%. Comparably, Intervale also has ~117 acres (~34%) in cultivated fields (including the Conservation Nursery's field and the community gardens).

Nicholls et al. (2020) proposes a methodological tool that uses ecology-related principles to assess at the farm level the agroecological status of a farm (i.e., the principles related to landscape diversity, crop diversity, genetic diversity, soil quality and management, and plant health and pest management). This methodological tool helps to assess landscape diversity (e.g., natural vegetation surrounding the farm like hedgerows, forest remnants, forest or weedy borders, flower strips) using a metrics of 1 or less if only 20% or less of the perimeter of the farm is surrounded with diverse vegetation, 2.5 if around 20% to 50% of the perimeter of the farm is

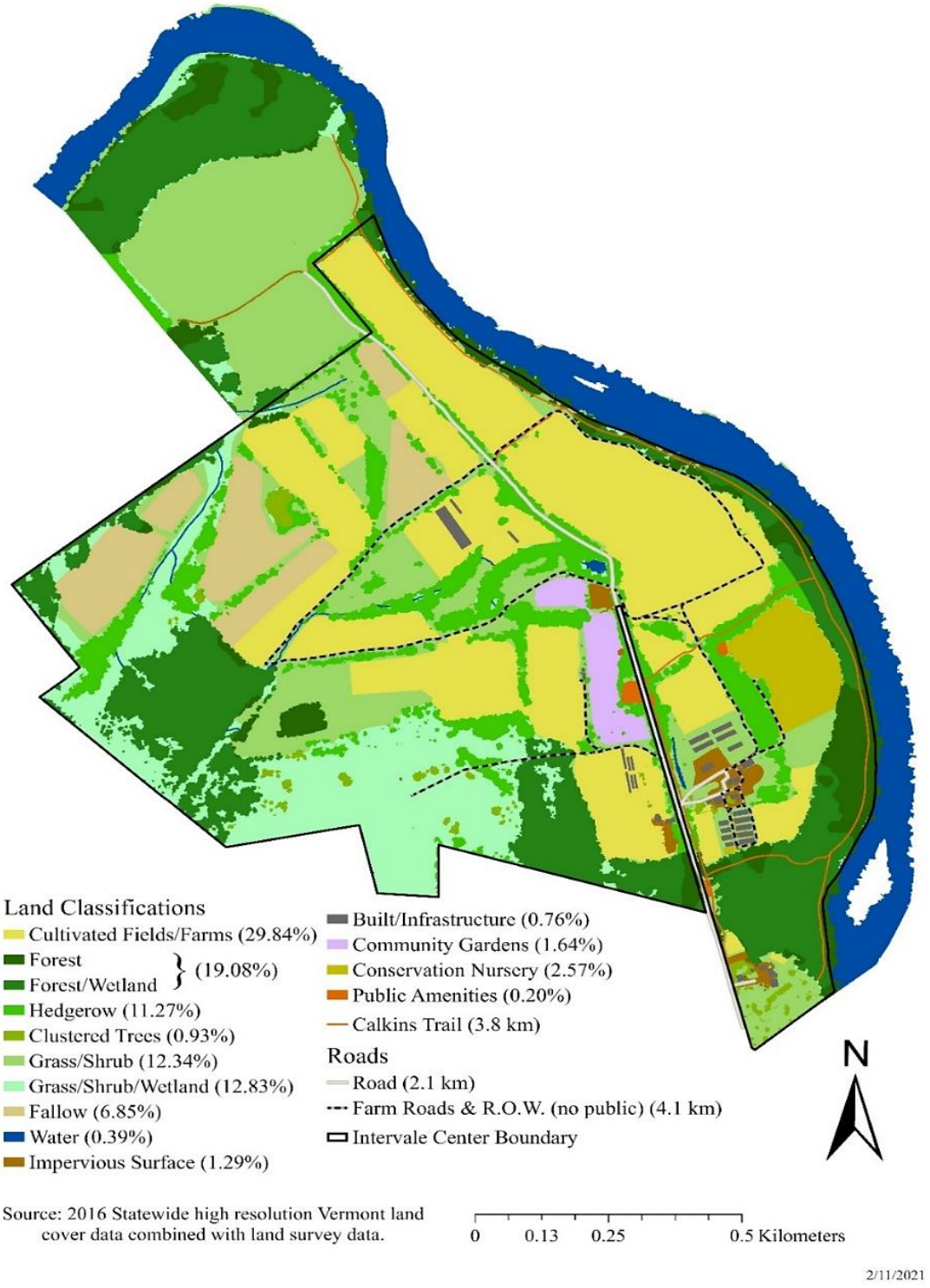


Figure 5.6: The Intervale Land Cover/Land Use Map (2020) with Classes' Percentage Area

surrounded by diverse vegetation, and 5 if 60% or more of the perimeter of the farm is surrounded by diverse vegetation. Based on Nicholls et al. (2020)**,** the Intervale most have a high value of 5 in landscape diversity with its matrix of organic polyculture farms with a combined and equally high percentage of hedgerows, borders and patches of native floodplain forest, wetlands and natural grass/shrubs. In short, based on observations on the field and geomatics, the Intervale's agroecosystem shows functional biodiversity with its combination of planned biodiversity or productive biota in the farms and resource biota or associated biodiversity in the natural areas surrounding the farms (Altieri, 1999).

Moreover, according to the theory of landscape multifunctionality for agroecosystems, the hedgerows and forest areas at the Intervale (in addition to the wetland areas) are providing not only nonmarket biophysical or ecological services to the farms, but also valuable public services for a healthier environment in Burlington (through carbon sequestration and cooling of the local environment during summer to advance P8 *resilience to climate* change) even though such assessment has not yet been calculated.[24] However, the Intervale's mix of cultivated fields (~34%), forested areas (~19%), hedgerow (~11%), grass/shrubs (~12%), and wetland (~13%) indicate a diverse and intricate "landscape mosaic" (Perfecto et al., 2009: 29) and what seems a fairly balanced agroecosystem between cultivated and forested/natural areas for *nourishing biodiversity and soils* (P9), thus providing healthy ecological services.[25] Agroecosystems have been pieces of ecological complexity in the environment since humans started fragmenting lands for farming around the world, thus their sustainable management is important for the conservation of biodiversity (Vandermeer and Perfecto, 2017; Perfecto et al., 2009). As mentioned before, the Intervale has land and forest management plans to protect and enhance planned and associated biodiversity (Altieri, 1999) as part of the mandate from the conservation easement agreement.

The Land Management Plan (2009: 2) provides criteria to guide any activity at the Intervale. Related to *nourishing biodiversity and soils* (P9), the list includes "minimal impact on

[24] T. Gladkikh (2021), graduate student from the University of Vermont, is finishing a doctoral research related to this topic using the Intervale as one of her case studies.

[25] An in-depth analysis of how well balanced and integrated this agroecosystem is for the conservation of biodiversity in the long run, both above and below the ground, is beyond the scope of my study. Such study could span the fields conservation biology, landscape ecology, geomatics, and soil ecology in collaboration with agroecology.

agricultural soils, water quality and plant, wildlife and aquatic habitat" and "the identification and protection of natural communities, plant, wildlife and aquatic habitats and other ecological sensitive or important areas." Based on these criteria, land management strategies include:

- minimizing new structures and any improvements on existing structures that may have an adverse impact on the soils or the ecological function of the floodplain;
- maintaining the structure and integrity of the of Silver Maple-Ostrich Fern Floodplain Forest patches or the identified Special Treatment Areas or STAs identified in the conservation easement agreement mentioned above, as well maintaining clear boundaries between these STAs and the agricultural fields;
- working to remove invasive species from the understory that can be harmful to the integrity of the STAs with organic methods (i.e., with brigades of staff and volunteers to pull and cut invasives).

The objective of the Intervale's Forest Management Plan (Tobi, 2014: 4) is *"*to manage for a healthy forest which in turn will support quality wildlife habitat, erosion control, local biodiversity which can in turn help support and enhance beneficial insects and other helpful biological processes, and lastly some limited wood products production." The Plan identifies rare, threatened, and endangered species or natural communities, as well as fish and wildlife habitats on or near the property. The important thing about this plan is that it provides clear guidance for the management of the STAs and the hedgerows around the cultivated fields. In the Plan, the sensitive areas are divided in four distinct forest management stands, each one with its own management objectives and strategies to guarantee a healthy and diverse floodplain forest. The natural community of all the stands is a combination of Silver Maple-Ostrich Fern Riverine Floodplain Forest and Silver Maple-Sensitive Fern Riverine Floodplain Forest. The Intervale's Forest Management Plan, based on its objectives and proposed strategies, was written to *nourish biodiversity and soils* (P9) of the site.

The Intervale's Land and Natural Areas Stewardship component, in collaboration with Intervale Conservation Nursery, has worked closely in reforestation projects to comply with the Forest Management Plan (2014: 11, 14, 17) and restore some areas as part of the management objectives to "grow a healthy and diverse forest" for "important ecological functions." Such collaboration included the restoration of a section of the floodplain forest stands along the

Winooski River. The Intervale Conservation Nursery's Production and Volunteer Coordinator, Maddie Cotter (2019), explains how such collaboration is protecting and restoring *biodiversity and soils* (P9) at the Intervale:

> "The Intervale has a really healthy riparian forest. It was a planting that happened back in the 1940s. That's sort of how we have this Silver Maple Floodplain Forest. There's this one section along the walking trail that doesn't have a buffer that we have been working on. It's right next to Pitchfork Farms fields. We've been working with Patagonia and some of their employees and volunteers. Every year we do an event where they come down and plant. This year we did about 110 trees, and we steward the trees that we have already planted. So, we're trying to connect all of the buffers, but the Intervale is very well planted overall."

Independent farms play an important role in protecting and restoring *biodiversity and soils* (P9). The sustainable management of hedgerows and remnant of forests in and around cultivated fields is important for *taking care of biodiversity and soils* (P9), but even more important is the type of crop production management in the cultivated fields, what Altieri (1999) refers to as planned biodiversity. Perfecto et al. (2009) and Perfecto and Vandermeer (2010) postulate that what matters *for nourishing* or endangering *biodiversity* is the quality of the whole agricultural matrix (with its patches of natural habitats) within the agroecosystem. Assessing and managing the quality of the matrix means not only protecting "the natural habitat that is being covered, but most importantly, it involves, at its core, the management of agricultural ecosystems" so they can become "biodiversity-friendly" (Perfecto et al., 2009: 4-5, 8). As a field of study that inherently embraces the science of ecology, agroecological practices are pivotal in cultivated fields to protect biodiversity and provide healthy agroecosystems. As stated by Perfecto et al. (200: 203) "[a]gricultural landscapes dominated by diverse, ecologically based systems, are frequently our best bet for biodiversity conservation." Moreover, a high-quality matrix is a combination of the quality of the individual natural community patches as well as the whole agricultural field within which those natural patches are embedded (Perfecto et al., 2009;

Perfecto and Vandermeer, 2010). Thus, a high-quality agroecosystem is one that allows easy and safe migration of species between the patches of natural communities.

When signing their annual lease agreement, independent farmers agree to comply with the Intervale's Land Use Protocols (Intervale Center, 2017b: 26) which very first line reads: "All Intervale farms produce crops by following the organic standards set by the Vermont Organic Farmers (VOF) organization." These protocols that all farms at the Intervale have to comply with in their daily operations include *not using agrochemicals* (P10) and specific practices to *nourish biodiversity and soils* (P9). For example, for cover crops and rotation, "[f]armers must cover and rotate crops once they acquire the land as a standard practice to maintain soil tilth and health…. Farmers must lease enough land for proper crop rotation... [and] a winter cover crop on all parcels is required whenever possible" (Intervale Center, 2017b: 26-28). Moreover, "farmers must rotate perennials when feasible. Perennial crops require extra attention to under-sowing and compost applications. Practicing interplanting and companion planting is required to avoid a monoculture." Land Use Protocols for farms operating at the Intervale also require "annual soil tests… as a guide to determine the compost needs" … and compost must be spread "shortly before planting in a field or over cover crops." Also, "farmers need to manage their field properly to conserve nutrients and organic matter." Protocols also demand "acceptable means of controlling weeds" (e.g., mulching, mowing, hoeing). Similarly, "[i]nsect management requires attracting and encouraging beneficial insect populations as a means to balance populations of insect pests. Farmers are required to understand current organic methods of control" (i.e., versed in Integrated Pest Management or IPM). Moreover, "[c]hemical pesticides that are not approved and regulated by VOF are not allowed" neither are fungicides, bactericides, or other use of chemicals. Protocols also state "[a]cceptable controls include: crop rotation, VOF approved organic fungicides, diseased plant removal and disposal, tool sanitation, restriction of foot traffic, cleanliness, black plastic mulch use and/or drip irrigation or watering at ground level" (Intervale Center, 2017b: 26-28).

These practices are known and accepted agroecological (and organic) practices in cultivated fields. Since agroecological practices *suppress the need for agrochemicals* (P10) by mimicking and *integrating the natural ecological processes of the elements in an agroecosystem*

(related to P9 and P11) in non-industrial farming, the Intervale is most likely promoting a high-quality agricultural matrix for *nourishment of biodiversity and soils* (P9) within its agroecosystem/socioecological system. As Amekawa (2010: 221) poses "agroecological practices are better qualified to address contextual ecological holism and social complexities than conventional agriculture."

The use of the above practices for *nourishing biodiversity and soils* (P9) are also evidenced when farmers describe their practices. For example, Andy Jones (2019), Manager and farmer of Intervale Community Farm, explains:

> "We are always thinking about our hedgerows and our perimeter plantings. We don't actively manage them very often, but we do value them as they provide a lot of habitats… So, we do a lot of green manures and cover cropping, crop rotation and things like that to manage our soil as well as trying to maintain good riparian zones and soil covered through the winter months, and in Spring in particular when we're really at more risk of flooding."

In summer months, Intervale Community Farm produces close to 40 different vegetables, herbs, fruits, and flowers, according to their list of products and the weekly shares promoted in their website. Pitchfork Farm, one of the other farms located at the Intervale, produces around 20 different crops, specializing in salad greens, roots, peppers, radishes, onions, herbs, and cabbages. When Eric Seitz (2020), farmer and co-owner of Pitchfork Farm, talks about the principle of *nourishing biodiversity and soils* (P9) at his farm, his short explanation also evidences that he is practicing other environmental domain principles at his farm by *eliminating the use of agrochemicals* (P10) with organic methods, and *advancing resilience and adaptation to climate change* (P8) with crop rotation and cover cropping:

> "We do a lot of cover cropping. It's an organic vegetable farm. We have a diverse array of crops. We don't grow the same crops in the same place year to year, we rotate."

Seitz is also a birdwatching enthusiast. While identifying the benefits and challenges of providing a *healthy integrated agroecosystem* (P11) to conserve wildlife and help *nourish biodiversity* (P9)

at the Intervale, Seitz talks about the array of animals captured through motion detector wildlife cameras in his farmland, but admits that some animals, especially deer can be a problem:

> "We're surrounded by wildlands. Basically, the Intervale is farms, but it's also more. There are wetlands. I studied forestry and I am an avid birder. I carried my binoculars with me, and you see so many amazing birds, three kinds of owls with all kinds of raptors, kestrels. Deer are a problem. We use electric fence, but I bought one of those motion detector animal cameras that you put on a tree. It's camouflaged.... I've seen coyote, raccoons, I've never caught a bear, but I guarantee there are bears down there. A moose ran through. The only problem are the deer. I suppose if you grow corn, raccoons are really bad with corn. We don't grow corn…"

The **gardeners at the Tommy Thompson Community Garden (TTCG)** are allowed to use only organic materials and products at their plot(s) to *nourish biodiversity and soils* (P9). Organic practices are part of their agreement with Burlington Parks, Recreation & Waterfront (n.d.-c, n.d.-d) to lease a plot, and their leaflet with the guidelines and site rules clearly specify that "organic gardening only! Miracle Grow, chemical-soluble fertilizer and pesticides are not allowed… No genetically engineered seeds of plants [GMOs] are allowed."

Community gardeners' commitment to organic practices come through their responses to the principles of agroecology during the interviews, as well as by observing and photo-documenting. Just by walking around the TTCG, visitors can observe areas in fallow for crop rotation, the practice of cover cropping to cover and replenish the soil, mulch in the gardens, the use of compost, and a significant amount of crop diversity, flowers, bees, and butterflies throughout the different plots. Community gardener, Fred Schmidt, also a retired university professor and volunteer educator and coordinator for more than 10 years at the TTCG, explains *nourishing and protecting the soil* (P9) at the gardening plots, which also *advances resilience and adaptation to climate change* (P8) as follow:

> "We mandate rotation, bringing green manure in. Every third year the plots are supposed to sit empty while they're planted with several rounds of green manure, usually winter rye or oats… Our rule is that

> we want to have rotation here and every three years the land has to lie fallow… Most of us that are no-till are planting cover crops anyway."

The Vermont Community Garden Network has a teaching garden in the Tommy Thompson Community Garden (TTCG), a collaborative agreement with Burlington Parks, Recreation & Waterfront in exchange for educational opportunities for the community gardeners. Carolina Lucak, Manager, Garden Education Manager at Vermont Community Garden Network, highlights not only how all the environmental principles are interconnected and reinforcing each another with her response, but how important the environmental domain is for the TTCG, especially *nourishing biodiversity and soils* (P9):

> "I would say all of the environmental – eight, nine, ten, eleven – [referring to P8, P9, P10 and P11] go very hand in hand for me on the organic methods. We encourage the elimination of agrochemicals. We have a pollinator strip to encourage biodiversity in the sense of insects and birds, and all who want to visit our garden… Our pollinator strip is from here, it runs the whole length of our garden, and they are not edible plants. Most of them are native and they bloom all season long and attract a whole range of beneficial insects… I've been particularly interested in soil health. There wasn't much soil health done before I got here. There was no soil test on record, so I've started to do soil tests every year to know what we're doing to the soil, to see how things have changed… In other practices, I definitely encourage people to mulch a lot because there's so many weeds here… What I'm trying to do differently is cover cropping, and so this is the cover crop… there're peas and oats planted there now... You can see this whole row is cover crops for weeds, for erosion control, for giving nutrients."

Finally, the use of polyculture, including flowers for beneficial insects, can be appreciated in most TTCG's plots for *enhancing biodiversity and soils* (P9). Rob Krupp, another community gardener that has also volunteered as educator and site coordinator for many years, confirms my observation:

> "Well, just look around. That's what you see. You see herbs, you see flowers, you see fruits… if you look at these gardens, they're all different, and that's what makes them unique. We have the

> biodiversity which brings in more insects and hummingbirds and butterflies and bees … And, so, this whole area is biodiverse."

During my research period, I toured several of the plots with the community gardeners I interviewed. With Wendy Coe, Head Volunteer Site Leader and community gardener, we counted 30 different types of crops in her 2 ½ plots (each garden plot is approximately 25 by 30 ft. or 750 sq. ft.). Coe (2019) signaled the different crops and flowers she and her husband planted, revealing how she was contributing to *nourishing biodiversity and soils* (P9):

> "This is where I had my cabbage, but we've harvested it all. These are sweet potatoes… These are tomatoes and that's the winter squash… Here are green beans. These three rows have my shelling peas. You take the shell off like snow peas or snap peas… This is lettuce… and these are two asparagus plants. These are cucumbers and a cherry tomato plant. I tried a different kind this year. It's not as prolific as other ones that I've had but, anyway, one cherry tomato plant will give you plenty. This is our pre-bin compost system. You can see that it's just pure soil on the bottom there… My husband is just storing wood chips there. These are peppers…. I have a lot of dill… This is yellow squash which is a summer squash, and they grow really fast... Over here, this is my older asparagus plot, and this is the newer one. I have garlic in here, which you put in at the end of October and harvests in July… These are my artichoke plants, they're kind of wild, they look like dinosaurs or something… I think that they're cool and really yummy…This are my herbs. This is rosemary. The basil I cut it a few times… and then I got parsley, which I have to pick. Sage, this is mint, and these are raspberries. This is tansy... The sunflowers, they pop open, you pull up some and you keep others… I let some clover grow because the bees like it… Has anyone ever told you that red clover is the Vermont State flower? … Bees really love clover."

When Burlington Parks, Recreation & Waterfront, under their Burlington Area Community Garden, started a program at the TTCG to focus on facilitating subsistence food gardening for New Americans, the percentage of New American gardeners rose from 7% to more than 50% (Cahill, 2019). New Americans add diversity to garden plots in the TTCG, not only in cultural

practices of gardeners but also by introducing culturally relevant crops. There are obvious differences between the plots of the New American gardeners and the native-born gardeners' plots. For example, New Americans organically grow a variety of African corn that is not typically found in the grocery stores of North America. As Abenakis and other Indigenous communities have traditionally done, underneath their corn, New Americans synergically combine other crops, mostly beans and squash. This "three-sisters" planting helps to *nourish the soil* (P9) because the corn is a natural stake for bean vines to climb and grow. The beans, through their roots, help to fix nitrogen improving the overall fertility of the surrounding soil. Furthermore, the squash vines provide the needed shade to hinder the grow of weeds and maintain the moist in the soil. Some New Americans also plant and grow a few other crops like a variety of African eggplant contributing to *nourishing crop diversity* (P9) as well.

The expression of *nourishing biodiversity and soils* (P9) at the Intervale is evidenced not only by the significant positive responses of participants, but also by the fact that the Intervale has a conservation easement agreement that clearly mandates following this principle. The Land Use Protocols, part of the Intervale's farmland lease agreement, provide clear directives to farmers for *nourishing biodiversity and soils* by following known ecological-based farming practices, including polyculture. Practices and legal protections are further consolidated with land and forest management plans insuring conservation and sustainable management of the patches of natural communities in their intricate agricultural matrix. These measures clearly contribute to *enhancing a healthy integrated agroecosystem* (P11), which consequently helps *nourish biodiversity and soils* (P9). Biodiversity is also evidenced by the diversity of crops in the farms and natural habitats, including, the presence of wildlife. There is a delicate balance between production and conservation that the Intervale, as an organization, has managed over the years and, sometimes, can be a concern to farmers. In Hilary Martin's (2019) words, co-owner and farmer of Diggers' Mirth Collective Farm:

> "We don't do anything to the wildlife outside of our farms, but we're definitely not inviting them to come in. We do feed a lot of wildlife I think, and I'm not sure that's good either… We maintain the habitat in the perimeters, and I think there's a lot of habitats down here at the Intervale. I mean, the actual tilled acreage, I'm not sure what the total

> is, but compared to the 300 total acres of the Intervale, there's a lot… Certainly, the goal is to nourish the soils and have a healthy ecosystem."

The community gardeners at the Tommy Thompson Community Garden are also taking care of biodiversity and soils by following ecological-based practices that include: intercropping and rotating an array of different crops in their plots, meshing the crops with native flowers for pollinators and other beneficial insects, taking care of the soil with fallow areas, cover crops, mulching and compost, and embracing the diversity of life (Wilson, 1992) with the New Americans' culturally distinct plots and crops. When you visit the site, *biodiversity, and care for the soil* (P9) can be appreciated in plain sight within and between the garden plots.

After discussing the three principles with the most substantive significance at the Intervale above, the next three chapters go into evidencing the main contextualized expressions and practices rendering the exemplification of all the other principles of agroecology at the Intervale, as proposed by CIDSE (2018), under the economic, political, environmental, and socio-economic domains.

6.

EXPRESSIONS AND PRACTICES OF AGROECOLOGY AT THE INTERVALE: ECONOMIC AND POLITICAL PRINCIPLES

This chapter is divided into two subsections corresponding to the economic and political domains with tables that synthesizes the main expressions and practices of each CIDSE (2018) agroecological principle under respective domains. The tables also identify under which of the different components of the Intervale's socioecological system the principles are mostly evidenced. As previously mentioned, the principles are so interrelated and interconnected that when providing an example of the expression or practice of a particular principle, most of the times it inevitably connects to other principles as well.

Assessing Economic Principles

The expressions and practices of the CIDSE's agroecological principles under the economic domain at the Intervale -P1 *Builds transparent and short distribution webs*, P2 *Increases economic resilience and autonomy*, and P3 *Powers the local market; builds on a social and solidarity economy-,* are summarized in Table 6.1. The last economic principle, P3, was one of the principles that resulted in substantive significance at the Intervale, so it was already fully discussed in the previous chapter, but I expand on how P3 correlates to the expressions and practices of the other two principles in this economic domain.

The following expressions and practices of the economic principles stand out at the Intervale:

- the Food Hub, a food distribution non-profit that is part of the Intervale Center, with direct deliveries to local households and business partners;
- the Intervale Community Farm, a consumer CSA coop where members of the coop pick up their weekly share of fresh produce at the farm;
- the Intervale farmers' involvement and support of local farmers' markets, especially the Old North End Farmers Market;
- the close and direct business-to-local-business relationship the farmers have through various local networks and selling venues;

ECONOMIC PRINCIPLES adapted from CIDSE, 2018	Main expressions or practices at the Intervale	Intervale A&D[1]	Indep. Farms[2]	Food Hub	Cons. Nursery	Gleaning & Food Rescue	Land / Natural Areas Steward	Community Gardens (TTCG)[3]
1. Builds transparent and short distribution webs	Direct deliveries; direct business connections and networks; cross-docking		●	●				
	Intervale Community Farm's (ICF) Community Supported Agriculture (CSA)		●					
	Diggers' Mirth Collective Farm (Diggers) support and participation in local farmers' markets and their food truck		●					
	Fair Share; direct donations of produce to social service organizations						●	●
2. Increases economic resilience and autonomy	Diversity of produce at the farms and in the products delivered to customers		●	●				
	More than one selling venue (e.g., direct deliveries, farmers' markets, others)		●					
	Extension of season and risk management with appropriate technologies: high tunnels (low-impact technology), pack shed, winter CSA		●		●			
	Other businesses related to the farm: Pitchfork Pickle (Pitchfork Farm)		●					
	Collective ownership and cost sharing: Intervale Farmer Equipment Co. (IFEC), pack shed, Diggers (employee-owned), ICF's CSA/consumer coop	●	●		●			
	Different revenue streams: Food Hub and cross-docking, Conservation Nursery, farmland leases, Community Barn rental	●						
3. Powers local market; builds on a social and solidarity economy	NGOs as part of the social and solidarity economy (SSE): the Intervale and the Food Hub's missions, visions, strategies	●		●	●	●	●	
	Other types of SSE models (e.g., CSA/consumer coop, employee-owned businesses, as already mentioned above)		●					
	Direct local-business-to-local-business commerce; cross-docking; support and participation in famers' markets; local circulation of money and resources	●	●	●	●			
	Diggers initiating and supporting Old North End Farmers' Market		●					
	The social responsibility of guaranteeing food security and justice for low income families					●		
	Collaboration, transparency and reliability via direct and local market networks	●	●	●	●			
	Emphasis on voluntarism	●		●	●	●	●	●
	Informal exchanges or bartering of produce, seeds, knowledge							●

1 The Intervale Center, Administration and Development
2 Independent farms include Intervale Community Farm (ICF), Diggers' Mirth Collective Farm, and Pitchfork Farm, unless specified otherwise.
3 Tommy Thompson Community Garden (TTCG), managed by Burlington Parks, Recreation & Waterfront/Burlington Area Community Gardens

Table 6.1: Economic Principles at the Intervale

- the diversity of produce that is being grown on each farm and across the whole agroecosystem;
- the appropriate local scale technologies to reduce vulnerability and increase profitability;
- the collective ownership structure for cost sharing and managing infrastructure, equipment and resources that benefits most of the socioecological system's components;
- the strong social and solidarity economy (SSE) around voluntarism, which also serves to secure the inclusion of low-income families by facilitating their access to fresh produce;
- and even the practice of bartering crops between community gardeners.

Based on numerous cases around the world provided by FAO, CIDSE, and different scholars, the above expressions and practices help to boost the local economy by stimulating a vigorous and more autonomous local food system with shorter and direct distribution webs. Supporting and participating in local farmers' markets provide the opportunity for fairer and more transparent food webs by directly engaging producers and consumers in the production and consumption of food, including lower-income citizens. These direct webs between producers and consumers, which also include business partners, provide local food-based employment opportunities and reduce the inefficiencies and costs associated with food transport, storage, use of energy, and production of food waste that are common in international agribusiness conglomerates.

More ethical resource-efficient cycles are created when the local market is prioritized using local resources and capacities to meet local socioeconomic needs. These more equitable local cycles also build on a social and solidarity economy (SSE) with the creation of social and institutional innovations and collaborations that increase economic autonomy and, at the same time, guarantee accessibility to healthier diets for all community members. Moreover, having strong local distribution networks in combination with a diversified mix of crops and alternative selling venues reduce vulnerability and increase the resilience and autonomy of the farmers, as well as the consumers and the overall local food system (CIDSE 2018; FAO, 2018; Dumont et al., 2006). Moreover, as explained in the previous chapter, the SSE is invariably express in the Intervale's mission, vision, and related daily operations.

A perfect example of how one of the farms at the Intervale, Diggers' Mirth Collective Farm, expresses all the economic principles is with their initiation, support, and participation in the Old North End Farmers Market. The Old North End is locally known as the most diverse (in terms of race, income, and number of immigrants) neighborhood in Burlington. In the words of Hillary Martin (2019), Diggers co-owner and farmer, commenting on Figure 6.1:

> "So, this is my farm partner Elango, and he's working at the Old North End Farmers Market… This illustrates P1, *promotes fair, short distribution webs, producers and consumers working together* because this farmers' market is put together by farmers, it is direct marketing to customers. Then it also illustrates P2, [*increases economic resilience and autonomy*], and P3, [*powers the local market; builds on a social and solidarity economy*] because this is in the farmers' market. So, it's helping the economic domain, I can see it in one [P1], two [P2], and three [P3]."

Figure 6.1: Elango at the Old North End Market
(Source: H. Martin, 2019)

Abby Portman (2019), Community Relations Coordinator at the Intervale, expands on Hilary's interpretation of how Diggers' Mirth is practicing the economic principles of agroecology (Figure 6.2). She asserts that Diggers is *building transparent and short distribution webs* (P1) with their active participation in the downtown Burlington Farmers Market and their strong local-business-to-local-business wholesale partnerships with the example of the City Market Onion River Co-op.[26] Also, as Portman explains, Diggers *increases economic resilience and autonomy* (P2) through their initiatives to secure lower income families' access to fresh local produce with their initiation of and participation in the Old North End Farmers Market, and their creative 'veggie truck' that they drive once a week around the neighborhood to sell fresh vegetables from their farm directly to consumers in the Old North End. Diggers' different selling venues increase its *economic resilience*. By embracing P1 and P2 in their practices, especially when including lower income consumers, Diggers is also *building on a social and solidarity economy that empowers the local market* (P3). In Portman's own words:

Figure 6.2: Hands of the People
(Source: A. Portman, 2019)

[26] City Market, Onion River Co-op (n.d.-a) is a community-owned grocery store cooperative with two stores in Burlington that focuses mostly in selling local, organic foods, and an array of other Vermont-made products.

> "Diggers' Mirth, specifically, spearheaded the Old North End Farmers Market, they sell to City Market, they're at the downtown farmers' market, they have the veggie truck that drives around the streets at night. So, they are really good at connecting with consumers, especially low-income consumers… They have this old like an ice cream truck that goes around and sells vegetables all throughout the Old North End... I think it's great."

The Food Hub is another big player in the expression of the agroecological principles in the economic domain, especially when it comes to P1 *building transparent and short distribution webs* by *reconnecting consumers and consumers*, which also relates to P7, *encouraging participation of food producers and consumers.* Referring to Figure 6.3, Brian Teed, Food Hub's Operations Lead, explains:

Figure 6.3: Sunrise Delivery
(Source B. Teed, 2019)

> "Here's the truck early in the morning. I selected *short, fair distribution webs* [P1], again, because that's what we do. We distribute food and it's not going that far. So, we delivered about 20 different places around town and do vegetable drop offs and then people pick-up their shares at work sites or community places. So, this photo represents P1 *promotes fair short distribution webs producers and consumers working together*. Generally,

> I'm not delivering more than eight-mile radius around town. So, it's really not that far for a distribution web. … Right now, we're at like 320 [customers]. Last summer we had 460, so last summer was crazy."

The Intervale Community Farm (ICF), the first CSA in Vermont and now the largest in the northeastern New England, has had an important role in cementing many of the principles of agroecology at the Intervale in the different domains since they started operations 30 years ago. Specifically, ICF has contributed to the socioeconomic aspect by *building a short distribution web* where *consumers are directly working with producers* (P1), also related to *encouraging participation of producers and consumers* (P7), by *increasing community resilience and autonomy* (P2), and *building on a social and solidarity economy* (P3) with a consumer coop that directly *serves, benefits, and strengthens the local community* (related to P13 under the sociocultural domain). Hilary Martin, co-owner and farmer of Diggers, provides a limpid insight into how ICF, the largest adjacent farm to Diggers, is serving and contributing to the local economy (Figure 6.4):

Figure 6.4: Andy Removing Poison Ivy at the Entrance of ICF
(Source: H. Martin, 2019)

> "This is Andy Jones removing poison ivy from the walking pathway into the farm by hand. And this was on Saturday, so he was here on the weekend, donned in his protective suit, not using any pesticides [which

related to P10, *eliminates the use of agrochemicals*]. This is where people walk to the pickup spot for the Intervale Community Farm. Hundreds of people visit the Intervale through the Intervale Community Farm. They have two pickup days a week… So, there's hundreds of people coming, I think it's somewhere around 500 people in their CSA that come here and pick it up, and many of them will walk into the farm through this pathway…They are really focused on inviting people into this space and feel comfortable and feel welcome, and to stay and to be together in community at the farm. And, so, I just felt this little detail, which is obviously essential, [because] you don't want to give anybody a rash. I always appreciate the attention to detail that this farm gives to their community, to the coop. Their farm is a consumer co-op, so the CSA members own the farm and this farm, in particular, is a really good steward of the Intervale as a whole."

Figure 6.5: Fall Brassicas and Greens at ICF
(Source: A. Jones, 2019)

Andy Jones (2019), Manager and farmer of Intervale Community Farm (ICF), spoke of increasing *economic resilience and autonomy* (P2) with the *diverse array of crops* ICF grows,

which also *nourishes biodiversity and soils* (P9) in the cultivated fields. Commenting on Figure 6.5, Jones explains:

> "These are our fall greens, I guess this is a good example of diversity. So that is a picture of our fall Brassica crops and greens. That's the farmer's catchall for all of the stuff that falls in the same family. That would be, broccoli, cabbage, Brussels sprouts, kale, collards, cauliflower, rutabaga, turnips. That would all fall into the Brassica [family]. We're producing these things for our members who are coming to the farm and we're really diverse: diversified cropping, different planting dates, different crops. So, diversifying incomes, right? Exactly. Because if one thing gets wiped out by bad weather, probably the other one will be fine and still have stuff to sell. And *biodiversity and soils*, like we have a lot of different crops in the same area and all of our things are grown with soil stewardship in mind, using cover crops and organic fertilizers and things like that."

Figure 6.5 is also a good visual example of how intercropping practices can be appreciated in the cultivated fields in combination with the forested areas and hedgerows behind (i.e., P11 *enhancing the integration of the agroecosystem elements*).

Figure 6.6: High Tunnel Tomatoes
(Source: M. Fisher, 2019)

The high tunnels used by farmers at the Intervale, especially ICF, not only increase *economic resilience and autonomy* (P2) by extending the season of production for some crops, but they also *advance adaptation and resilience to climate change* (P8) by protecting some crops from the more frequent and extreme changes in the weather. As Mandy Fisher, director of development and special projects, accounts by sharing Figure 6.6:

> "This one is a great example of increasing resilience. Why? Because of the high tunnel. Right now, it has tomatoes in it. So, the climate adaptation aspect is that the high tunnel keeps the tomatoes, when they're young, from being damaged by a pounding rain in June, which is becoming more and more common. And then also helps to reduce pest exposure. It also allows the farmers to potentially start plants earlier and keep plants longer, which is going back to P2 in terms of *diversification of income* [for economic resilience]. So, it's kind of doing P2 and P8 in the same ways because it's sort of a solution to climate change. That's also a diversification of income that is also a solution to climate change, you know what I mean? … Once the tomatoes are done, we'll have winter green in it, and we'll allow this farm to supply winter greens to local markets and to the CSA throughout the winter. While before they had this tunnel, they couldn't grow those products. That's diversification of income but is also a climate adaptation strategy because if you have a bad summer, if you have a flood, if you have a drought, being able to have a winter income is really important."

Fisher also explained that high tunnels are excellent appropriate low-impact technology for Intervale's location in a floodplain (see next chapter).

The Intervale *built on a social and solidarity economy to power the local market* (P3) when planning for and building the new pack shed at the Intervale. Patrick Dunseith, Intervale Land Manager, uses the front façade of the pack shed in Figure 6.7 to explain the collaboration and partnership story behind it. In his explanation, Dunseith not only connects the pack shed to P3, but also to *increase in economic resilience and autonomy* (P2) because the new infrastructure provides cold storage for the harvest and helps extend the production season. Furthermore, Dunseith links the pack shed to *decentralized, collective, participatory governance* (P5) because the building was possible thanks to a business partnership between Intervale Community Farm

and the Intervale Conservation Nursey to use and share the space in different seasons. The pack shed *needed support from the local government* for its appropriate environmentally friendly construction in the floodplain *and investments* (P6) from donors to make it happen. What's more, as Dunseith explains, the pack shed *provides resilience to climate change* (P8) with enough cold space to save, for example, harvested ripe crops, seeds and plant seedlings in case of severe weather events, and it uses the appropriate building technology for energy efficiency:

Figure 6.7: Pack Shed Cooperation between ICF and ICN
(Source: P. Dunseith, 2019)

> "This one is the new building we built last year. It was a partnership between the Nursery and ICF [Intervale Community Farm] to make it happen and all of the work ICF did to fundraise for it. It's a really effective space and an efficient building. That is why I associated it with P8. It is a cooperation and partnership, and all of the other partnerships to make it happen, Vermont Working Lands, and others. There were a lot of people involved to make it happen [referring to P3, P5 and P6]. As far as providing or having a space like this it makes it easier for the farm in all seasons and to have a comfortable work environment in colder months [P2 and P8]. And P13 because of the food producers to have cold storage and a warm place in the winter. Strengthening the food producer strengthen the farm."

Finally, the overall spirit of voluntarism, and the constant awareness of farmers and gardeners to reduce food waste combined with the NGO's charitable Gleaning and Food Rescue program (i.e., the circular economy promoted by FAO, 2018), put Intervale in a forefront position to keep building on a *social and solidarity economy vision* (P3) around food security and justice. Fred Schmidt (2019), volunteer coordinator, educator and gardener at the Tommy Thompson Community Garden (TTCG), puts in words what the sign on Figure 6.8 "Remember the Food Shelf" represents at the TTCG and Intervale in general. For Schmidt, this photograph represents voluntarism, the awareness about not wasting food, and the desire to expand the gleaning and food rescue collaboration between the gardeners and Intervale staff to bring more fresh food to low-income families in Burlington:

Figure 6.8: Remember the Food Shelf
(Source: F. Schmidt, 2019)

> "And this year it's being used to support the Food Shelf [referring to one of the Vermont Community Garden Network's plots that during the 2019 summer was used for the benefit of the Food Shelf]. There's a coordinator who comes from the Food Shelf with volunteers that work that plot. And when the harvest season comes, one of the main activities at Intervale is gleaning, not wasting food. And when the season is over or when someone abandons a plot, Intervale provides technical assistance to anyone that ask, and they send volunteers to come in and pick what's there. That's really more theory than practice because the gardens are so small, but they do that systematically with the commercial growers. Travis [the Intervale's Executive Director] has

> worked with this group [referring to Intervale's Gleaning and Food Rescue program staff], and this group is very successful and professional about the way they glean. And that's a very important part of the Intervale Center... The three of us, my son David, Ron [a fellow gardener], and myself, whenever we have too much of something, we'll take it to the Food Shelf… We just agreed, Robin, Hannah [Manager of Intervale's Gleaning and Food Rescue program] and I, that we would work more heavily on the coordination between the community gardeners here and the Food Shelf. I mean, so many of these gardens have surplus, it's just a matter of organizing it. When we do the last garden cleanup, we glean the whole place… we'll have a truckload of stuff to take to the Food Shelf. But we could be so much more coordinated."

Schmidt explanation also touches P1 with the coordination of a *fair and short distribution web* to rescue food for those in need within the community. Likewise, gleaning and rescuing food also *strengthen local community* (P13) by incorporating low-income families in the local food system, thus *promoting a healthier diet* (P14), and by encouraging *solidarity among peoples* (P15) from diverse socioeconomic backgrounds.

Assessing Political Principles

The expressions and practices of CIDSE's agroecological principles under the political domain at the Intervale -P4 *Supports access to and control of resources (land, seeds…)*, P5 *Foster decentralized, collective, participatory governance,* P6 *Has supportive public policies and investments*, and P7 *Encourages participation of producers and consumers* -, are summarized in Table 6.2.

The following expressions and practices stand out:

- the legal restrictions in place (i.e., agricultural district zone) with the conservation easement for the land stewardship (i.e., public trust) to guarantee the perpetuity of farmland, community gardens, and floodplain forest (as explained in the previous chapter under P9 *Nourishes biodiversity and soils*);
- compared to market rates, the affordable leases for the farmers and gardeners to have access to cultivate the land, and their access to water;

POLITICAL PRINCIPLES adapted from CIDSE, 2018	Main expressions or practices at the Intervale	Intervale A&D[1]	Indep. Farms[2]	Food Hub	Cons. Nursery	Gleaning & Food Rescue	Land / Natural Areas Steward	Community Gardens (TTCG)[3]
4. Support access to and control of resources (land, seeds…)	Conservation easement/public trust, mission of Intervale as an NGO	●					●	●
	Affordable leases for farmland and gardening plot; Vermont Land Link host	●	●					●
	Access to water	●	●	●	●	●	●	●
	Land and natural resources volunteer stewardship program						●	
	Collection on the property and use of native plants and seeds for propagation				●		●	
	Seed swaps							●
	Potential with the Abenaki Heritage Garden	●						
5. Fosters decentralized, collective, participatory governance	Type of SSE business models, as mentioned in the economic domain (e.g., consumer coop/CSA, collective ownership, employee-owned businesses)	●	●		●			
	Voluntarism and peer-to-peer collaborative governance of site							●
	Lease agreements for farmers (with Land Use Protocols, Intervale Farmer Equipment Co.) and gardeners (site rules, shared gardening tools)	●	●					●
	Collective responsability for farmland, gardening site and resources stewardship	●	●		●	●	●	●
	Decentralized distribution of local and regional produce through direct collaborative agreements with growers		●	●				
6. Has supportive public policies and investments	Agricultural district zone and farmland conservation easement with Chittenden County, City of Burlington and VT Land Trust	●					●	
	Direct collaboration with Burlington Parks, Recreation & Waterfront/Burlington Area Community Gardens	●					●	●
	Collaboration and grants with federal and state agencies (e.g., USFWS, NRCS-USDA, VHCB)[4]	●			●	●	●	
	Collaboration with other NGOs for relevant public policies and specific projects/programs[5](e.g., The Nature Conservancy, NOFA-VT, VVBGA)	●	●		●	●	●	
7. Encourages participation of producers and consumers	Consumer coop/CSA; consumer surveys; direct support and connections between growers and consumers via different venues (e.g., direct negotiations and deliveries, farmers' markets)		●	●				
	Growing small amounts of particular crops to satisfy specific local customers/niche markets, including culturally appropriate crops		●					

1 The Intervale Center, Administration and Development
2 Independent farms include Intervale Community Farm (ICF), Diggers' Mirth Collective Farm, and Pitchfork Farm, unless specified otherwise.
3 Tommy Thompson Community Garden (TTCG), managed by Burlington Parks, Recreation & Waterfront/Burlington Area Community Gardens
4 US Fish and Wildlife Service (USFWS), Natural Resources Conservation Services (NRCS) under US Department of Agriculture (NRCS-USDA), Vermont Housing and Conservation Board (VHCB)
5 Northeast Organic Farming Association (NOFA), Vermont Vegetables and Berry Growers Association (VVBGA)

Table 6.2: Political Principles at the Intervale

- the Intervale Community Farm's CSA coop owned by local consumers, the Intervale Farmer Equipment Company LLC owned by the Intervale Center and the farmers, and the farmers-owned Diggers' Mirth Collective Farm;
- the type of collective and participatory governance structure facilitated by Burlington Parks, Recreation & Waterfront for the Tommy Thompson Community Garden through volunteer site leaders and collaborative guidelines and site rules;
- the economic support and collaboration Intervale has from the municipality, especially Burlington Parks, Recreation & Waterfront, among many other collaborators from the local public and private sectors (just some examples: Vermont Housing and Conservation Board, Vermont Land Trust, Winooski Valley Parks Districts, Vermont Agency of Agriculture, Vermont Fish and Wildlife, the U.S. Department of Agriculture's Natural Resources Conservation Services, The Nature Conservancy, Vermont Food Bank, Farm to Plate Network, Gardener's Supply, City Market Onion River Co-op, Community Bank, Ben & Jerry's, Seventh Generation);
- the direct collaborative web the Food Hub has with the participation of local producers, food business partners, and consumers for a decentralized distribution, sale, and consumption of produce;
- the collection of native plants seeds and seedlings for propagation by the Intervale Conservation Nursery, and the seed swaps between community gardeners; and
- and the attention growers take to satisfy specific local costumers needs by growing small amount of particular or culturally appropriate crops, even if the small production is not profitable compared to their cash crops.

At the heart of the political dimension in agroecology is the empowerment of local farmers and their communities so they can attain more autonomy and *control of their local resources and food system* (P4). To provide this empowerment, you need P6 *public policies and investment in place* (CIDSE, 2018; FAO, 2018). The above expressions and practices of agroecology are intended to achieve more autonomy and control of Burlington's resources and food system by the different players at the Intervale. The quest for autonomy can be appreciated, for example, in the public trust assigned to the NGO to guarantee the perpetuity of the farmland and gardening site for the community, the easy access to water, the affordable leases to cultivate the land,[27] the different types of collective ownerships and participatory

[27] I was able to obtain The Farms Program Manual of 2017, which has not been updated. According to the Land Manager (Dunseith, 2021), the Intervale Center is still trying to review the rates based on present costs. Nevertheless, based on the best available information to have a general idea, in 2017 annual fees included a land management fee of $775.00 plus $210.00 per acre leased, $285 annual fee for well water per meter, $400 per

governance, the collection and use of native plants seeds and seedlings in the same agroecosystem for reforestation projects, the collaboration and economic support the NGO receives from the local government and institutions to achieve its mission of *strengthening the community food system,* among other examples.

Access and control of land (P4) is an essential expression of agroecology. In relation to P4, Executive Director of the Intervale, Travis Marcotte (2019), explains how access to land works at the Intervale:

> "Part of how the Intervale Center works is that we own land in community trust as a non-profit with the goal of then making that land available to farmers. So, it doesn't quite put the full control in the farmers' hands because we have a public trust mission… I think it is affordable. I mean, there are farmers in Vermont that will rent land for nothing because there are places where that makes sense, and there are places where farmers rent land for a little bit more. My sense from where we are is that the land at the Intervale is relatively affordable for what you are getting."

When exploring the opinions of farmers, they all agree there is *access to land* (P4) but with some mixed feelings in terms of control since the land is under a land conservation easement. Hillary Martin (2019), co-owner and farmer of Diggers' Mirth Collective Farm, argues:

> "The mission of the Intervale Center is very much about having this be agricultural, and having it be an asset for the city of Burlington. This land was owned by BED [Burlington Electric Department], and the Intervale Center bought it in agricultural trust… We could still talk about who has access to this land, who sets those rules? But, yeah, absolutely, as a farmer, you're not paying up front for land, equipment, pumps. There's no upfront investment that you have to do. There is still costs associated, and I think its below market rate. It's not super cheap, but, definitely, you're not having to go into debt to start a business, which is really amazing and unusual."

greenhouse lot, and $310 for cooler space, among other similar annual costs to use shared infrastructure and equipment (Intervale Center, 2017a: 33).

Eric Seitz (2019) co-owner and farmer of Pitchfork Farm, echoes Martin in both having access versus having control of the land:

> "Certainly. They've given us access to land… It is good farmland, but on the other hand, it is flood land, so you have a challenge there. The Intervale Center, my landlord, first and foremost, they give me access to land that I pay for, but at the end of the day too, a lot of it is one-year leases. It's the relationship with Center, we have a great relationship, but it can at times feel tenuous. It can feel uncertain just depending on which way the wind is blowing. But absolutely, I would not be where I am if in 2006 Kit Perkins and Lindsey Ketchel [Perkins was the former Executive Director of the Intervale and Ketchel the former Farm Program Director] didn't let me join the [farm incubator] program."

The Intervale also manages the Vermont Land Link (n.d.), a website created to help Vermont's farm seekers find available farmland as well as farmland owner find farmers interested in leasing or buying land (Figure 6. 9). Farm seekers can connect with farm property owners (or vice versa) to lease, buy or sell land exclusively for agricultural activities. The Intervale manages the website with the support and guidance of the Vermont Farmland Access Task Force which includes organizations and agencies interested in perpetuating farmland: Land for Good, Vermont Farmer Project, University of Vermont Extension, Vermont Land Trust, Farm to Plate, Vermont Housing & Conservation Board, and the New England Farm Link Collaborative. This initiative is also a manifestation of how Intervale is helping to *facilitate land to famers* (P4) not only at the Intervale site by leasing land at reasonable prices below market rates, but also throughout Vermont as part of their outreach activities. The Vermont Land Link also evidences that there are *supportive public policies and investment* (P6) to conserve farmland by *facilitating access* (P4) to interested farmers and providing information about other farming related resources and services, including educational opportunities for sustainable farmland tenure (Vermont Land Link, n.d). As Abby Portman (2019), Community Relations Coordinator at the Intervale, succinctly indicates:

> "*Aim to put control of seeds land and territories in the hands of the people* [P4], I saw this as more increasing land access to farmers in Vermont through the Vermont Land Link. That's a great way to

connect people who are landowners who have land available for farmers or farmers who are looking for land, and that's a really amazing resource."

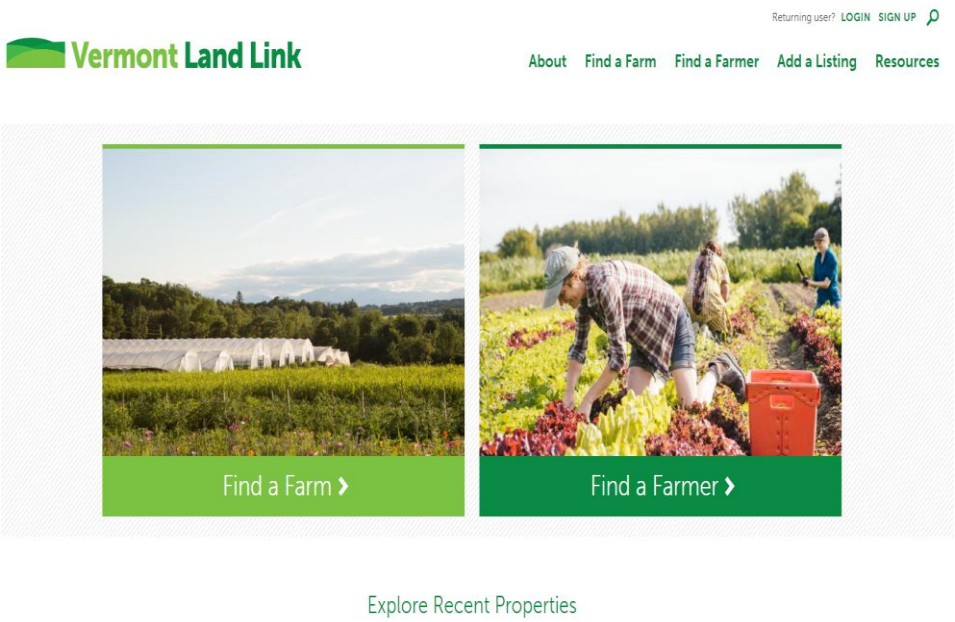


Figure 6.9: Vermont Land Link Homepage
(Source: Vermont Land Link, n.d.)

Land access and control (P4) is important for community gardening, especially in urban and peri-urban areas, with adequate *public policies and investment in place* (P6). Burlington Parks, Recreation & Waterfront provide access and collaborative stewardship of the land at the Tommy Thompson Community Garden (TTCG) for interested community gardeners as a way to manage the land under their jurisdiction. At the TTCG, 25 ft. by 30 ft. (750 sq. ft) plot of lands are available for $60 per growing season. Dan Cahill (2019) explains:

> **"**The community garden model is founded upon a grassroots approach to managing lands. The city has an open space protection plan that we use to guide the ways and the reasons why we would either protect open spaces or manage open spaces. Community gardening is one of those methods for managing open spaces. We are using community gardening as the method for managing that specific area [referring to the TTCG], by providing people a space to grow food."

When it comes to seeds, the community gardeners lead with their annual seed swap (Figure 6.10) and their constant sharing of seeds and other resources for their gardens. Burlington Parks, Recreation & Waterfront, in collaboration with other sponsors, support a seed swap event once a year, just before the spring at the local public library. Community gardeners at the TTCG frequently swap or barter seeds and other crops on their own. As Dan Cahill (2019), Land Steward of Burlington Parks, Recreation & Waterfront, claims:

> "For P4, you could take any photo, *aims to put control of seeds, land and territories in the hands of the people*. It's the basis of the community gardens. Take a picture of the sign: Tommy Thompson Community Garden… I guess I underlined seeds because there isn't any program for seed collection or seed saving. It happens amongst gardeners; people are doing it on their own… oh! That's not true… there's a seed swap event!"

Figure 6.10: Seed Swap Poster
(Source: D. Cahill, 2019)

Fred Schmidt (2019), the TTCG site coordinator and educator, supports Cahill's claim above:

> "I'll collect seeds, Ron collects seeds and he, shortly after the town meeting in March, will plant seeds in his window. And then he'll stagger and plant them all spring long until April. I cut firewood kindling for him and he gives me seedlings, and they all end up down here, in the community garden. He often has a surplus and he'll share those seedlings with other gardeners."

The above quote by Schmidt evidences that there is a lot of gifting (i.e., related the gift economy),[28] sharing and bartering at the TTCG among gardeners, which also manifests the spirit of the *social and solidarity economy* (P3). As Anna Stevens (2019), another community gardener, attest:

> "I think a lot of us feel really enriched and also grateful to have the opportunity to grow our own food and talk about that, and sometimes barter, like, 'this is going really well for me, this is really doing well for you.' … Like flowers, 'I have too many zinnias, these are doing really well, do you want some?' I think that happens at the Tommy Thompson [Community Garden], and from my experience, it is the epitome of this [referring to solidarity economy in P3]. There's definitely solidarity in that experience of all of us going down there and working in the dirt and harvesting or shoveling or watering."

The Intervale Conservation Nursery (ICN) *has access and control of native seeds* (P4) by collecting native seed in the same floodplain forest where the Intervale agroecosystem is nested. The manager of the ICF, Mike Ingalls (2019), explains:

> "We utilize the whole 340 acres of the Intervale for seed collection and hardwood collection and softwood collection. It's a great floodplain forest… We actually utilize the entire landscape."

[28] A gift economy is a type of economic system in which goods and services are given without any explicit agreement for immediate or future monetary compensation or reciprocity. This type of economy is focused on growing qualitative relationships among the members of a community by providing social or intangible rewards. When the gift economy is practiced simultaneously and recursively, it helps to redistribute and circulate different valuables within the community.

Maddie Cotter, ICN's Production and Volunteer Coordinator, echoes Ingalls' view by sharing Figure 6.11 with one of her volunteers using a ladder to collect seed in the branches of a native silver maple tree:

> "This is a photo of one of my volunteers. We are down at the far end of the Intervale collecting silver maple seeds. This is pretty integral to us being successful at the Nursery. We need native maple and shrub seeds. And I think involving volunteers in this activity is a way for them to see what seed saving could be like or what it means to actually go out and collect seeds from a tree."

Figure 6.11: Seed Collecting for Biodiversity
(Source: M. Cotter, 2019)

Closely related to the access to land and resources is the sizes of the farms. CIDSE (2018: 9) posits that, "agroecology prioritises the needs and interests of small-scale food producers." The three largest farms at the Intervale are considered relatively small if compared to the average size of farms in the United States. The World Bank categorizes smallholders as typical family-owned enterprises, cultivating in two hectares or less (i.e., 5 acres or less) with a low asset base (FAO, 2017; IFC, 2019). A 2016 study revealed that 84% of all the farms around the world are smaller than 2 hectares (Lowder et al. 2016). This size mirrors the reality of subsistence farming that is common in the Global South. Another description of smallholders is marginalized farmers

with limited access to adequate resources, technology and markets, and operating under structural constrains (Brooks et al., 2009; Murphy, 2012; FAO, 2017). Notwithstanding, smallholders are responsible for providing fresh supply of food to approximately 70% of the world population or over 80% of the food consumed in large parts of the Global South (FAO, 2013; IFAD, 2013; ETC Group, 2017). The situation in the United States is different, and there are considerable variations in the definition of smallholders. For example, the size of what is considered a smallholder can exceed 10 hectares (25 acres) in some countries and sectors (IFC, 2019). Thus, any definition has to be country specific. There is not a one-size-fits-all definition of a smallholder because of their conspicuous diversity, the peculiarities of each country, and the different farming system zones around the world (FAO, 2017; Dixon et al., 2004; Brooks et al., 2009).

In the United States, the U.S. Department of Agriculture (USDA) categorizes small commercial farms as those with annual gross sales under $250,000 (MacDonald, 2021). According to this USDA category, small farms account for approximately 88% of all farms in the United States (USDA, 2020). The National Institute of Food and Agriculture (NIFA) claims that this percentage is over 90% (NIFA, n.d.). Even though the number of small farms under this USDA category have experienced some increase, especially the non-commercial farms, their share of sales have been decreasing. There are fewer and bigger farms controlling the majority of the market in the United States (Guta, 2021; USDA, 2017).[29] Agricultural production keep shifting to larger farms due to economies of scales and modern tillage systems, seeds, and equipment favoring larger scale production (MacDonald, 2021). Consequently, under the politics of agroecology, this is a critical issue that needs further discussion in the United States. According to NIFA (n.d), small farms are vital for the welfare and prosperity of the United States because they cradle the development of new types of enterprises and marketing systems, provide sustainable livelihoods to many local communities, maintain the competitiveness of local farm

[29] Related to this trend, an interesting data is that there were 105,453 farms in the United States that produced 75 % of all sales in 2017, even though there were 2.04 million farms and ranches. Also, the smallest farms (between 1-9 acres, as identify by the Census of Agriculture), make up only 0.1 % of all farmlands, and the largest (with 2,000 acres or more) make up 58% (Guta, 2019; USDA, 2017). In 2019, 51.1 % of all farms had less than $10,000 in sales and 81.5 % of all farms had less than $100,000 in sales. In contrast, only 7.4 % of all farms had sales of $500,000 or more (USDA, 2020).

economies, and are more focused on protecting and enhancing natural resources and the environment. Presently, the average farm size in the United States is 444 acres, but in Vermont the average is 176 acres. The average size of small farms (less than $250,000 in gross annual sales) is 304 acres for those with sales between $10,000 and $99,000, and 976 acres for those with sales between $100,000 and $249,999 (USDA, 2020). Based on the above average farm sizes, and the particular context and situation in the United States, the farms at the Intervale can be considered in the small range in the United States. Intervale Community Farm, Pitchfork Farm, and Digger's' Mirth Collective Farm, the three largest farms at the Intervale, respectively operate on 58, 22, and 16 acres. That's just 98 acres in total between the three farms. Yet these farms together represent a significant contribution to the local and sustainable agri-food landscape in Burlington.

Agroecology also enhances the food security and sovereignty of local and Indigenous communities through *greater and more direct participation of food producers and consumers in the decision-making process* (P7). This greater participation of producer and consumers provides the opportunity to develop innovative, self-organized, *decentralized, collective, and participatory governance structures* (P5) through a *circular and solidary economy* (P3) around their local food system (CIDSE, 2018, FAO, 2018).

Mandy Fisher (2019), Director of Development at the Intervale, shows one of the greenhouses (Figure 6.12) of the Intervale Farms Equipment Company (IFEC), which started in 2005 to share the management responsibility of Intervale's farming equipment (i.e., tractors and implements) and greenhouses with the farmers themselves. According to Fisher, IFEC provides the Intervale producers a more *direct participation in the decision-making process* (P7) and it is also an innovative way to *support decentralized, collective, and participatory governance* (P5) between the farmers and the NGO:

> "This is an IFEC greenhouse, which is collectively owned. They're sharing part of it. So, this greenhouse is collectively owned by farmers and is governed in a democratic way."

This collective management, facilitated by the Intervale Center as institutional investor, provided farmers with equity interest in their businesses. The NGO invested 35% and the

farmers 10% in the limited liability company (LLC). Through the Intervale's owned portion, the Intervale Conservation Nursery and the New Americans farming at the Intervale (under a collaborative agreement with Burlington's New Farm for New American program detailed in Chapter 8) can use IFEC's equipment and some of the greenhouses. Specifically, for the economic sustainability of IFEC under a *decentralized, collective participatory governance* (P5), member farms pay a reasonable per hour rent for equipment and per bench rent for the use of a greenhouse, based on the available information in The Farms Program Manual of 2017

Figure 6.12: Starts in the Greenhouse
(Source: M. Fisher, 2019)

(Intervale Center, 2017c; n.d.-q). Members also lease some additional infrastructure from the Intervale Center (e.g., the barn with the shop) and pay a portion of the shared buildings utilities. Farm members are also required to contribute work hours for the maintenance and repairing of the equipment. The members of IFEC elect a board of managers for general decision-making but they vote on larger issues based on the company's policies and procedures. The Board can elect officers, designate committees (i.e., for equipment, greenhouses, and finance) and choose managers between the same IFEC members to help its day-to-day operations. Depending on the agreement

with the Board, the managers may be compensated for their efforts with monetary renumeration or reduced rental costs of shared resources. As a collective enterprise, all IFEC members share the risk of equipment breakdown and are required to provide time or money for the continued use and maintenance of the resources (Intervale Center, 2017c, n.d.-q).

The Intervale Community Farm's (ICF) CSA coop is another example of *decentralized, collective, and participatory governance* (P5), in addition to typifying the *social and solidarity*

Figure 6.13: ICF's Members Picking Up their CSA Share
(Source: M. Juncos-Gautier, 2019)

economy (P3), as described in the economic domain, and encouraging *greater direct participation of food producers and consumer* (P7) in the decision-making process (Figure 6.13). Even though ICF is considered a CSA, its governance structure is different from most CSAs. ICF is a consumer cooperative governed by a board of directors elected by the coop members that have the direct collaboration of the Farm Manager. In general, IFC's members are involved in the governance and the farm staff runs the farm (ICF, 2019b). In the own words of the ICF's Manager and farmer, Andy Jones (2019):

> "The farm is owned by a business that's a cooperative, but you don't have to be a cooperative member to buy a CSA share. We have about 300 members of the cooperative. They can vote and run for the Board of Directors and help make the long-term decisions that are important. Over the years, working with the Board, we've identified a set of things that are very much in line with all of these principles of agroecology… There are a lot of people who like cooperatives, and like the fact that it's a participatory economic organization, that it's really based on social capital and decentralized ownership."

Decentralized, collective, participatory governance (P5) is firmly embodied at the Intervale in different ways, so it is important to provide some additional examples. Diggers' Mirth Collective Farm is an employee-owned farming enterprise that not only expresses P5 but also conveys the social *and solidarity economy* (P3). Diggers' agricultural labourers, even though they do not own the land, collectively own their farming enterprise (Figure 6.14). As Hillary Martin (2019), Diggers' co-owner and farmer, explains:

> "We are a partnership but within our business we organize as a collective. Currently, we're five owners and we all have an equal percent ownership in the business. We divide our profits equally, meaning we all make the same hourly wage. We take our net profit at the end of the year and divide it on a percentage basis based on how many hours we've each worked... So, to recognize the alternative economy, that we are participating in as a collective where we have owners with equity in the ownership structure. We also are trying to, when we have time and when we can, participate in efforts to strengthen the cooperative economy or alternative economy in the area just by supporting other employee-owned businesses or talking about it with people who are curious about that."

Figure 6.14: Diggers' Vegetable Wash Station
(Source: M. Juncos-Gautier, 2019)

At the Tommy Thompson Community Garden (TTCG), the *decentralized, collective, participatory governance* (P5) of the community garden is facilitated by Burlington Parks, Recreation & Waterfront through *supportive policies and investments* in collaboration with the Intervale. In the political arena, supportive policymakers and institutions, alongside grassroots agroecological movements lead by producers and consumers, are pivotal for scaling up and scaling out agroecology (Ferguson et al., 2019; Girardo and McCune, 2019; Mier et al., 2018; CIDSE, 2018; FAO, 2018; Wijeratna; 2018; Parmantier, 2014; Altieri & Nicolls, 2008). Every year, a group of TTCG gardeners who serve as site coordinators or leaders help implement the TTCG's guidelines and rules to facilitate the collective governance of the space and gardening tools. The gardening tools are provided by Burlington Parks, Recreation & Waterfront.

Figure 6.15 shows the sign on one of the tool sheds that reminds gardeners to return to the shed the shared tools. The explanation of Fred Schmidt (2019), site coordinator, educator, and gardener, reveals this *collective participatory governance* at the TTCG site:

> "In the annual guidebook, you get the combinations to these locks and they're actually one, two, three different sheds on this site. The one that you can see with the poster on the front, is everybody's. The next door, you can't quite see but it's in that little alcove, is for the site coordinators. And we have supplies in there, tools, basic tools. So, there's that second one, which is a backup really for the community,

Figure 6.15: Shared Tools
(Source: F. Schmidt, 2019)

> for the site coordinators. There are five of us. I'm in charge of the hoses and I have a couple of new hoses in there, and I have some hose repair stuff… Then there's the third one, you can see the little outhouse behind that with two doors to it, and that has equipment for the teaching garden."

Wendy Coe (2019), another site coordinator and gardener, adds to Schmidt explanation when it comes to Burlington Parks, Recreation & Waterfront's *supportive policies and investments* (P6). Coe (2019) also reminds us how important the political context is, with appropriate inclusive, accountable, and transparent governance to facilitate the transition to sustainable community agri-food systems (FAO, 2018):

> "We moved our whole community garden system to be part of our political system to be under Parks and Rec [Burlington Parks, Recreation & Waterfront]. We made our government help us with our community gardens. We need them for the water system, and to manage registration. Also, sometimes, just to enforce the rules… Parks and Rec could not run all of the community gardens without all of the

> volunteers. They have to have site leaders because we are an extension of them, and we don't get paid per se, but we got a free plot, which is worth $60 bucks for the whole summer. And, so, I do get a benefit, I got one of their free plots… After Bernie [Sanders, Burlington's mayor from 1981 to 1989], we had Peter Clavelle [progressive Burlington mayor that served the city from 1989 to 1993, and from 1995 to 2006]. We continued to have progressive party mayors that have recognized the community garden program. And Burlington has just blossomed, to use a garden term. A future mayor would have to be pretty nasty to ignore what an asset it is to Burlington. I mean, it's just a beautiful thing, it is public. Our rent that we pay for each plot doesn't really cover all of our costs, so there's a little bit of wiggle room in the Parks and Rec budget to make sure that we function… I have this whole thing that every shed should have five shovels, three hoes, and three rakes, and things like that. In May and October, we do an inventory and make sure they're there [in the tool sheds] and sometimes they get stolen or broken, so we replace them. Parks and Rec can buy shovels by the hundreds… It's cheaper if they can buy them in bulk."

As an organization institutionalized with the support of the local government in 1988, the Intervale has been successful in securing the *support of policymakers and investors* (P6) to sustain its operation throughout its 32 years of existence. Mandy Fisher (2019), Director of Development and Special Projects, comments:

> "This is my fundraising photo, and this is about P6, *requires supportive public policies and investments*. This is a photo of me completing a budget for a quasi-governmental agency, we have a partnership with the Vermont Housing and Conservation Board [the quasi-government agency]. Our total budget this year is $2.7 million, our federal contracts and state contracts are about $375,000 of that. So, even from the total we will raise $1.3 million. The Nursery's [Intervale Conservation Nursery] biggest customers are state and federal governments, they use state and federal dollars to pay for their products and to do conservation plantings… There are some regulations and some laws that apply to this area where you can't do much. I mean, you can do agriculture, you can do conservation, but

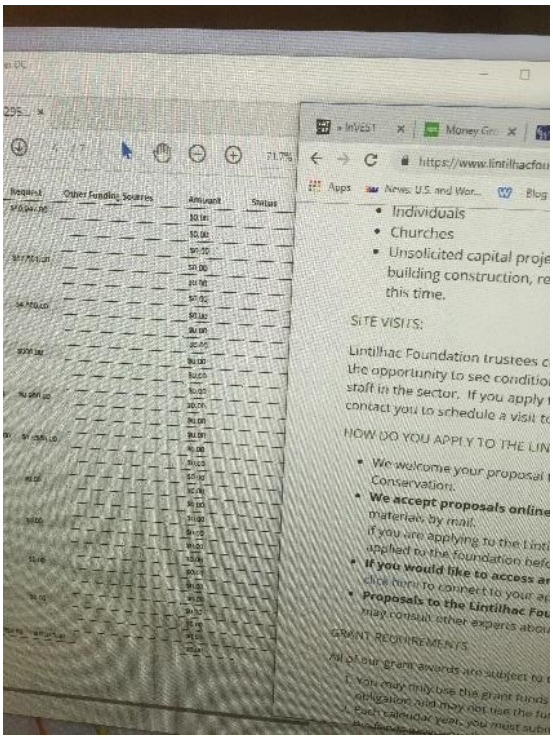


Figure 6.16: Fundraising
(Source: M. Fisher, 2019)

there's some limits in an easement. That means you have support in laws that allows you to do what you're doing. Totally. It's also in perpetuity, there's no right to develop on this land."

The role Intervale Food Hub has played since its foundation in 2008 has been vital not only in the economic domain, but also in the political arena as a non-profit social enterprise under the umbrella of the Intervale Center. As a *local food distribution service* (P1), the Food Hub has a *direct decentralized collaborative network of local and regional producers when it comes to participating in collective* annual *planning and negotiation* processes (P5). This network extends directly to consumers as well with the Food Hub's online store for particular food products, and the direct weekly delivery services of a food basket with seasonal fresh produce to its members in Burlington. This *direct web* of *vendors (producers) and customers (consumers) connected* to the Food Hub*, encourages stronger participation of food producer and consumers in decisions related to the local food system* (P7). At the same time, it creates a localized *circular and solidarity economy* (P3)

among constituents. From the producers' side, the Food Hub Purchasing and Quality Assurance Manager, Keith Drinkwine (2019), assures:

> "The whole point of this is to not only deliver fresh healthy delicious food to our customers in Burlington, but also provide a really dependable market for our farm partners… Our focus is on direct purchasing from farmers, and that's kind of long-term planning with them. They can count on a certain dollar amount per year. Again, we just focus on the local producers, and we work collaboratively with them. I don't just send out a list of what I want and that's what I want, when I want it, and that's it. I get feedback like, 'Hey, if we bumped that back a couple of weeks, we can definitely do that quantity' or 'I don't think we can meet that demand this year, can you include us working with another farmer on that?' So, there's a lot of back-and-forth... At any time, conversation on what the cost is going to be is always open. We can always try and accommodate what the grower needs so we can fairly pay them for their products… We are decentralized. I don't have a distributor that I call up and they bring me whatever I need regardless of what season. We are very independent. As the Purchasing Manager, I'm making decisions, but I also get to talk directly to the growers, people who are out in the field with the food that we're purchasing. So, the flip side of it, not being centralized, is that there's a lot more people involved. There's a lot more conversations that are happening, so that's how I look at it from a decentralized standpoint… instead of just calling up a broker and saying, 'give me all the head lettuce you got'. I can call up a bunch of the farmers and ask them to bring what they might have on hand. And it's participatory, we get the feedback from the grower directly about what's possible and what's not possible…"

Figure 6.17: Preparing the Food Baskets at the Food Hub.
(Source: M. Juncos-Gautier, 2019)

Moving to the Food Hub's customers side (Figure 6.17), Drinkwine (2019) adds:

> "The beauty of us having customers signed up is that we have direct access to every one of our customers, we are delivering directly to them. This past spring-late winner we sent to all of our customer lists a link to a survey… Some of it is kind of wonky like 'we like the way that you package this or we like when our delivery shows up at this time', but a lot of it is around what's coming in the basket and what people enjoy, what they don't enjoy. Part of that greater feedback loop is also customer education like, 'no, you will not see sweet corn in June, because that's when it's being seeded, but come at the end of July or August and you can pretty much have all the sweet corn you could desire.' So, there's that level of customer education as well, unlike a grocery store. That's something that I think our producers and our customers have come to really celebrate, that there is a seasonality and there is a movement of product coming into season and available for a short time… I feel this is our modus operandi all together, is having our food producers and consumers be part of the process and completely participating. And I think that's just inherent in a customer signing up for a basket. They want to participate with our farms and with the local food that is available in our area. So, kind of creating that trust and that community around the food sourcing..."

Lastly, smaller farms, working closely to the community, can pay attention to special culturally appropriate diets and local customers' needs by growing small numbers of particular crops as a benefit for their community. This direct connection is *encouraging a greater participation of food producers and consumers* (P7) in the local food system, in addition to *building on a social and solidarity economy* (P3) and *strengthening local communities (including producers, knowledge culture*…) (P13). Mandy Fisher, Director of Development and Special Projects at the Intervale, points to the presence of these principles with her story of a farmer:

> "These are okras that Hillary grew. She is going to sell them at the Old North End Farmers' Market. Hillary grows this okra because people want it not because it makes money for her farm. So that's P7 *participation of producers and consumers and meeting the consumer need*…. I mean, that's what the Old North End Farmers' Market is doing, is trying to *enhance the power of local markets*, and *build on a social and economic solidarity vision* for the community. By *bringing that food directly into the community*.**"**

Figure 6.18: Hilary and Okras.
(Source: M. Fisher, 2019)

Even though the principles under the political domain were among the least referenced by participants in their explanations, stories, and examples (Table 5.1., and figures 5.4 and 5.5), there

is evidence that there are some important manifestations of these principles at the Intervale's socio-ecological system as can be appreciated above. My inference as a participant observer, and as result of the triangulation process, is that the Intervale is already doing some of the countermovement politics promoted by agroecologists by just being a much-needed lighthouse, as Nicholls and Altieri (2018) propose, for alternative, sustainable, and community-based agri-food systems in the Americas. After all, there are following their mission as a non-profit in the social economy: "to strengthen community food systems". I will touch on this topic again in the last chapter.

7.

EXPRESSIONS AND PRACTICES OF AGROECOLOGY AT THE INTERVALE: ENVIRONMENTAL PRINCIPLES

The expressions and practices of CIDSE's agroecological principles under the environmental domain at the Intervale – P8 *Advances resilience and adaptation to climate change,* P9 *Nourishes biodiversity and soils*, P10 *Eliminates the use of agrochemicals, P11 Integrates agroecosystem's elements (plants, animals…)* – are summarized in Table 7.1. *Nourishing biodiversity and soils* (P9) is one of the three principles that had substantive significance at the Intervale and was fully discussed previously. Even though the list below provides examples of P9 fundamental expressions and practices, this chapter focuses on the other three environmental principles while nevertheless acknowledging the synergistic connections of P9 to these other principles. Under the environmental domain, the principles are so intermeshed that it is almost impossible to discuss one principle without connecting its expression or practice to the other principles.

The following expressions and practices of the environmental principles stand out from Table 7.1:

- the use of bioengineering techniques for soil protection and restoration in riverbanks, and the control of flood waters;
- the use of appropriate technologies and infrastructure to increase resilience;
- the adaptability of farmers as they learn from past experiences and their sharing of knowledge for sustainable practices and resilience;
- the organic-related practices of the farmers and gardeners following their particular lease agreements (i.e., protocols, guidelines, and rules in place), including integrated pest management;
- the existing diversity within (polyculture) and between the different farms and garden plots across the agroecosystem;
- the collection and use of native flora for reproduction and reforestation initiatives;
- pollinator gardens and the beehives scattered around the agroecosystem;
- the restoration and protection of forest patches, buffers, and hedgerows;

ENVIRONMENTAL PRINCIPLES adapted from CIDSE, 2018	Main expressions or practices at the Intervale	Intervale A&D[1]	Indep. Farms[2]	Food Hub	Cons. Nursery	Gleaning & Food Rescue	Land / Natural Areas Steward	Community Gardens (TTCG)[3]
8. Advances resilience and adaptation to climate change	Organic-related practices in the field (e.g., Land Use Protocols for farmers, guidelines and site rules for gardeners, conservation easement mandates; diversity of crops or polyculture in the farms, diversity of small producers at the site)		●		●	●	●	●
	Use of appropriate technologies (e.g., high tunnels and pack shed for risk management and extension of season, use of drip irrigation in smaller fields for water use efficiency)		●		●	●		
	Bioengineering with and use of local natural materials (e.g., berms to control flood, live stakes and fascines for riverbank stabilization and erosion control)		●		●			
	Local production of food; short distribution networks (as covered in the related principles under the economic and political domains)		●	●				●
	Use of local seeds and cuttings for native flora reproduction and reforestation; protection of hedgerows and forest stands as buffers and for carbon sequestration				●		●	
	Learning from past experiences, adapting to the floodplain and planting crops accordingly; collaborating and sharing knowledge for sustainability and resilience		●		●		●	●
9. Nourishes biodiversity and soils	Collection on the property of native flora seeds and cuttings for reproduction; reforestation and protection of native forest patches as wildlife corridors; keeping track of forest health; plan and strategies for the control of invasive species				●		●	
	Organic-related practices in the farmland and property (as principle 8 above). Special attention and awareness to soil protection and enhancement with organic methods.		●		●	●	●	●
	Pollinator gardens and beehives sprinkled throughout the agroecosystem		●		●	●	●	●
	Soil erosion control in riverbank with reforestation, live stakes and fascines				●		●	
	Collaboration with wildlife conservation and monitoring projects (e.g., with USFW, NRCS-USDA[4]; Nature Conservancy); conservation easement mandates	●			●		●	
10. Eliminates the use of agrochemicals	Land Use Protocols, guidelines and site rules for organic practices (agrochemicals not allowed), use of IPM[5]; land conservation easement mandates		●		●	●	●	●
	Organic first policy: 95% of what is sold/delivered to the community is produced in organic farms; use of biobags and recyclable thermal bags			●				
11. Integrates elements of the agroecosystem	Land and forest management plans in place (conservation easement mandates) to achieve a balanced agroecosystem matrix; Lower Winooski landscape management perspective	●					●	
	Integration of diverse land uses and natural communities (e.g., farmland, hedgerows, forest and wetlands in the perimeters, patches of forest as wildlife corridors, pollinator gardens, beehives, recreational areas, community gardens…)		●		●	●	●	●

1 The Intervale Center, Administration and Development
2 Independent farms include Intervale Community Farm (ICF), Diggers' Mirth Collective Farm, and Pitchfork Farm, unless specified otherwise.
3 Tommy Thompson Community Garden (TTCG), managed by Burlington Parks, Recreation & Waterfront/Burlington Area Community Gardens
4 US Fish & Wildlife (USFW), Natural Resources Conservation Service (NRCS) under the US Department of Agriculture (USDA)
5 Integrated Pest Management (IPM)

Table 7.1: Environmental Principles at the Intervale

- the NGOs' collaboration with wildlife conservation and monitoring projects with other NGOs and government agencies;
- the land and forest management plans as part of the conservation easement mandates;
- the integration of a diverse agroecosystem matrix that, based on the land uses of the property promises to be sustainably balanced, providing not only environmental benefits but also an array of social and economic services as well to the community.

As the word 'agro-ecology' denotes, the main root of the discipline is about applying the scientific principles of ecology at the farm scale. In the 1980s and 1990s, agroecologists Miguel Altieri and Steve Gliessman refined the farm-level definition of agroecology by incorporating the comprehensive concepts of sustainability and agroecosystem: "the application of ecological concepts and principles to the design and management of sustainable agroecosystems, or the science of sustainable agriculture" (Gliessman 2018a: 599; Altieri, 1995a). Therefore, ecological science underpins various expressions and practices of agroecology at the Intervale under the comprehensive systemic lenses of sustainability and agroecosystems.

When it comes to *advancing resilience to climate change* (P9), farmers at the Intervale are actively *adapting* to production in a floodplain. The ecosystem services provided by floodplains are numerous. For example, floodplains detain storm water, thus attenuating floods, retaining sediments, filtering water quality, providing habitat for wildlife, while supplying rich agricultural soils. For all these reasons, the Intervale's floodplain is protected under a conservation easement agreement. The Intervale floodplain therefore plays an important role in the ecology of the Burlington area. The Intervale's Natural Resources Stewardship Coordinator, Duncan Murdoch (2019) clearly situates the Intervale:

> "This is a flood plain and we want to keep it that way. We're not building retaining walls and trying to keep the waters out. We understand the importance of that for resilience and we also understand the importance of tree canopy and forests to keep as many trees as possible and to plant as many trees as possible to help with combat against climate change."

Consequently, farmers have learned to work in their farms under this natural agroecosystem context and have been adapting accordingly. One of the farmers at the Intervale, Hilary Martin (2019), co-owner of Diggers' Mirth Collective Farm evidences how her farming team is experimenting with sustainable alternatives to manage floods and be more resilient (Figure 7.1):

> "Flooding is something that happens in the spring and is when we would expect and commonly see flooding. Now we're used to the fact that flooding could happen at any point in the season. It could happen multiple times in a season. We expect it to happen at least every three years. It used to be that we would wait for the flooding risk to pass and then we would plant. But now it's more often. So, we started to build berms where we plow around the field where it is at the lowest. We plow close to them, and we've managed to prevent a handful of floods from coming into our fields, and often times our crops survive. This can be four to six hours of a group of us building and watching it. As long as we're there when the flood comes in, if the flood isn't too high, we can keep it from coming… There's a gauge at up-river from us, in Essex, and we know when it's at 12 feet that we'll start to see flooding here. And that is about 12 hours ahead of when the water hits here. Sometimes it's shorter or longer. And then there's also a prediction of what that will do as well. Even if we don't have the actual number, it might get up to 14 [feet], we better like spring into action."

Figure 7.1: Berm Keeping Out the Flood
(Source: H. Martin, 2019)

Climate change is the most pressing threat in the 21st century, not only to farmers and their farm fields, but to all life as we know it. Farming practices for *adaptability and resilience* (P8) are therefore a primary concern. Martin (2019) explains further how important it is to learn from past experiences, be flexible, and *share what is learnt with other farmers (farmer-to-farmer)* (P12) in the same agroecosystem to be able to *advance resilience and adaptation to climate change* (P8):

> "We've gotten better at that. It used to be that we would expect a flood in the spring, and we would wait to plant until the spring melt came down through the valley. And now we can expect a flood at any time if the water table is high and we get a big storm. We know better how to watch what's happening with the river and expect where the water is going to come in. And we have flood plans for what we have to do, where we have to move, what needs to happen in what order… We have a beautiful field out here, but it's the lowest field, and now we plant there last. We plant the highest areas first because those are going to be the driest and easier for us to get in the spring when it's very wet… We're just trying to minimize risk, whereas before it would be like, 'we'll plant whatever out there.' We definitely have figured out how to minimize risk where we can… We won't put our more valuable crops in certain places, we wouldn't put them in very low areas. You can't really replant them or get them back… We're okay because a lot of our crops take three or four weeks to mature. So, if we lose them, it's like 'oh bummer' but we can replant and be back in action. It's about learning about the land, and learning about your business, and learning about the crops, and putting it all together in a way that you can nimbler around [the farm]."

Eric Seitz (2020), farmer and owner of Pitchfork Farm, expresses how aware he is about *adapting and achieving resilience* (P8) at his farmland due to climate change:

> "I have had to be adaptive and resilient. Essentially, what we've done is, let's say 60% of the farm revenue now comes from crops that are somewhere between 21 and 20 days from seed to harvest, as opposed to say a field of peppers or corn or pumpkins where those are more like 80% or a 100% whole season crops. If I do have a flooding event,

> because so much of my business is based on quick turnaround crops, we are able to be sort of back on our feet within a month or so. Whereas if I had a field of peppers and they got flooded out, that's it for the season. There are fields where I'll never plant what we call gamble crops on our farm, which would be like peppers. We do great sales in peppers every year but, at the end of the day, for us it's about salad greens, it's about radishes, about bunched herbs. So that kind of stuff we grow sort of in our safest fields. And then the other stuff that's sort of a gamble. It's a matrix. We sort of figure out what makes most sense in a given moment. So that's a little bit of resilience. I mean, it's a challenge, but at the same time we think about how to manage the land much better. Because, so far, the soil is very rich. It's a very nice place. Everything grows very fast and very good, but then you have that challenge."

Mandy Fisher (2019), Director of Development and Special Projects at the Intervale, also provides a good example of how the Intervale worked with the Federal Emergency Management Agency (FEMA) to help farmers *become more resilient to floods* (P2 and P8) with the use of high tunnels or hoop houses, an appropriate low-impact technology:

> "You can also see it as our support of farmers as figuring out how to build high tunnels in the Intervale… The Intervale is a floodplain, and you weren't allowed to build high tunnels in floodplains or floodways, as defined by the FEMA. We worked with some scientists and farmers to demonstrate that putting up a high tunnel has no more effect than having fence posts which ranchers are allowed to have. If a rancher is allowed to have a fence, a vegetable producer or whoever should be able to have a high tunnel that the sides can come up, and then if there's a flood coming you put the sides up and the water goes through the high tunnel and there's no problem. It's the same as having a fence in terms of water distribution. We helped make that happen which makes house farms have more resilience. Other farms can use that model for hoop houses in floodplains. They can use that to figure out how to build one on their property in a way that will satisfy FEMA's requirements."

The Intervale's floodplain is also surrounded by wetlands.[30] Actually, more than 12% of the property has a wetland classification.[31] Wetlands are considered important for *climate change resilience* (P8) because they serve as carbon sinks by sequestering carbon produced by nearby agricultural activities and other land uses. Thus, well protected and managed wetlands have the capacity to control greenhouse gases. Wetlands are also considered 'green infrastructure' or nature-based solutions for removing pollutants from water (e.g., like phosphorous and nitrogen from manure and fertilizers in the runoffs of farming activities) through infiltration and their natural biological, physical and chemical processes through time. Wetlands also serve as groundwater storage and, like floodplains, help to attenuate floodwaters. Furthermore, wetlands are called 'biological super systems' *because they support biodiversity* (P9) by providing habitat for a phenomenal number of flora and fauna species. The richness of wetlands' biodiversity can be compared to that of rainforests and coral reefs (The Wetland Initiative, n.d.).

Patrick Dunseith (2019), Land Manager at the Intervale, knows that wetlands can benefit the Intervale's agroecosystem. He attests to how the Intervale is contributing to *advancing resilience and adaptation to climate change* (P8) by working with the local Department of Environmental Resources to assess how the wetlands in and around the NGOs property are doing, how they are supporting *biodiversity* and, at the same time, sustainable farming. By assessing and protecting the wetlands, Dunseith (2019) also explains (in reference to Figure 7.2) how the NGO is *nourishing biodiversity and soils* (P9) and *integrating the elements of its agroecosystem* (P11):

> "This is a picture of us when we went out with somebody from the Department of Environmental Conservation to go through their rapid assessment tool for wetlands. I put P8, P9 and P11. As far as our contribution to *supporting resilience in the face of climate change*, this would be really the most direct work I felt we have done in the past year, really looking into the marginal areas that were once cultivated

[30] While a floodplain is defined as a "low-lying area near water which floods during periods of high rain", a wetland is "an area where water frequently saturates the soil and may have water in the surface." There can be wetlands in a floodplain, as well as along coastal areas (Keeter, 2020).

[31] Land classification at the Intervale (2020) includes 13% of grass/shrub/wetland. This percentage does not include some forest areas that have also a forest/wetland classification.

and that could still be cultivated but were historically wetlands and understanding that role in the landscape and how we can enhance them over time. So P8 is a really strong one, same with P9 because we are trying to prevent invasive species from coming in, and really helping as these return to wetlands, that they are actually going to represent natural ecosystems and not just be a mess of non-native species. This is also P11 because the work of integrating wetlands and agriculture is really controversial in some ways. Some people think you should never grow in wetlands and farmers think it is a great place to grow food, and historically that's been the case. So, for us to really understand these spaces and enhance them and protect them, and its all about integrating."

Figure 7.2: Wetland Assessment
(Source: P. Dunseith, 2019).

Figure 7.3 : Native Habitat Restoration
(Source : D. Murdoch, 2019)

The Natural Areas Stewardship Coordinator, Duncan Murdoch (2019), restores native habitat at the Intervale with volunteers (Figure 6.3), which not only *supports resilience to climate change* (P8) but also *nourishes biodiversity* (P9) and enhances the natural areas for their healthy *integration into the agroecosystem* (P11). The fact that Murdoch integrates community volunteers to steward the natural areas also contributes, in his words below, to P13 *strengthen the local community (culture, knowledge…)* by providing to community members opportunities to steward the land with the Intervale.

> "This is native habitat restoration. So, this is where we are not only removing non-native invasive species, but we're planting native species in its place… It *supports resilience and adaptation to climate change* since we're planting native trees and shrubs, that supports resilience by adding these plants that will help sequester carbon from the environment. It *nourishes biodiversity and soils*: we are trying to replicate or bring back to this area the biodiversity that was here before we introduced the non-native species. P11, *integration of various elements of the agroecosystem*: we're adding plants to this agroecosystem. P13 *strengthens the food producers, local communities, culture, spirit and knowledge*: so, it supports local communities because it was a local group [of volunteers], and that's culture around land stewardship and knowledge. They walked away with new knowledge about non-native and native plants."

The Intervale Conservation Nursery contributes *to climate resilience and adaptation* (P8) in different ways by collecting native flora seeds (which also related to P4 *aims control of seeds in the hands of people*), growing native trees and shrubs (Figure 7.4) for reforestation projects to increase buffer areas around the agroecosystem (which is also related to P9 *nourishing biodiversity and soils*), and for carbon sequestration and absorption of runoff from the cultivated fields and other land uses; and bioengineering with natural materials to reduce soil erosion (P9 *protect soil*) and stabilize the riverbank.

Figure 7.4: Watering Seedlings
(Source: M. Juncos-Gautier, 2019)

Related to the stabilization of the riverbank, live willow (*Salix spp*.) stem cuttings are used to build fascines. I volunteered for fascine construction with willow grown at the Intervale Conservation Nursery to better understand how they are made and used (Figure 7.5). As explained by Mike Ingalls, Conservation Nursery Manager at the Intervale:

> "If you look in our catalog that's inside the nursery, one of our products is bio-engineering material, it's just living material that you can make into a live stake or in this case, fascines, which is basically just a bundle of willow whips that you bundled together. Then you actually plant those, and we trench them typically in a linear fashion. Then you're going to have all this growth that comes up immediately [referring roots and branches with vegetation] which starts stabilizing the bank. If you look back in history, they've been around for a very long time and they've been used for basket making and bridges... I know the armies used to use them. They made bundles and put them in trenches, and they'd drive their tractor or tanks over them, and stuff

Figure 7.5: Building Fascines with Live Willow Stem Cutttings
(Source: M. Juncos-Gautier, 2019)

> like that. …We use them for soil bank erosion. We'll plant them in and then, ideally, in a year or two, they'll start holding that bank in place. And then, ideally, other natives will start moving in."

Community gardening (Figure 7.6) at the Tommy Thompson Community Garden (TTCG) is about *increasing autonomy, and economic* (P2) *and climate change resilience* (P8), according to Dan Cahill, Land Steward of Burlington Park, Recreation & Waterfront, who oversees the TTCG:

> "Some of the more peripheral involvement is just the role the community gardens play in the local food by giving people more access to local food networks and decreasing regional and national food demand... Climate change will continue to put pressure on food systems and energy. So, these spaces [the community gardens] will become really vital hubs of connectivity for people to have options and resources. In a way, now they're a hobby. In the future they may become a necessity. And that's not completely fair because for plenty of people this not a hobby, they are relying on this for subsistence."

Figure 7.6: Tommy Thompson Community Garden (TTCG)
(Source: M. Juncos-Gautier, 2019)

Supporting Cahill's position are two community gardeners' awareness and straightforward explanations of how food gardening can increase *autonomy, and economic* (P2) *and climate resilience* (P8). At the TTCG, Anna Stevens (2019), community gardener, and Wendy Coe (2019), Head Volunteer site leader and community gardener, provide their respective testimonies:

> "Oh, I feel like that's a scary one [referring the P8]. I think that the way that I see that is the practice of providing for yourself and providing for your community in an intimate way and not in this way that relies on these like huge capital systems that are what's killing the earth… It's about being resilient and able to produce your own food close to your home and not relying on the fossil fuels and the chemicals on the food that we're getting" (Stevens, 2019).

> "Yes, definitely, our whole gardening calendar depends on what is happening with the weather, and so we have to adapt. If it's a flood season in the spring, we have to wait patiently until we can plant our garden. And, so, we are very connected to what nature is doing. It's one of the lovely things about being down here. But yes, so we work with nature… Well, all the food that people grow here and eat means that they're not buying food that has been shipped from, like, California. So, they have reduced the carbon footprint by doing their own thing" (Coe, 2019).

The *elimination of agrochemicals* (P10) is completely intermeshed with the *enhancement of biodiversity and soils* (P9), one of the principles with the most substantive significance at the Intervale as covered previously. So, as I explain how P10 is expressed and practiced at the Intervale, it will be obvious, in most instances, that P9 is being expressed and practiced as well.

One important practice in agroecology is integrated pest management (IPM)[32] to try *to avoid, as much as possible, the use of inorganic or synthetic pesticides (i.e., agrochemicals)* (P10). Farmers at the Intervale are required to use IPM for the control and elimination of pests in their farms, as it is indicated in the Intervale's Land Use Protocols. In Figure 7.7, Andy Jones, farmer and Manager of the Intervale Community Farm, provides an example of how they handle tomato hornworm (*Manduca quinquemaculata*):

> "This tomato hornworm is a caterpillar parasitized by beneficial insects. So, these are tiny little wasps that seek out the caterpillars and they lay their eggs in the caterpillar and then the eggs hatch and then they devour the caterpillar from the inside out. It's the coolest thing. It's really great because the caterpillars of the tomato hornworms are about the biggest caterpillars we have in Vermont. They'll be the size of your finger when they're full grown and they can just strip the leaves off. By not spraying you don't kill the wasps. And by having other habitat in your greenhouses, you also make it a friendlier environment for beneficial insects. We plant a lot of things in our greenhouses: alyssum, green beans, other crops that aren't what we're growing [for food or cash crops]. We'll put some in the ground and those things serve as places for the beneficial insects to thrive. Yeah, we're getting natural control of those. I mean, we also pull a lot of them off by hand,

[32] Integrated Pest Management (IPM) is a decision-making process using science and farmers' experiences and knowledge to identify and manage pests, and to reduce as much as possible the use of inorganic or synthetic inputs. On their website, the US Department of Agriculture defines IPM as "a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools in a way that minimizes economic, health, and environmental risks." Farmers that use IPM combine their knowledge of pests with biological and environmental management tactics and monitoring. IPM helps to prevent harmful levels of pest damage in crops, avoid risk to people, property, and the environment, and minimize any possible evolution of pesticides' resistant pests (USDA, n.d.-b).

Figure 7.7: Tomato Hornworm
(Source: A. Jones, 2019)

> but it's really so neat when we see that. …When we see that we jump up and down because that's great, because that means those things are going to hatch and then there'll be more of the adults to fly around and find the next caterpillars."

Growers at Pitchfork Farm do not use integrated pest management, but they have adapted their practices to grow crops that are more resistant to common pests in the region, another way to *eliminate the need to use of agrochemicals* (P10). Eric Seitz (2020), farmer and co-owner of Pitchfork Farm, not only explains how he avoids pest-related problems in his farm, but also reveals that he runs a successful organic farm business:

> "We don't do anything with P10 [*eliminates the use of agrochemicals*]. I've literally never sprayed a single pesticide. We just don't grow those crops that are susceptible. We don't as such have an IPM plan. When I do see disease in my crops, usually we've got enough growing that we can weather it. We've never had a complete profit failure."

At the 2.5-acre New Farm for New American (NFNA) farming site at the Intervale, a collaborative project with the Association of African Living in Vermont (AALV), François Gasaba from Burundi is one of the three 'New Americans' that was farming at the site in 2019 and was proactively monitoring the cultivated field and hand-picking pests from their crops (Figure 7.8). Gasaba evidences the practice of *not using inorganic pesticides* (P10) when he

Figure 7.8: Monitoring for Pests
(Source: M. Juncos-Gautier, 2019)

shows the pests, mostly Colorado potato beetle (*Leptinotarsa decemlineata*) he collected in a water bottle. Integrated pest management also involves day-to-day proactive management and monitoring for pests. Hand-picking pests found on the crops is a laborious but not impossible task in small organic farms, as I learned in a workshop with Vermont Community Gardens Network at the Tommy Thompson Community Garden.

The Intervale has high-quality fertile soils for agriculture at walking distance from downtown Burlington, so their protection is imperative. As explained under P9 *nourishing biodiversity and soils*, farmers and gardeners are required to use organic practices, based on the Intervale's Land Use Protocols and the guidelines and site rules for the Tommy Thompson Community Garden provided by Burlington Parks, Recreation & Waterfront. Four practices that are commonly seen at the Intervale to *nourish and protect* the richness of the Intervale's alluvial *soils and their biodiversity* (P9) are cover cropping, fallow areas, mulching and the use of compost. Hilary Martin (2019), farmer and co-owner of Diggers' Mirth Collective Farm, depicts the practice of cover cropping in Digger's' managed fields (Figure 7.9):

> "This is our perennial vetch cover crop that we planted in the fall. So, this is nice. We planted oats and vetch, and the oats are an annual, so they died back over the winter, but the vetch came back in the spring.

Figure 7.9: Perennial (Vetch) Cover Crop
(Source: H. Martin, 2019)

> So, this is in the spring and the vetch is perennial. It was really nice because we don't have a lot of experience with it. And I was like, 'is it going to do all right? Should we just turn it in?' I wasn't sure in the spring how it was going to come in, and then it just came in so nicely. So, number nine [P9], *nourishes biodiversity and soil*, cover cropping nourishes, feeds the soil."

In the words of Albert Bates (May 30, 2021): "never have bare soil! It is an open wound on the flesh of the earth."[33] By practicing cover cropping, farmers at the Intervale are adhering to all principles of agroecology listed in CIDSE's environmental domain. Cover cropping is a well-known organic practice to cover and protect the soil surface that is not in production with fast-growing plants that are not intended for harvesting (e.g., buckwheat, winter rye, vetch, among others) to *protect and enrich soil health* (P9). Cover crops break through tillage pans and allow organic matter (i.e., nutrient deposits) as well as microbial diversity and carbon to restore the soil. After the season of growing and harvesting the edible or commercial crops, cover crops are sown on the field (e.g., during the fall and winter seasons) to keep the soil covered and provide some nurturing and rest to its environment. Before the growing season starts again in spring, farmers turn the cover crops' plant material into the soil (i.e., green manure). Cover cropping also helps to *increase resilience to climate*

[33] From an online session on regenerative agriculture and food security (May 30, 2021). The session was part of the Global Ecovillage Network's online course Ecovillage Design Education.

change (P8) because it protects the soils from more frequently erratic intensive rainfall and drought events by slowing down soil erosion and keeping the soil moisture, thus enhancing water availability. Simply put, cover crops help to protect soils from extreme weather events (rain, wind, or drought). Likewise, the fast-growing cover crops can *substitute agrochemical herbicides or pesticides* (P10) by choking out weeds (e.g., physically blocking the emergence of weeds' seedling, providing direct competition for space, sunlight and nutrients), and by *nourishing biodiversity* (P9) with habitat for beneficial arthropods (i.e., pollinators and pest predators) above and below the ground. Thus, cover crops contribute to the *integration of the agroecosystem's elements* (P11) by supporting natural ecological processes.

Another practice that adheres to P10, *elimination of agrochemicals,* at the Intervale is weeding by hand with the help of volunteers (Figure 6.10) or with hoes (Figure 6.11) in the different cultivated fields, including the Intervale Conservation Nursery's (ICN) and the People's Garden fields, the last one managed and used by the Gleaning and Food Rescue program. As Maddie Cotter, Production and Volunteer Coordinator of the ICN, accounts:

> "We grow all our trees and shrubs organically, so our field maintenance is done organically. That means a lot of hand weeding! So, here, the volunteers are hand weeding, and you can see there are these little baby pines that they are rescuing."

Figure 7.10: Manual Weeding
(Source: M. Cotter, 2019)

Figure 7.11: Weeding with a Hoe
(Source: M. Juncos-Gautier, 2019)

Based on the 2020 land use/land cover map, the Intervale has 7% of its site classified as fallow ground or soil with some cover vegetation. Fallow ground is basically a field that has been set aside as out of production for a longer period of time (i.e., usually from one to five years) to rest and regenerate by replenishing nutrients. This sustainable agricultural practice divides the land into two halves, one for planting and the other for fallowing. The following year the field that was fallow is then used for production and the one that was in production is then left fallow to rest and replenish. This rotation repeats every year (Larum, 2021). Hence, fallowing at the Intervale is a practice that adheres to all the principles of agroecology in the environmental domain.

Fred Schmidt, a retired University Professor, community gardener and volunteer educator and coordinator for more than 10 years, is adamant about organic practices at the Tommy Thompson Community Garden (TTCG) for *nourishing soil biodiversity* [P9]:

> "The one area where policy and mission, and really legal commitment, is this one, '*eliminates the use of and dependence on agrochemicals*.' That's the one thing they try to police, or we try to police…"

Visitors at the TTCG can observe the practices of fallowing, cover cropping, mulching and composting. During the spring when gardeners are preparing their plots for the growing season, Burlington Parks, Recreation & Waterfront provides a pile of compost based on pre-paid orders by the bucket load, but some gardeners also make their own compost (Figure 7.12). At the TTCG most mulching is done with wood chips or straw. The mulch is spread over the surface of the soil to cover and protect the soil (as with cover crops), providing nutrients to the soils as it supports beneficial microbes and arthropods that break down the mulch into soil organic matter (Figure 7.13). Practicing mulching also helps to conserve soil moisture, serves as year-round insulation to keep the soil temperature cool in the summer and warm in the winter, and it helps supress weeds by blocking sunlight and their growth. Compost is already decomposed organic material that it is mixed into the soil to replenish it with nutrients. In the case of the TTCG, community gardeners mostly use food scraps and plant material for compost. Gardeners at the TTCG are definitively *not using agrochemicals* (P10) and are *nourishing biodiversity and soils* (P9) with their mulch and compost.

Figure 7.12 Compost Pile and Bins at TTCG
(Source: M. Juncos-Gautier, 2019)

Figure 7.13: Straw and Wood Chips Mulch at TTCG
(Source: M. Juncos-Gautier, 2019)

By protecting the rich living soil in their plots, gardeners are also increasing the community garden site *resilience to climate change* (P10) and are helping to *integrate the biotic and abiotic elements and processes that are important for a healthy agroecosystem* (P11). Fred Schmidt (2019) summarizes mulching and composting practices at the TTCG:

> "You're encouraged to mulch and compost. I would say those are in the mission, people agreed to them… Because our rule is that we want to have rotation here and every three years the land has to lie fallow. That applies to the whole area, well actually not the no-till area, but most of us that are no-till are planting cover crops. We mandate rotation, bringing green manure in. Every third year, the plots are supposed to sit empty for three years while they're planted with several rounds of green manure, usually winter rye or oats… One of the basic forms of composting is just developing a plie of leaves and turning it over. It brings organic material back into the soil. Several of us do that in our garden plots."

The Intervale has a multifunctional integrated agroecosystem which is an expression of P11 *Integrates the various elements of the agroecosystem.* The only thing the Intervale does not have are domesticated farm animals integrated into the agricultural production.

Nevertheless, the Intervale's overall multifunctional landscape and role, as part of the non-profit's combined environmental, economic, and socio-cultural responsibilities in the community, contribute to *enhancing biodiversity and soils* (P9), *empowering the local market by building on a social and solidarity economy* (P3), and *strengthening the local producers and community* (P13). Travis Marcotte, Executive Director, explains the "neat spot" the organization has to harmoniously integrate the various elements for multifunctionality at the agroecosystem:

> "We are in a really neat spot as an organization that totally supports agriculture, and totally supports food production, and totally supports conservation, like ecosystem restoration. And they shouldn't be at odds with each other, they could actually live together. So that's a really neat space."

The response of Carolyn Zeller's (2019), Administrative Coordinator at the Intervale, resonates with Marcotte's explanation above when she synthesizes in her own words the *integration of the multiple functions of the agroecosystem* (P11), including passive recreational opportunities for the community (Figure 7.14):

Figure 7.14: Rena Calkins Trail along the Winooski River
(Source: M. Juncos-Gautier, 2019)

> "We are an example of an enhanced integration of various elements of the agroecosystem with having this community recreation resource really integrated in with all of our farm fields, and food production, in addition to our riparian buffer ecosystem with recreation right through it, alongside one of Vermont's largest rivers."

In the environmental domain, landscape multifunctionality[34] means that the agroecosystem provides, in addition to market products, non-commodity services to the community even when some of these services do not remunerate the farmers directly. The benefits that the concept of multifunctional landscapes propounds are that the agroecosystem's overall performance is enhanced when it integrates multiple functions (Lovell et al., 2010b; Amekawa et al., 2010; Zasada, 2011; Wiget, 2019). The multidimensional principles of agroecology promote multifunctional agroecosystems, which are common in many urban and peri-urban farming settings as well (Lerner, 2021; Lovell, 2010a; Zasada, 2011; Brinkley, 2012). In general, if the *elements of the agroecosystems* (P11) are adequately integrated and managed in time and space to enhance *biodiversity* (P9)*,* they can provide an array of biophysical/ecological functions and nonmarket services that go beyond the production of food. These services include *nurturing soil fertility* (P9), protecting crops, and sustaining farm productivity as well (Altieri, 1999; 2002).

Lovell et al. (2010b: 334)[35] studied landscape multifunctionality using the Intervale as one of the case studies in Vermont and concluded that "the Intervale is a landscape uniquely positioned to support multifunctional activities", including production, and ecological and cultural functions. Comen (2013) also researched the landscape multifunctionality of the Intervale and describes the site as a multilayered peri-urban landscape. Using a theory and

[34] Landscape multifunctionality goes beyond the scale of the farm field and encompasses the larger landscape, although the concept can also be applied for the design of agroecosystems (Lovell et al. 2010b; OECD, 2001).

[35] Lovell et al. (2010b) propose the integration of both agroecology and landscape multifunctionality for the design and assessment of agroecosystems. The authors also propose a multifunctionality assessment tool with landscape features to help evaluate the design of agroecosystems. Using three main functional attributes of production, and ecological and cultural services, the scores of the Intervale Conservation Nursery and the community gardens were the highest for multifunctionality at the Intervale, followed by forest and vegetation buffers.

model of multifunctionality developed by the European Union (EU) in the late 1990s,[36] Comen's results showed that the Intervale is consistent with the EU multifunctional landscape theory and the model's three main pillars: sustainable land use through diversified small organic farms, forest stewardship and the conservation of biodiversity, and preservation of cultural heritage and regional identities. These pillars can be related to the principles of agroecology under CIDSE's (2018) economic, environmental, and socio-cultural domains. Comen (2013) ended up modifying the model to reflect the Intervale's unique contextual reality in Burlington. If an agroecosystem is managed in harmony with the local biodiversity, as well as with the local environmental and socioeconomic conditions, it can provide improved economic and ecological outputs (Altieri, 1999). The combined production of the independent farms with the roles of the different components of the Intervale's socioecological system (i.e., the Intervale Food Hub, Intervale Conservation Nursery, Land and Natural Stewardship program, Gleaning and Food Rescue program) is a palpable example of how the Intervale is trying *to manage and integrate its agroecosystem* (P11) to provide these positive multifunctional outputs.

Mike Ingalls, Manager of the Intervale Conservation Nursery, and Hilary Martin, farmer and co-owner of Diggers' Mirth Collective Farm, both evidence how the Intervale is committed to *integrate the various agroecosystem's elements* (P11) by using the riparian buffers not only to be *more resilient to climate change* (P8) because of flooding from more frequent and intense rainfalls, but also by experimenting with some crops that thrive in this wet riparian environment, like elderberries (*Sambucus*), to *increase diversification of crops and economic resilience* (P2) for the growers:

> "Farmers are looking at the riparian buffers that will slow the velocity of the river speed coming into our fields wreaking havoc. Buffers will be able to slow down a lot of the debris that will come in and start destroying their farm fields. We are seeing more heavier periods of rain at once. We're looking at that, and more farmers are 'if we're

[36] The EU model of multifunctional landscape was implemented by the EU Comprehensive Agricultural Policy (CAP) (Comen, 2013; Organisation for Economic Co-operation and Development, 2001).

going to have a buffer, maybe there are ways it can be a productive buffer.' Something that Vermont farmers struggle with is you can't necessarily get federal funding that will pay for a productive buffer because, depending on most projects, they want you to leave it alone and stay out of that area… So, planting elderberry, which is a great riparian plant, will produce berries that they can harvest to make their syrups or tonics" (Ingalls, 2019).

Figure 7.15: Elderberries
(Source: H. Martin, 2019)

"This is a picture of an elderberry plant [Figure 7.15] and the Intervale Center planted this elderberry patch as an experiment to see how it would do in the field that is very wet, low and wet and prone to flooding… and potentially, could this be viable crop economically? Will it survive with multiple floods? … There's a lot of interest in it and is just a nice big healthy patch of elderberry. I think that's an interesting project and concept to think about. What are the crops that will do well here as climate change advances and our fields become wetter? It's not a struggle, it's not in opposition to a coming change like that. And then a potential source of diversification" (Martin, 2019).

Lastly, the site is embedded in the silver maple-ostrich fern and silver maple-sensitive riverine floodplain forests, which host a diverse array of wildlife in their riparian and wetland ecosystems (Figures 7.16 and 7.17), as well as in their hedgerows (Figure 7.18) and pollinator havens scattered around the 340-acre property, including beekeeping hives (Figure 7.19). Particularly, the conservation easement agreement and, consequently their land and forest management plans, provide the backbone to ensure the *integration of the various elements of the Intervale's agroecosystem* (P11) by *protecting biodiversity and soils* (P9).

Figure 7.16 : Riparian Forest
(Source : M. Juncos-Gautier, 2019)

Figure 7.17: Grassy Wetland
(Source: M. Juncos-Gautier, 2019)

Figure 7.18: Hedgerows as Wildlife Corridors
(Source: M. Juncos-Gautier)

Figure 7.19: Pollinators' Heavens Around the Farms and Scattered Beehives
(Source: M. Juncos-Gautier, 2019)

Regardless, bees and other beneficial pollinators like butterflies, as well as different types of birds, reptiles, and amphibians (Figure 7.20) are frequently observed in the farms and community gardens. These examples demonstrate not only that the Intervale is *nourishing biodiversity and soils* (P9) and *not using agrochemicals* (P10), but it is also synergistically promoting the *positive integration and interaction of various biotic and abiotic elements in the agroecosystem* (P11).

Figure 7.20: Common Garter-Snake and American Toad
(Source: M. Juncos-Gautier, 2019)

Furthermore, in 2019, the Intervale constructed bat boxes (Figure 7.21) with the help of a group of volunteers from YouthBuild[37] and put them on some of the buildings and trees around the property to shelter the native little brown bat (*Myotis lucifugus*). The aim of this initiative is to help increase the population of this tiny native and beneficial insectivorous mammal by *enhancing its integration in the Intervale's agroecosystem* (P11).

Figure 7.21 : Bat Box
(Source : M. Juncos-Gautier, 2019)

[37] As taken from their website, YouthBuild is a 12-month training program for at risk and low-income youth that are not at school of employed to learn construction skills. YothBuild provides these young people, ages 16 to 24, the opportunity to earn a trade certification and an AmeriCorps Education Award.

Wild mammals were hard to photo-document during the day, even though the Intervale floodplain serves as habitat for many of them in the area. Deer, as mentioned before, are often a problem for farmers and gardeners at the Intervale, but foxes and beavers are not. Carolyn Zeller (2019) observed the presence of beavers (*Castor canadensis*) (Figure 7.22) at the Intervale by the marks left on some of the trees in the Rena Calkins trail, which runs inside the riparian forest buffer along the Winooski River bordering the eastern side of the Intervale. Another way of evidencing the presence of wild mammals is through prints. Zeller substantiates the *rich biodiversity* (P9) at the Intervale's unique peri-urban *amalgamated and multifunctional agroecosystem* (P11), by talking about the marks some mammals leave at the property:

Figure 7.22: Presence of Beavers
(Source: C. Zeller, 2019)

> "This is a photo that supports P11 because it's a photo of a cottonwood tree that you can tell has been chewed on by beavers in the past. It's got wounds that have healed from beaver chewing where the beaver (or beavers) was not able to get through the tree… But you see their chew marks. They have learned to hide from us a lot. And speaking of critters who hide, there's a lot of pawprints from raccoons, so I think

> this is a really popular spot for raccoons as well. They're catching stuff and washing it in the river. I can't think of too many other places that have an active wildlife habitat right adjacent to the farms, even intermeshing with the productive act of agriculture as well. There aren't too many places like that is what I'm saying. It's one or the other. It makes me really happy to see both of them together, and it's within the city, close, and it's very, very special. It's a very strange place where you see wildlife so close to productive farmland, so close, within the borders of the city."

No doubt that the expressions and practices of the principles of agroecology under the environmental domain, as proposed by CIDSE (2018), makes the Intervale's socioecological system an 'agroecological lighthouse' (Nicholls and Altieri, 2018) in North America. This induction is without taking into consideration the expression and practices of the other principles in the economic and political domains, as already illustrated in the previous chapter, and the socio-cultural principles in the next chapter.

8.

EXPRESSIONS AND PRACTICES OF AGROECOLOGY AT THE INTERVALE: SOCIO-CULTURAL PRINCIPLES

The expressions and practices at the Intervale of CIDSE's agroecological principles under the socio-cultural domain -P12 *promotes farmer-to-farmer exchange*, P13 *strengthens local communities (producer, knowledge, culture…)*, P14 *nurtures healthy diets and livelihoods*, and P15 *fosters diversity and solidarity among peoples (including women and youth empowerment…)*- are synthesized in Table 8.1**.** *Strengthening local communities (producer, knowledge, culture…)* (P13) was one of the substantive significant principles manifested at the Intervale, and therefore this principle was fully discussed previously even though examples of its expression and practices are included below. In this chapter, I focus on the other three principles under the socio-cultural domain and on how P13 correlates to the expression and practices of these other principles.

The key expressions and practices of the socio-cultural principles at the Intervale are:

- the ample connections and collaborations, locally and statewide, with different public, private and civic institutions (including the land grant University of Vermont)[38] that promote all types of exchanges for the sharing of knowledge, education, and social responsibility initiatives;
- the sharing of equipment and day-to-day communication and camaraderie between the Intervale's farmers, not only as neighbors growing food in the same agroecosystem, but also as members of the Intervale Farmer Equipment Company;
- the gardeners' site management structure facilitated by Burlington Parks, Recreation & Waterfront, which facilitates volunteer site leadership for guiding and sharing knowledge, in addition to workdays, some gardening educational opportunities, communal areas, and sharing of gardening tools;
- the Intervale's mission and vision with their land stewardship and public trust responsibility;

[38] The United States Land Grant University System is comprised of higher education institutions located in every state of the United States that received federal land in the late 19th century through the Morrill Act to focus, mostly, on agriculture and mechanical careers.

SOCIO-CULTURAL PRINCIPLES adapted from CIDSE, 2018	Main expressions or practices at the Intervale	Intervale A&D[1]	Indep. Farms[2]	Food Hub	Cons. Nursery	Gleaning & Food Rescue	Land / Natural Areas Steward	Community Gardens (TTCG)[3]
 12. Promotes farmer-to-farmer exchanges	Collaboration and open exchanges of information under a common collective mission and agroecosystem; sharing equipment and spaces (e.g., Intervale Farm Equipment Company, Red Top)	●	●	●	●	●	●	
	NOFA and VVBGA[4] membership for local support, education and networking	●	●					
	Close collaboration with UVM Extension (land-grant university); UVM Farmer Training Certificate; collaboration with a diversity of UVM's professors and students	●	●		●		●	●
	Scaling out work with farmers in Vermont (i.e., Farm Business Planning)	●						
	"Gardener-to-gardener" with site leaders/coordinators, workshops, bartering							●
 13. Strengthen local communities (producers, cultures, knowledge….)	NGO's mission and vision, their public trust and land stewardship; farming and gardening community around food production and sharing of same agroecosystem	●	●	●	●	●	●	●
	Summervale: event during summer to celebrate community, farms, and local food	●						
	Volunteer program; informal educational opportunities; community garden governance (site leaders, workdays, workshops, communal areas, sharing tools)	●	●	●	●	●	●	●
	Partnerships and collaboration with local business, educational institutions, government and other NGOs	●	●	●	●	●	●	●
	Support to local producers (e.g., pre-planning, access to market, farm viability program, affordable leases for both farmland and gardening plots)	●		●				●
	Inclusion of low-income families and diverse groups for food security and justice (e.g., Fair Share, People's Garden, collaboration with social services orgs.[5], support to the Old North End Farmers' Market)	●	●			●		●
	Opportunity with the Abenaki Heritage Garden	●						
 14. Nurtures healthy diets and livelihoods	Production of local fresh seasonal organic food; support of and participation in farmers' markets		●					●
	NGO's mission and vision, payroll and benefits; Farm Business Planning program; Food Hub's mission	●		●				
	Sharing of recipes (using seasonal crops and food baskets); workshops on how to grow own food and store produce		●	●		●		●
	Community gardening plots and some farmland for subsistence farming for New Americans	●	●					●
	Gleaning /food rescue for low-income families; support from farmers and gardeners		●			●		●
 15. Fosters diversity and solidarity among peoples	Access to land for subsistence farming for New Americans, their integration for diversity	●	●					●
	Sharing and bartering produce; sharing tools and equipment; communal areas; sharing the same agroecosystem		●					●
	Inclusion of low-income families and diverse groups for food security and justice (e.g., Fair Share, People's Garden, collaboration with social services orgs., support to the Old North End Farmers' Market, as mentioned above)	●	●			●		●
	Volunteer opportunities, internship program and summer jobs for youth	●	●	●	●	●	●	
	Women in leadership positions (e.g., owners, directors, managers, site leaders)	●	●		●	●		●
	Opportunity with Abenaki Heritage Garden initiative	●						

[1] The Intervale Center, Administration and Development
[2] Independent farms include Intervale Community Farm (ICF), Diggers' Mirth Collective Farm, and Pitchfork Farm, unless specified otherwise.
[3] Tommy Thompson Community Garden (TTCG), managed by Burlington Parks, Recreation & Waterfront/Burlington Area Community Gardens
[4] Northeast Organic Farming Association (NOFA), Vermont Vegetables and Berry Growers Association (VBGA)
[5] E.g., Vermont Foodbank, Vermont Gleaning Collective, New Farm for New Americans (NFNA), Salvation Farms

Table 8.1. Socio-cultural Principles at the Intervale

- the Intervale's volunteer program and high degree of voluntarism;
- Summervale and Wintervale events to promote and celebrate local community, farms and food;
- the direct support to and business with local producers (e.g., pre-planning, access to local markets, affordable leases, farm viability);
- the inclusion of low-income families via the Intervale's Gleaning and Food Rescue program with the Fair Share, People's Garden, and newest People's Farm initiatives, as well as through close collaboration with the Vermont Foodbank, the Vermont Gleaning Collective, and other similar social service organizations;
- the Abenaki Heritage Garden initiative;
- the production of local seasonal organic food and participation in farmers' markets for the direct selling of the fresh produce;
- the practice of sharing recipes and food-related workshops with local fresh produce;
- community gardening and the New American's subsistence farming site and gardening plots;
- internships, summer jobs, and volunteer opportunities for young people, mostly college students;
- the number of women in leadership positions.

As a transdisciplinary field that promotes the multifunctionality of agroecosystems, agroecology recognizes the importance of the socio-cultural domain to deal with societal complexities and advance sustainability. Socio-cultural aspects and realities have to be taken into consideration to achieve ecology-based food systems (CIDSE, 2018; FAO, 2018; Francis et al., 2003; Dumont; 2016; Amekawa, et al., 2010). After all, agroecology has been recognized not only as a science and a practice, but also as a social movement (Wezel et al., 2009). As a social movement, agroecology prioritizes context-specific knowledge instead of alien scientific prescriptions or fixed canons from corporate farming. The experiences and skills that local communities have acquired through decades or centuries, based on their unique environmental, political, socio-cultural, and economic realities, are integrated in fair horizontal *knowledge exchange dialogues*. These knowledge exchange dialogues (*diálogo de saberes* in Spanish) for the co-creation of knowledge are not only held between academic researchers, farmers and other community members, but between farmers themselves, thus *farmer-to-farmer* (CIDSE, 2018; FAO, 2018).

At the Intervale *farmer-to-farmer exchanges for sharing knowledge* (P12) seems to be a natural process, as producers are close neighbors sharing the same agroecosystem. What separate the different farms at the Intervale are usually rows of grass and shrubs or hedgerows. Proximity, shared spaces, and a strong sense of belonging to a farming community facilitate the expression of P12 at the Intervale. As Eric Seitz and Hillary Martin, both farmers and co-owner of Pitchfork Farm and Digger's' Mirth Collective Farm respectively, attest:

> "We're neighbors… and when I say neighbors, I mean there's a line of trees that separate one agricultural business from another. We try and have happy hours where all the farmers get together in the Intervale, beers, bonfires, we share with each other at lunch, we share the same spaces… So, at the Red Top, that's the workshop, you could have four different farms in there working on something at any given time" (Seitz, 2020).

> **"**We share information, and if we run out of something – it's pretty amazing because a lot of us are actually even growing the same things—and if, for example, we ran out of the bag that we pack our salad greens in, well Pitchfork uses basically the same bag so we can get a sleeve of bags from them while we wait for ours to come in the mail. There's a lot of filling the gaps. It's like, 'oops! We ran out of spinach seeds; do you guys have any extra spinach seeds?' It's an amazing community. And we have several new tools and methods that we are experimenting with. Let's see, one, two, three, like four kind of new tools that we're using this year and all of those we learned about from farms that are down here. So, there are a lot of ways of sharing information, and in this agricultural community to be able to stumble into them when you're picking up your key for the truck and you have this quick conversation with somebody and be like, 'oh, that's interesting' and then think about it, and next year you're trying it out. That's really cool!" (Martin, 2019).

Jessica Sanford's (2019) memories of farming at the Intervale support Seitz and Martin's personal accounts.[39] Stanford recalls how working on such proximity, within the 340-acre peri-

[39] Stanford presently owns Adam's Berry Farm in Charlotte, Vermont with her husband Adam Hausmann. They started at the Intervale under their farm incubation program.

urban socio-ecological system, facilitated the *farmer-to-farmer exchanges for sharing knowledge* (P12), especially among women farmers, which *encourages the empowerment of women* (P15):

> "Part of that is because it's multiple farms and businesses all in one spot, so you have a greater opportunity to meet someone that you can identify with -whereas if you were just on a farm in a rural area, you might not have diversity of people to connect with. And being in an urban area too. If you worked at Intervale Community Farm, you still have the opportunity to see other women working in the farm community that you could talk with, and find support from, and in different roles, and find inspiration from. I think that was powerful."

The *collective participatory governance* (P5) of shared equipment and facilities to reduce overhead costs for each individual farm also enables the *farmer-to-farmer encounters for sharing knowledge* (P12). This *collective participatory governanc*e that helps augment P12 happens mostly at the agricultural complex (Figure 8.1).

Travis Marcotte (2019), Executive Director of the Intervale, explains that the non-profit is already facilitating *farmer-to-farmer exchanges* by providing the necessary spaces and organizational arrangements within the agroecosystem. Furthermore, Marcotte (2019) is aware of the importance of these exchanges and wonders if the organization can do even more to strengthen these *exchanges* at the Intervale:

> "Some of this is already happening really well in the Intervale and the Intervale Center doesn't necessarily drive it. We just create the platform at the agricultural complex or Intervale Farm Equipment Company. The farmers in the Intervale have to work together, and I think there's a lot of opportunity just from proximity for exchanges and knowledge sharing. So, I don't think about it a lot as a need in the Intervale but, can we do more?"

Figure 8.1: The Intervale's Agricultural Complex
Source: National Agricultural Imagery Program (2016), and ground truthing with GPS (2020)

Maddie Cotter (2019), Intervale Conservation Nursery Production and Volunteer Coordinator reiterates Marcotte's statement above. The fact that the Intervale *supports decentralized, participatory governance of farming facilities and equipment* (P5) reinforces and facilitates the expression of P12 for *farmer-to-farmer exchanges to sharing knowledge*:

> **"***Promotes farmer-to-farmer exchanges for sharing knowledge*… at the Intervale, all the farmers down here are a part of IFEC [Intervale Farmer Equipment Company]. It's a shared system that we all pay into, and it gives everybody access to the shared tractors and the shared implements. The Nursery is a part of it, we use the IFEC tractors. We have one tractor and one implement that we own that's used for our spring harvest. Every other time we get on a tractor it's the IFEC tractor and the IFEC implements, so we really rely on this sharing system. But then there's also the Red Top which is the big shop area for the farms. You come across other farmers all the time. If I'm having a problem with something usually there's someone around. If it's not Mike it could be Silas, he works for the Intervale Community Farm… If something goes wrong with an implement you have a farmer that you can go to, like 'hey this happened I don't know what to do'… We are always chatting with each other, and we also have a Google group that we can send information to each other, it's called Intervale Red Top."

Hilary Martin (2019) shares her particular story on how *farmer-to-farmer exchanges for sharing knowledge* (P12) are already happening at Diggers' Mirth Collective Farm. In this case, the knowledge being shared is about different types of corns. Her story testifies that even within the same farm, *farmer-to-farmer exchanges* (P12) are happening at the Intervale. Martin's story (as she refers to Figure 8.2) clearly interlaces the expressions of the other three socio-cultural principles with P12 at Diggers:

> "This is Isha who works with us. Every year she plants corn for herself and her family. This is a picture of her harvesting the green corn. She does it here, in our fields, and we help her start the plants. She gives us seeds, we start the seeds in the greenhouse in the spring, and then it's her private own project. She tends the corn on her own time and harvest it for herself. So P12, because it's a different kind of corn, it's

Figure 8.2: Isha's Corn
(Source H. Martin, 2019)

> not sweet corn. Occasionally we will also do our own not-for-sale corn raising, and it's either sweet corn or it's corn for flour to make like polenta or grits or whatever cultural name you want to give it. But she grows it to eat it green, like an elote. It's like field corn, a starchier corn to eat green. It's just fun when we are growing corn but different kinds and we're talking about the stages of it, and when it's going to mature, and what's going to happen. And this is something that she grew at home in Somalia. She has this wealth of knowledge of how to grow it… So, we share information about growing things, both agronomically and culturally".

Based on the above response by Martin, the farmers at Digges' Mirth Collective Farm are *strengthening their community* (P13) and producers by sharing knowledge around culturally appropriate crops, which also *nurtures healthy diets and livelihoods* (P14). Diggers is also *fostering diversity and solidarity among people* (P15), again, not only *by exchanging knowledge between farmers* around *culturally relevant crops* (P12 and P14), but also by welcoming racialized farmers

into their collective (Figure 8.3). Andrea Solazzo (2019), agriculture and community outreach manager of the Vermont Foodbank, summarizes well the exceptionality of Diggers:

> "Diggers is the best farm ever. They're growing all these culturally responsive foods, they're selling them at a reduced rate in the neighborhood, they have a mobile food truck…. You go to the farmers' markets and all of the New Americans are getting their food from Diggers because they're growing food that they asked for them to grow. They participate in the gleaning program a hundred percent. They are collectively owned. They're the only farm with any diversity on the farm."

Figure 8.3: Diggers' Mirth Collective Farm
(from top left to right: Sophia Howart, Elango Dev, Dylan Zeitlyn, Isha Abdi, Hilary Martin, and Micah Barritt).
(The Intervale Center, n.d.-h)

The socio-cultural and political context, especially as it relates to connections and networks, matters to catalyze *farmer-to-farmer exchanges for sharing knowledge* (P12). The needed context and networks to encourage these knowledge exchanges are also pivotal to *building an economically autonomous and climate resilient agri-food system* (both P2 and P8 respectively). A recent cross-cultural study with farmers from Vermont and Puerto Rico (Estrin et al., 2021), revealed that relationships or networks (i.e., strong business, community, and family

networks), in addition to attitude (i.e., positive mindset and flexibility) have a high priority when it comes to resilience and long-term sustainability of the farmers interviewed, both in Puerto Rico and Vermont. This finding concurs with Altieri et al. (2015: 15) who argue that "[t]he capacity of farmers to adapt is based on the individual or collective reserves of human and social capital that include attributes such as traditional knowledge and skills, levels of social organization, and safety networks, etc." As discussed before, Burlington is a socio-politically progressive city that has provided the stage for the success of the Intervale for decades.

Moreover, Burlington is also a college city due to the strong presence of the land-grant University of Vermont (UVM), in addition to four other colleges. According to the National Institute of Food and Agriculture (NIFA) of the United States Department of Agriculture (USDA), through agricultural extension and experiment stations, land grant universities provide research-based education, practical information and non-credit earning activities to farmers, ranchers, and the community they serve. These universities operate the Cooperative Extension System (CES) in partnership with local, state and federal governments. NIFA-USDA provides annual funding and leadership at the federal level. Consequently, UVM is well-known in the United States for its food systems' education, research and collaborative projects under the College of Agriculture and Life Sciences. According to their website, UVM is the first and only university in the United States to offer undergraduate, masters, and doctoral degrees in Food Systems. The Department of Plant and Soil Science, under the College of Agriculture and Life Sciences, also offers undergraduate and graduate programs in a variety of agronomy-related topics, including agroecology. This strong academic setting around the topics of food systems and agricultural science has strengthened the social capital and the safety networks for resilience, as Altieri et al. (2015) postulated. Thus, the development of the Intervale has been supported by the academic setting just steps away from the organization's main entrance. Actually, the Intervale is one of the main partners of UVM for teaching, research, and service learning. Andy Jones (2019), farmer and manager of the Intervale Community Farm, explains how his farm has benefited from this close academic environment where collaborative and horizontal famer-to-researcher/student, as well as *famer-to-farmer exchanges* (P12) have been taking place for years:

"We [the Intervale Community Farm] host a lot of workshops and we're a regular host farm for the UVM Farmer Training Program, which is a non-credit certificate program. We do a lot through that as well as presenting and networking at conferences and other things."

Figure 8.4: ICF's Electric Farmall Super C Tractor
(Source: A. Jones, 2019)

Referring to Figure 8.4, Jones tells the story of how this *collaborative and horizontal exchange of knowledge* (P12) with a land-grant university is benefiting his farm, as well as other interested farms in Vermont, by helping them reduce their carbon footprint to *advance their resilience and adaptation to climate change* (P8):

"This is an electric tractor that we worked with a UVM engineering group. Nobody builds them. You have to make your own. It's an old 1950s tractor that we took the gas engine out, and I work with this engineering team that made the design and then we put it together with them. Now we have two tractors that run on electric power. This is a big item for promoting *farmer-to-farmer exchange*. There are a lot of people interested in electric tractors, within the organic farming world. It's always a thing of conversation… This is *supporting our resilience and adaptation to climate change* because this is an electric tractor..."

In addition to UVM, other important examples of support networks for farmers at the Intervale is the Northeast Organic Farming Association (NOFA) of Vermont (Figure 8.5) and the Vermont Vegetable and Berry Growers Association.

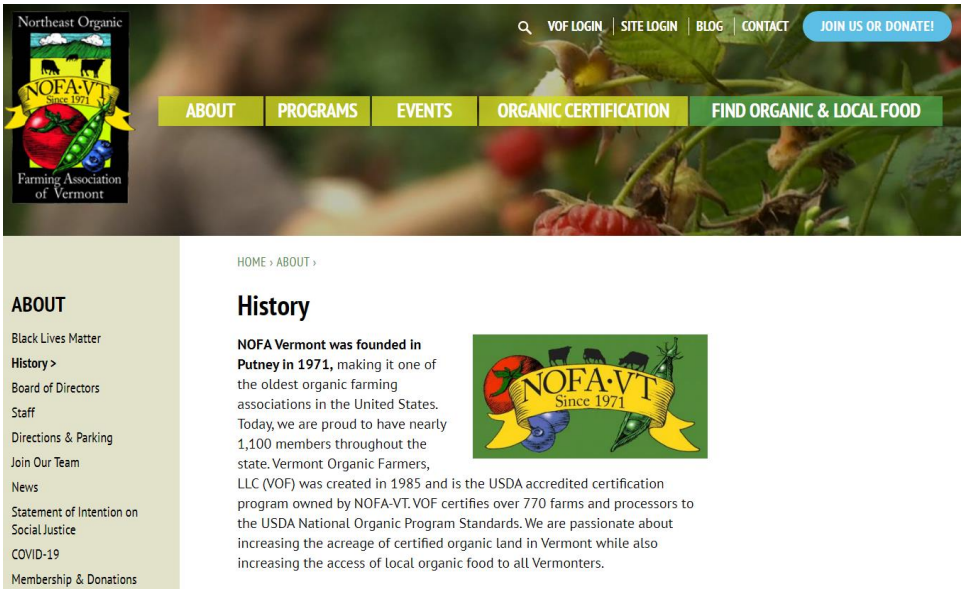


Figure 8.5: Northeast Organic Farming Association of Vermont Website
Source : NOFA (n.d.-b)

Hilary Martin (2019), one of the owners and farmers of Diggers' Mirth Collective Farm, echoes Jones when she explains how important it has been having these support *farmer-to-farmer networks for sharing knowledge* (P12) about organic certification, especially among small to medium sized farm holders in Vermont. This close-knit *farmer-to-farmer networks* have also provided *a decentralized, collective and participatory governance for the local organic food system* (P5), which in turn have help to *strengthening the knowledge of food producers* (P13) at the Intervale's farming community, as well as *built a more economically autonomous and resilient* (P2) organic agroecosystem:

> "Most of us are also members of NOFA and then the Vermont Vegetable and Berry Growers Association. Both organizations are very strong grower-led organizations that are working on defining what organic means and leading the way of how we're certifying our farms. In the case of NOFA and the Vermont organic farmers for veggie and berry growers, an example of what we're doing now is they, together

> with UVM Extension, started this program called CAPS [Community Accreditation for Produce Safety], which is a peer reviewed food safety program. Essentially, food safety is more and more becoming nationally and internationally an issue. The idea is that one day the FDA [Food and Drug Administration of the United States] will come down on us with food safety guidelines that we'll all have to comply with, and a lot of them may not be applicable to small and medium sized growers. And for years, UVM Extension has been working practical food safety trainings, teaching growers how to just institute some kind of common-sense food safety principles. There are several programs where you can certify your farm for farm safety/food safety, but a lot of them involve, for example, all expensive stainless steel wash stations… But there are other things that you can do to institute food safety on your farm that don't necessarily involve lots of investments. What's known as common-sense food safety, practical food safety. CAPS takes it one step further and have farms write up their food safety plans, have them reviewed by somebody from Extension and another grower. There's an online platform where your food safety plan is uploaded and gets reviewed. Every year you update it. Once it's reviewed and approved, you have a certificate you can provide to the vendors that you work with, your accounts… If the federal government were to be like, 'you guys have to do this', we can say 'actually we have food safety plans through the State of Vermont, they're recognized by our accounts and by our consumers…' That's just an example of ways that we're self-organizing in food safety. It's a very specific annoying thing that we're facing, the federal government who's lumping us together with the agro-industry. So that's a way that our community is responding –grower led, organizing ourselves."

When it comes to the Tommy Thompson Community Garden (TTCG) component within the Intervale's socioecological system, *farmer-to-farmer* translates into *gardener-to-gardener*. The *gardener-to-gardener exchanges for sharing knowledge* (P12) are facilitated by the proximity of the garden plots and the type of garden site governance. Ron Krupp (2019), community gardener at TTCG, as well as volunteer coordinator and gardening educator, explains *gardener-to-gardener* plainly:

> "Gardener-to-gardener, not farmer-to-farmer. Well, I think it's just a natural process. One gardener next to another gardener. A new gardener will look at what an experienced gardener is doing. Fred and I have people come down and look at our gardens, at our composting."

Again, the sociopolitical context matters, not only for the Intervale as a non-profit and the individual farms, but for also for the TTCG. Dan Cahill (2019), Burlington Parks, Recreation & Waterfront's Land Steward, explains how his government agency *fosters collective participatory governance* (P5) and helps to *build community knowledge* (P13) at the TTCG by *facilitating gardener-to-gardener exchanges* (P12) through shared gardening spaces, infrastructure, and equipment, as well as through voluntarism:

> "The community gardens are founded upon peer-to-peer, city volunteers and gardeners supporting each other through community…. But then also utilizing a volunteer approach towards having peer-to-peer connection where there is site leadership that are volunteers and members of that community that are supporting and speaking for and representing the growers and the people that are the ascribed users of the space. So, Parks and Rec will make decisions around some of the baselines of the infrastructural needs of the space in terms of the water system, fencing, the agreement to use the land… Then in terms of how everything operates, we expect a certain level of participation of the site leaders working with the gardeners to have some control of the decision-making."

The testimonies of Megan O'Brian, Community Outreach Coordinator for the Burlington Parks, Recreation & Waterfront's community garden program, and Carolina Lucak, Garden Education Manager of the Vermont Community Garden Network which has several garden plots at the TTCG (Figure 8.6), clearly support Cahill's and Krupp's statements above:

> "The point of community gardening is to get to know your neighbors and get to know who is doing what, and 'oh, Greg has that cool thing for hops! How I do that?' Just getting to know the people who are doing things around you, I think it's the point. And some of the gardeners are very good friends and they tend to exchange seeds and exchange ideas … I'm close with my direct [community garden]

neighbors. If they're going to be gone for a week, we're happy to water for them. Just sharing everything is huge" (O'Brian, 2019).

"I think the nature of a community garden is learning from other gardeners, sharing knowledge. Whether you're here at the same time as somebody and you ask them, 'oh, what's that plant? Or why are you covering your garlic? Or tell me about that variety of tomato that looks so nice.' I think that's something that happens in the community garden that doesn't happen when you're home alone. You can peak over the plants and see what they're doing there and learn from them" (Lucak, 2019).

Figure 8.6: Carolina Lucak Teaching Integrated Pest Management at TTCG
(Source: M. Juncos-Gautier, 2020)

Agroecology also goes hand-in-hand with *nurturing healthy diets and livelihood* (P14) because its practice cultivates a closer relationship between people and the way their food is produced. The building of *transparent short distribution webs* (P1) *empowers the local market* (P3) by *re-balancing stronger direct producer-consumer participation in their agri-food system* (P7), which in turn helps to decouple both producers and consumers from the control of agro-industrial conglomerates. This decoupling also *strengthens community resilience and autonomy*

(P2 and P8). A virtuous cycle is then created for a more *social and solidarity economy* (P3) around communities' agri-food systems that enable the *direct provision of organic, seasonal, and healthy culturally appropriate food,* in addition to providing *decent livelihoods to the local producers and food -related business* (P14) (CIDSE, 2018; FAO, 2018).

All the agroecological principles just mentioned are expressed, in one way or another, in the Intervale's mission, vision, and the objectives of its programmatic areas. As a non-profit, the Intervale also aims at *nourishing healthy diets and livelihoods* (P14) because it is part of their role as stewards of an organic peri-urban agroecosystem. To recall, the Intervale Center's (n.d.-a) mission is to "strengthen community food systems" and vision states: "We believe in the power of good food. We envision food systems that support joyful, vibrant communities. Farms and food businesses thrive, natural resources are healthy and protected, and people are nourished and happy."

Accordingly, the three programmatic areas of the Intervale under its tagline "Farms, Land, People" are expressing P14 and the other principles, especially "Farms" with the goal of "enhancing the viability of farming" to support famers' livelihoods and "People" with the "goal of ensuring community engagement with the food system." Moreover, the educational leaflets under these programmatic areas communicate that in 2019 the Intervale gleaned and distributed 37,000 pounds of fresh organic produce for food-insecure citizens, and the Intervale Food Hub distributed 15,000 food baskets to its members in Burlington, benefiting more than 50 food suppliers, including the farms at the Intervale (Intervale Center, n.d.-p, n.d.-r). In the words of Mandy Fisher (2019), Director of Development and Special Projects at the Intervale:

> "At the very beginning the idea was to reclaim this land for agriculture and feed our community with organic food, so we're still doing that. And then we're doing that over and over through the Food Hub. We had some cooking classes last year through the Food Hub. Just through many things we've done through our history and supporting local farmers markets, in helping farms develop plans that help them sell their food locally… Just within our own organizational culture, we're a food organization, we want people to be well fed and well-nourished and taken care of here, and then we want to model that out through our programs and through how we interact with donors, volunteers,

> the general public. The Food Hub very heavily emphasizes vegetables, Gleaning and Food Rescue emphasizes vegetables and recipes, and tries to make the preparing and cooking of vegetables and eating at home fun. That's something we talk a lot about, how we can help people think about cooking for their families as fun and pleasurable."

As Fisher mentions, sharing recipes and offering educational opportunities about cooking and other food-related topics are also part of the Intervale's strategies to *nourish healthy diets* (P14). The Intervale Food Hub's webpage 'The Beet' offers a variety of recipes customers can use with their weekly food baskets (Figure 8.7).

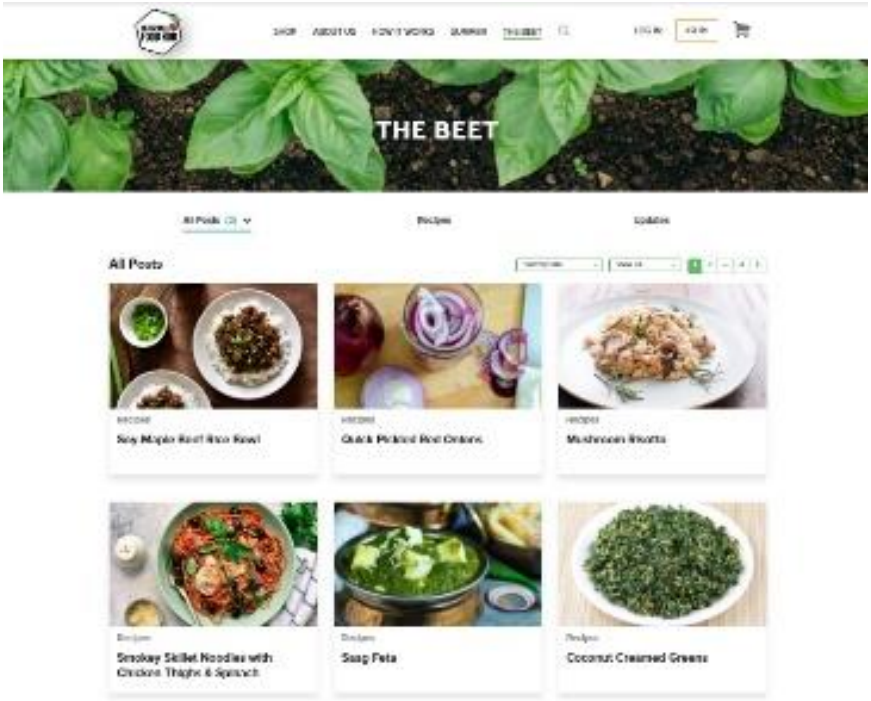


Figure 8.7: The Beet Page by Interval Food Hub
Source: Interval Food Hub (2021b)

Thereupon, *nourishing healthy diets and livelihoods* (P14) is an unmistakable function of the individual farms and the other food related components and operations at the Intervale. The Intervale Community Farm (IFC) has webpages "Cooking Your Share" and "Storing Your Share" (Figure 8.8) that provide tips for storing and cooking the ICF's weekly produce. Andy Jones (2019), ICF's farm manager and farmer, attests:

> "We have recipes. We do vegetables, and they are a key part of a healthy diet, and that is really what we grow, fresh! And one of our main objectives has been to have good jobs for the people that work here. [We have] fifteen employees in the peak summer. I have two people who are just here for the summer, college students. They start in later May and they finish in mid to late August. And then I have four and a half employees all year round. If you were to pick a point in January, there would be four and a half people. If you were to pick a point in July there are 15."

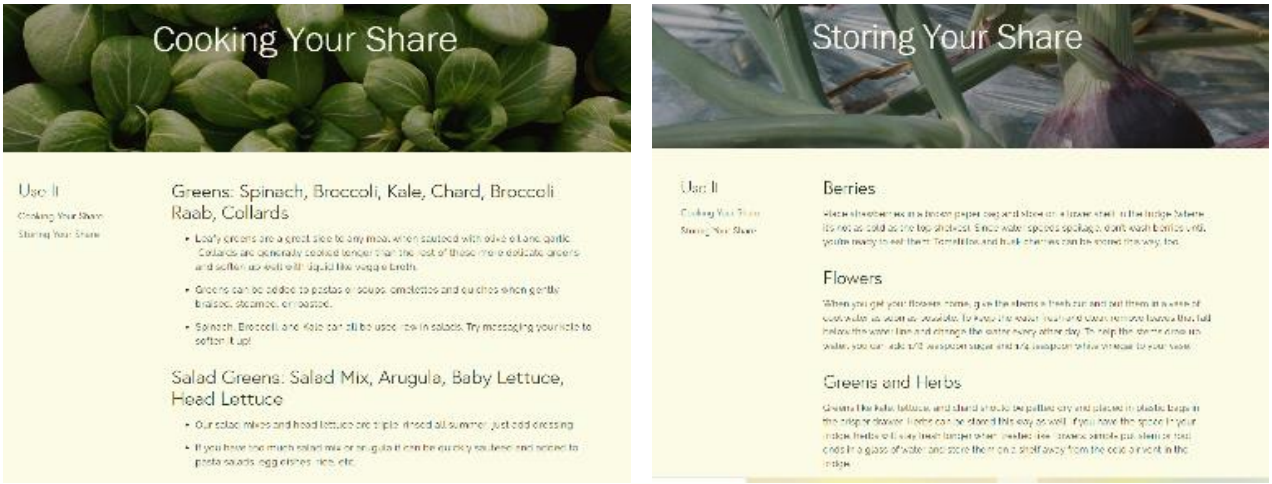


Figure 8.8: Intevale Community Farm's Webpages with Cooking and Storing Tips
Source: ICF (2019c, 2019d)

Other farmers at the Intervale are adamant about the positive role the organization is playing to guarantee the expression and practice of P14. Eric Seitz (2020), farmer and co-owner of Pitchfork Farm, says it candidly:

> "I mean, that's obvious, right? Real healthy, organic vegetables. I can tell you as from a livelihood standpoint, it's Rob and I are finally making good living. It is a wonderful lifestyle that we both love. We just love working outside, you know, we love working with young people."

Keith Drinkwine (2019), Purchasing and Quality Assurance Manager of the Intervale Food Hub, considers promoting *healthy diets* for their customers *and livelihoods* for local farmers (P14) at the heart of the Hub's mission:

> "P14 is really the end goal of what we do with our deliveries of baskets. We want farmers to be able to live and do well on their land. But we also want folks who haven't chosen farming as a profession, or gardening as a pastime, to be able to eat really healthy, really nutrient-dense food, and support their community, and support their farmers, and the land in the process. That's our focus from a marketing standpoint at the Food Hub."

The Intervale Food Hub's (2021a) mission substantiates Drinkwine's response in relation to the expression and practice of P14 at the Hub, in addition to evidencing *a short and transparent distribution web* (P1), the aim of *increasing economic and climate-related resilience* (P2 and P8, respectively), and their efforts to *empower the local market* (P3) and *strengthening community autonomy* (P2):

> "Our mission is to bring more Vermonters into our community food system through our weekly year-round deliveries of local food to homes in Burlington (as well as pick-ups at our hub). With the support of our members, we are able to provide fair pricing and reliable, stable markets for our farms and food partners, making Vermont's agriculture stronger and more resilient."

Brian Teed (2019), Hub's Operation Lead, shares his story about delivering fresh produce directly to Burlington residents (Figure 8.9) which *facilitates the promotion of healthy diets* (P14). This shows how *promoting healthy diets* interconnects with *building a transparent short distribution web* (P1) and allows *direct connection and participation of consumers* (P7). For Teed (2019):

> "*Promotes healthy diets and livelihoods*, I mean it's written in the food, right? It's as organic, and short distance, and it's local as it can get… I'm delivering fresh, local produce right to people's houses. Sometimes people will come out and greet me. This one fella, 5:00 AM every Thursday, comes out in his boxers and he gets his food right from my hands and brings it right to his fridge. It's direct as it gets. We also create recipes, try and talk to customers when we can, not only develop their experience of the Food Hub, but to inform them and share knowledge of what we know of agriculture."

Figure 8.9: Packing Line
(Source: B. Teed, 2019)

The Intervale, as a well-established non-profit in Burlington with more than thirty years of sustainable operations, provides a *means of making a living or livelihood* (P14) to a number of local residents. As of August 2021, and based on their website, there were 27 employees working in the different components areas of the socioecological system, excluding the employees of the individual farms. In 2020 their annual payroll was almost $1.6 million with wages and benefits (Dunseith, 2021). This number does not include the farms which lease land and operate separately from the non-profit, and their number of employees varies considerably during the different seasons.

The Gleaning and Food Rescue program is one of the Intervale's component areas (Figure 8.10) that comprise an important piece of *nurturing healthy diets and livelihoods* (P14) because it serves the food insecure members of the community. Carolyn Zeller (2019), Administrative Coordinator of the Intervale, confirms that the Gleaning and Food Rescue program is fundamental for the expression of P14 at the organization:

> "The biggest bucket for that [referring to P14] would be the Gleaning and Food Rescue program… There are all these barriers to eating healthy food, let alone healthy locally produced food. So, we work to address those barriers by gleaning food that would otherwise be

wasted, getting it to people in need, and then, hopefully, empowering them as well to continue making those good, healthy choices."

Figure 8.10: Volunteers Gleaning Spinach at Diggers' Mirth Collective Farm
(Source: M. Juncos-Gautier, 2019)

Hanna Baxter (2019), Manager of the Gleaning and Food Rescue program, describes how the Fair Share weekly initiative (Figure 8.11) under this program not only *promotes healthy diets* (P14), but also is built *on a transparent and direct distribution web* (P1). The Fair Share follow the model of a CSA except that the food is provided for free. Only income eligible community members and social service organizations can sign up:

> "Fair Share program provides a direct line for families to farm fresh produce, that in itself is *a short and fair distribution web from producer to consumers*, directly. *Promotes healthy diets and livelihoods*… there's so many overlapping ones! Because so many of our Fair Share members really have to limit the number of veggies and fruits, they

buy for themselves just because of money and having to budget. So being able to provide fresh fruits and veggies to people is great because people want to eat healthy. It's just hard to do so if you have a limited income… We've partnered with 15 social service organizations throughout Burlington, and they send one of their employees or volunteers down to pick up a larger sized share to bring to their clients, and they become part of the CSA -which is great because they are able to serve people that have difficulty in getting down here, either transportation or being physically unable to walk or bike or anything like that. And then we have 200 households on top of that. It's quite a production… We work really closely with the Vermont Food Bank. They're a gleaning program, in collaboration with Salvation Farms, and we're part of the Vermont Gleaning Collective, a statewide program housed in Salvation Farms… Feeding the community with food that's grown in their own community and keeping that web and flow of just nourishing people… And it's really amazing to be able to connect with families and share that experience and share like 'this is just as much your right as any other family' and to provide that physical and financial access to fresh veggies."

Figure 8.11: Fair Share for Service Organizations and Households
(Source: H. Baxter, 2019)

According to the Intervale website (n.d.-b), Hunger Free Vermont[40] attends the weekly Fair Share pick-ups at the Intervale "to provide taste tests, culinary demonstrations and engage with participants in food and nutrition education activities."

The Gleaning and Food Rescue program also has what they call the People's Garden, a one-acre plot behind the non-profit's main administrative building that provides a pick-your-own experience to supplement the Fair Share. Low-income families that go to the Intervale to collect their weekly Fair Share CSA have the opportunity to also go to the People's Garden to hand pick other crops and flowers directly from the Garden (Figure 8.12).

Community gardening is also, undoubtedly, about promoting *healthy diets and livelihoods* (P14). As Wendy Coe (2019) community gardener and head volunteer site leader at the Tommy Thompson Community Garden (TTCG), candidly expresses:

> "P14, *promotes healthy diets and livelihoods*, that's like a no brainer. We grow our own food… I mean, I brought my kids up on organic food that I grew and that made me feel good… It made me very autonomous. Generally-speaking it definitely saves family money."

Figure 8.12: The People's Garden Pick-Your-Own Experience
(Source: M. Juncos-Gautier, 2019)

[40] Hunger Free Vermont (n.d.) is a social service organization which aim "to end the injustice of hunger and malnutrition for all Vermonter," according to their website. One of their strategies is providing for all Vermonters education in nutrition.

Coe's (2019) response to P14 in terms of *livelihood* also shows how community gardening can provide *economic resilience and strengthen community autonomy* (P2).

Another community gardener at the TTCG, Anna Stevens, seconds Coe as well as Baxter above since Stevens works in a social service organization in Burlington:

> "I would say it is so natural for me to eat so well in the summer because I am just swimming in produce. So, it definitely promotes me having a healthy diet. And I'm also thinking about when I have the role of Nutrition Coordinator at this trauma-informed daycare. One of the things that I would do is pick-up our free Fair Share from the Intervale. I would very often do a 'meet the vegetables' with the kids, and I would say 'here, look what we got in our Fair Share!' And the kids would sit in a circle, and they would try it. Like mustard greens, 'let's try it because it's something new and it's exciting.' They might all be like 'whoa, that's so bitter… or it's so spicy… or it's too much'… So, engaging kids in a thoughtful way where you're like, 'this is food that we grew in our community that our community gave us to eat, look at it and let's learn about it', and how excited they were to see what came in the Fair Share!"

Providing access to land (P4) for refugees settling down in Burlington who come from agrarian communities is also about *facilitating healthy diet and livelihoods* (P14), as well as *strengthening community* (P13) and *encouraging diversity and solidarity among peoples* (P15). At the Intervale's agroecosystem, subsistence farming can be observed in plots at the TTCG (Figure 8.13) and in a parcel of about 2.5 acres set aside by the Intervale for New Americans. At TTCG, Dan Cahill (2019), Land Steward of Burlington Parks, Recreation & Waterfront, explains that:

> **"**Each community gardener comes with their own reasons for being there. Fred isn't so much worried about food sovereignty as he is a hobbyist. He is very scientifically interested in compost and tinkering. It is a workshop for him. He is trying out different things and observing. Others are growing for their own food sovereignty, to store enough corn meal to get them through winter. There are different cultural landscapes within each individual plot…"

Figure 8.13: Corn Grown by New Americans at TTCG
(Source: M. Juncos-Gautier, 2019)

Diggers' Mirth Collective Farm is right to the west of the TTCG. The only thing that divides Diggers from the TTCC is a row of fruit trees with some grass and shrubs. As a TTCG neighbor, the observation of the co-owner and farmer of Diggers, Hillary Martin (2019), substantiates Cahill's explanation above:

> "And you can see next to our farm, these are all the subsistence plots, all New American's plots… It's a really nice newer part of the Intervale. New Americans are bringing their practices and cultures here and using the land to feed their families in a way that they did at home. A lot of these plots are basically the size of four plots put into one so that families can grow enough corn for themselves for the season. So, there is really an effort to get people access to land, people who come from agrarian communities who have relocated in Burlington, who need that for themselves to grow food. They've made this more available for New Americans…"

François Gasaba, a refugee from Burundi, now a U.S. citizen, is one of the New American that farm at the 2.5-acre site provided by the Intervale (Figure 8.14). His testimony evidences how the

opportunity *to access land* (P4) at the Intervale is providing him and his family with some culturally appropriate food for a *healthy diet,* as well as some *income* for his *livelihood* (P14):

> "I plant beans. I don't plant corn here; I didn't plant any because some animals came to eat it. I plant shallots, small onions, turnip, kale, eggplant, cabbage. I can show you little pumpkins from my country, eggplants from Africa… For my family and for the market, for sale at the Intervale Food Hub, Stone Soup restaurant on College Street and City Market in Burlington."

Figure 8.14: François Gasaba Showing African Eggplants
(Source: M. Juncos-Gautier, 2019)

Gasaba's farming experience at the Intervale helps to *foster diversity and solidarity among peoples* (P15) in Burlington. As CIDSE (2018) and FAO (2018) put forth about the principles and elements of agroecology, respectively, agroecology respects diversity and creates opportunities for all people, no matter their gender, race, ethnicity, age, sexual orientation, or religion. "Agroecology places a strong emphasis on human and social values, such as dignity, equity, inclusion and justice all contributing to the improved livelihoods dimension of the SDGs" [Sustainable Development Goals of the United Nations] (FAO, 2018: 9).

The story behind Gasaba's opportunity to have a site for farming at the Intervale, which expresses the practice of *fostering diversity and solidarity among peoples* (P15), is explained by Travis Marcotte, Executive Director of the Intervale (Figure 8.15):

> "The director of AALV [Association of Africans Living in Vermont] at the time reached out to the Intervale Center and was putting together a grant to start a New Farms for New Americans [NFNA] space here… I wasn't the Director at the time, and it was about eight years ago... The inception grant was written in partnership with the Intervale Center and AALV. We were a contractor in the grant to help develop the site and we had an employee who ran it for the Intervale Center. That was a 3-year inception grant to get it going. What happened was that there were some farmers more inclined to be commercial in nature and less of a community garden... And that's when we set up the land where François is and said, 'you know, this is a different kind of production, this is something a little bigger, so a bigger plot of land.' Again, we're the platform, we provide access to the land. UVM Extension provides technical assistance to the producers and AALV runs the programing. Intervale Center makes the land available to AALV... But, also, the value of seeing François there for a very long time, having quite a bit of

Figure 8.15: Entrance Sign for the Intervale's 2.5 Farming Site for New Americans
(Source: M. Juncos-Gautier, 2019)

> connection to that land… He sells to the Food Hub, so let's just encourage that to be part of the Intervale. Then when NFNA wanted a greenhouse in our community greenhouses, that was also another very logical, yes. It was like, 'of course we should make some space available for their community gardens or commercial production."

By providing *access to land* (F4) for New Americans in the socioecological system in which they are embedded, the Intervale is *cultivating diversity and solidarity among peoples* (P15), as well as *strengthening the local community, its food producers, culture, and knowledge* (P13), and *building on a social and solidarity economic vison* (P3).

The discernments of two employees, Maddie Cotter, Production and Volunteer Coordinator of the Intervale Conservation Nursery, and Carolyn Zeller (2019), Administrative Coordinator, substantiate the importance of this initiative with New Americans:

> "The Intervale itself is also part of this New Farms for New Americans program. There are people who have come from totally different countries, most of them are from Africa and Nepal. Until New Farms for New Americans came down here, I never really did see any people of color farming down here. They were a few people here and there but now there's this whole new community that is getting to use this space and growing food for their families. They're all really cool. Their greenhouse is right next to ours so we actually interact a lot… So, for me it's been really great to hear their story about what farming means to them and how they do things because it's very different from the way that have set up our agricultural system. I think by having that program down here the diversity has definitely been increased" (Cotter, 2019).

> "We make this land available with water, electricity, a greenhouse, road access, walking access, and then in a quiet, secluded area with very good soil for New Americans who I would say need it the most. A lot of them come from agrarian societies or have experience with feeding themselves and their families through subsistence farming, and now find themselves in a completely different environment, completely different climate, and don't speak the same language, maybe have challenges to earning money or finding an employment or maybe they just want to farm, can you blame them? … But of course, farmland, especially within commuting or walking distance is cost

> prohibitive. There are all kinds of barriers and stipulations… It strengthens New American local communities because they're able to share their culturally significant food as well as keeping that knowledge alive" (Zeller, 2019).

Welcoming New Americans in the Intervale socioecological system to *encourage diversity and solidarity among people* (P15) can also be appreciated at the Tommy Thompson Community Garden (TTCG). There is a new section of about 1 acre at the TTCG that was created for the special food gardening needs of the New Americans (Figure 8.16), which also evidences the practice of *providing access to land* (P4) with *supportive policies and investments* (P6), and of *strengthening local communities, producers, knowledge, culture*… (P13). Travis Marcotte (2019) further explains how he facilitated the expansion in collaboration with Burlington Parks, Recreation & Waterfront:

> "There is an expanded section if you look at the map. I'll share with you how that came to be. When I became Executive Director, I wanted to look at all the land and figure out where there could be more value for the community. So, this is Tommy Thompson [Community Garden, and referring to the location of the Garden on the map], and 18 was a sumac field [referring to a field numbered 18 on the map]. It used to be a productive farm field and was covered in sumac. And, so, we set in motion a plan to remove the sumac, reclaim the land, and then work with Tommy Thompson [Community Garden] to expand on this with the

Figure 8.16: Expanded Garden Area at the TTCG for New Americans
(Source: M. Juncos-Gautier, 2019).

> Idea of working with New Americans over here. We were like, 'we need more space with larger community garden plots'… there was just a lot of demand. So, I worked with the previous Director at Parks and Rec [Burlington Parks, Recreation & Waterfront] to do this expansion onto our land. We made that available to the Tommy Thompson [Community Garden]."

Dan Cahill (2019), Land Steward of Burlington Parks, Recreation & Waterfront, expands on the initiative of *facilitating access to land* (P4) for New Americans at the TTCG with the aim of also *fostering diversity and solidarity among gardeners* (P15) and *strengthening the gardening community* (P13):

> "It's in the mission of the community garden program, in the ways we have adapted our outreach principles and practices to broaden the community there. So, maybe seven years ago or so the percentage of land being gardened at Tommy Thompson [Community Garden] by people of color was 7% of the garden space. Nowadays that percentage is somewhere between 50% and 60% of the community gardens that are being managed by people of color. Most of them are New Americans, people who have resettled in Burlington from another country through a resettlement program… We make sure the way we make community garden plots available is done in a more directed and inclusive way… We made a really concerted effort towards how we do that so I would say within our workplan, we are definitely meeting these agroecological principles."

That concerted effort that Cahill mentions includes the hiring of Megan O'Brian, the Community Outreach Coordinator for the Burlington Area Community Garden Program under Parks, Recreation & Waterfront. One of O'Brian's (2019) main responsibilities is to *foster diversity and solidarity among gardeners* (P15), as she herself indicates (Figure 8.17):

> "That's exactly what I do [referring to P15]. I encourage diversity, and I think it's a great opportunity for folks to be opened up to it. There's nothing quite like getting to know your neighbor gardeners when you don't speak the same language, but you're able to have a rapport. I think there's just something so special about that… It's been interesting to watch over the past four seasons the shifts that have happened. At Tommy Thompson

[Community Garden], specifically, I have Burundian gardeners and they have stayed very consistent, I know who is gardening and how many plots they have. And then I also have a large Somali population that I can't keep up with it. There are a lot of them, and they really, really love this space here, and they come a lot. I love being down here because they come in their big cars with a bunch of kids and they all just hang out at the garden, enjoying the space, and it's so nice to have those little giggles around running through the corn... The Somali group is always growing and that's part of the reason we did the expansion, so that we could keep some fallow ground somewhere while also meeting their need for growth."

Figure 8.17: Diversy of Crops and People at the TTCG
(Source: M. Juncos-Gautier, 2019).

Another way the Intervale is putting some efforts in *encouraging diversity and solidarity among peoples* (P15), as well *as strengthening communities and culture* (P13)*, putting some control of seeds and lands in the hands of people* (P4) and *supporting the growth of cultural-appropriate crops* (related to P14) is through their Abenaki Heritage Garden initiative. In this Abenaki Garden space of about half an acre, the Intervale, with the help of volunteers, do "three sisters" planting (the traditional corn, beans, and squash varieties) to honor the agricultural heritage of the Abenaki that inhabited the land before being invaded and colonized by Europeans. The Garden was

established in 2009 at the Intervale and started with a group of volunteers led by the Burlington Area Community Gardens (under the Parks, Recreation & Waterfront Department) with the close collaboration of the Intervale Center, the St. Francis/Sokoki band of the Abenaki Nation at Missisquoi, Gardener's Supply Company, the U.S. Department of Agriculture, and UVM (a collaboration that expresses P6, *supportive policies and investments*). Patrick Dunseith (2019), Land Manager of the Intervale, is in charge of this initiative at the non-profit (Figure 8.18)**,** which has a lot of potential for growth, as he himself admits:

Figure 8:18: Planting the Abenaki Garden
(Source P. Dunseith, 2019)

> "This is the planting at the Abenaki Garden. This is strong for both P13 and P15. This is really creating a space for the Abenaki, for cultural regeneration. They have been an oppressed group in this area for a long time. This helps them to strengthen their community and for them to be recognized. It is showing our support for them, that the work we are doing is not just about growing local food but reconnecting to the land. It's a focus on people and the power for food, and gardening and farming to be a positive force, rebuilding some of the wrongs and strengthening oppressed communities… So, working

with that community and preserving seed varieties, and that has a lot of room for grow. I see that being really important."

Duncan Murdoch (2019), Natural Areas Stewardship Coordinator, who works closely with Dunseith at the Intervale, supports Dunseith on the importance of the Abenaki Heritage Garden project not only to *foster diversity and solidarity among peoples* (P15) but also to *preserve and have control of heirloom seed varieties* (P4) (Figure 8.19):

Figure 8.19: Abenaki Bean
(Source: P. Dunseith, 2019)

"We've had an Abenaki Heritage Garden here running for a number of years, that's to increase the seed bank of heritage heirloom variety of vegetables from pre-contact [referring to pre-Columbian era] that the Abenaki have cultivated for years. We've been working to ensure the survival of those seeds and those vegetables. Recently, we're trying to transition by stepping out and just really providing the land for them to cultivate and for them to try it [referring to the Abenaki community]. We want to invite them to feel welcome again, welcomed back to their land, really. I mean, I have conflicted feelings, this was theirs; it was their land to begin with so that's the least we can do."

Encouraging diversity and solidarity among peoples also include *the empowerment of women and youth* (P15). Women a very well represented at the Intervale, and many have leadership positions. As August 2021, based on their website, 19 out of 27 staff members at the Intervale, exactly 70%, are women, and 10 are directors, managers, or specialists. To quote Duncan Murdoch (2019) again, who express it forthrightly as a male colleague at the Intervale:

> "*Encourages diversity and solidarity among people*… I circled women because the majority of the staff here are women. I think the Intervale has been a place to really foster that and to promote more opportunity for well-deserved women. So, we definitely encourage women empowerment here."

Adam Hausmann (2019), owner of Adam's Berry Farm who used to farm at the Intervale, also expresses unreservedly his experience with *solidarity and women empowerment* (P15) while he was farming at the Intervale:

> "First of all, just the number of women working at the Interval Center and, historically, how many women have worked there has been really powerful. Then, beyond that, in the farming community too. The farms have provided a really safe environment for women, and it has been this open welcoming environment to all. That openness has been very much part of the Intervale from the beginning in a really positive way."

As Hausmann recalls, the farming community at the Intervale seems that it has always been safe, welcoming, and open to the *advancement and leadership of women* (P15). For example, presently, Diggers' Mirth Collective Farm has two women farmers that are also co-owners of the farm. As of August 2021, seven of the nine members shown in the Board of Directors of the Intervale Community Farm's website are women. Sugarsnap, a small farm dedicated to catering, is run by a woman.

In terms of *inclusion and empowerment to the youth* (also P15), the Intervale focuses on opportunities that provide hands-on volunteer work that translate into educational experiences directly on the field. The Intervale also provide opportunities to UVM students for service learning

as part of their close collaboration with the educational institution. Maddie Cotter, Production and Volunteer Coordinator of the Intervale Conservation Nursery, shares an example of how middle school students are volunteering at the Nursery (Figure 8.20):

Figure 8.20: Youth Vounteers Planting Willows in the ICN Production Field
(Source: M. Cotter, 2019)

> "This one was really easy for me to say that it was P15 because these are kids that were all middle school age… It was so fun because they had so many questions about the trees, and what we do, and why we do it. They were very engaged. I love when I have groups like that because sometimes kids can be challenging, mostly because their attention can go to many different places really quickly. But these guys were just super into the trees and learning about them and planting them. And they had a lot of fun! So, for me it was the perfect example of empowering the next generation. They honestly were very versed in climate change language and how to talk about where we are, and how to make a difference in the world... They did a good job planting."

Hanna Baxter, Manager of the Intervale's Gleaning and Food Rescue program, shows a UVM student doing a service-learning internship with her in 2019 (Figure 8.21):

> "So happy face, Carrie! My glean queen. She is my field gleaning intern this season and she is wonderful. She's conservation focused at UVM. It's been really wonderful to have her as a support, and to see what she's getting out of the experience. I selected P15 because it's encouraging young people to be involved in agriculture and in their community, and age is a form of diversity. So, encouraging young people to use their voices and to get involved is a good thing. That's what Carrie represents to me."

Figure 8.21: Carrie in the Tomatoes
(Source: H. Baxter, 2021)

This chapter ends with the celebration of *local community, food producers, local knowledge* and *culture* (P13) through Summervale and Wintervale, two locally well-known community events that have become trademarks of the Intervale. As explained before, the overreaching P13 is the principle with most substantive significance at the socioecological system, mainly because

it is also tightly interlinked to several other principles. Summervale (Figure 8.22) is a food and music festival celebrated every Thursday during the summer months of July and August (between 5:30 to 8 PM). All community members are invited, including families with children, to the Intervale's administrative building's spacious front lawn to enjoy the property's summer outdoor setting with live music from different Vermont bands, and to celebrate local farms, food, beers, and community (as the Intervale promotes). Local vendors bring their food trucks or set up a kiosk to sell food prepared from fresh produce from local farms and beers from local brewers. The Intervale's agreement with local food vendors to use local produce also *promotes healthy diets and livelihoods* (P14) as well as *empower the local market* (P3) because the aim is to benefit local agri-food businesses. The promotion is that everything is local. Mike Ingalls, Manager of the Intervale Conservation Nursery, attests:

> "We're part of this overall local community. Thursdays we bring the community down to celebrate with Summervale. This is something we started when I started here. It was like, 'well how do we get people to learn about us, about what we do? So, let's come down and have a celebration with music, local food, local bands, and just enjoy the night.' And so that's been going on for quite a few years now. It's a really great sense of community and culture."

Figure 8.22: Summervale at the Intervale
(Source: M. Juncos-Gautier, 2019)

Wintervale is also an outdoor celebration one Sunday during the cold month of February. At Wintervale attendees can enjoy a bonfire, buy local food, hot drinks, and rent cross-country skis or snowshoes for a winter nature walk at the Intervale. The admission to Summervale and Wintervale is free (but donations are welcome, Figure 8.23) and vendors donate a small percentage of their proceeds to the non-profit.

Figure 8.23: Community Members' Donations at the Entrance of Summervale
(Source: M. Juncos-Gautier, 2019)

Again, these community celebrations confirm the role of the Intervale under the socio-cultural domain, especially its commitment to *strengthening local community, food producers, local knowledge, and culture* (P13). The organization of these events also shows how the Intervale encourages and secures *supportive policies and investments* (P6) from local business partners and the general community under *a social and solidarity economy vision* (P3), which is essential to scaling out and scaling up agroecology in Burlington and beyond.

9.

OPPORTUNITIES FOR AN ONGOING AGROECOLOGICAL TRANSFORMATION

Agroecology it is not a specific end goal; it is considered an ongoing transformation process (Anderson et al., 2021, 2019; HLPE 2019). Agroecology "entails a process of continuous transition that does not follow prescriptive rules" (Anderson et al., 2009: 2). Explicitly, it is about constant transformative social processes motivated by key drivers that facilitate scaling agroecology (Mier et al., 2018; Rosset and Altieri, 2017). I have shown in this study how the use of principles can be "adapted to place and context" when they are "supported by a set of underlying values" (Anderson et al., 2021: 5). Accordingly, as agroecologists propose, I am focusing on how these principles can guide an ongoing transition and transformative process, even at different levels, towards more just and sustainable agri-food systems (Anderson et al., 2021, 2020, 2019; Nicholls et al., 2020).

During the wrap-up reflection meeting of my fieldwork with the Intervale participants, when asked about the most difficult part of the principles-based self-assessment process, the Executive Director of the Intervale Travis Marcotte (2020) affirmed:

> "My hardest part was saying yes to almost all of them [the principles], but, to what degree? That was kind of tough. How much are you doing?"

Marcotte's response is a clear manifestation of this transition and transformative social processes in a case study. With the inclusion of the direct responses of participants as co-investigators, my research evidenced that the selected set of 15 agroecological principles by CIDSE (2018) are present, in one way or another, at the Intervale. However, since it is clear now that agroecology is not based on inputs but rather on processes (Rosset and Altieri, 2017), in this chapter I present the areas of opportunities the Intervale has for an ongoing agroecological transformation using the principles of agroecology as a compass**.** Table 9.1 (p. 247) summarizes

and orders areas of concerns and opportunities under each of the 15 agroecological principles by their substantive significance, as identified or referenced by the participants themselves.[41] I start with the concern related to fostering *diversity and solidarity among peoples* (P15) which resulted in the higher number of references in the words and perspectives of participants. Again, I use the direct quotes of the participants interweaved with my theory-based insights while exploring possible paths for transition and transformation.

It is important to recall that all participants have college degrees, and a significant amount of them come from environmental studies or related disciplines. Thus, participants generally understood sustainability-related issues, the need for alternative and just agri-food systems, and for strengthening local communities and economies. Participants were very critical with the principles-based assessment of their practices and therefore their input as co-investigators was very valuable. Hillary Martin (2020), co-owner of Diggers' Mirth Collective Farm, clearly expressed this view when sharing her experience participating to this research:

> "It was a useful exercise for me to understand how our work fits into that model or how that model explains what we do, what I've been doing with my life because it's so much more than just organic agriculture. I think before this exercise, I always talked about being part of a movement about food, for local communities, for local sovereignty, for a different kind of economy. This was kind of a really nice way to encapsulate everything that I'm interested in, actually, and also to see what we're doing that really hits it, and what we're doing that's not quite hitting it in the ways that we would like to."

Fostering More Diversity and Solidarity

One of the principles present in the Intervale's agroecological system, as explained previously, but to use Hillary Martin's exact words (2019) "not quite hitting in the ways that we would like to" is the issue of *fostering diversity and solidarity* (P15). It was the concern with most substantive

[41] Each of these areas of concerns and opportunities could be the object of future research by themselves so this chapter synthesizes participants' perspectives showing substantive significance (as explained in Chapter 4: Methodology.

Principle #	*Topics* and related principles (adapted from CIDSE, 2018)	Concerns and opportunities from participant's perspectives	Coded references (frequency)[1]	Relative frequency (%)[2]	Average # references per participant[3]	# Participants who referenced principle[4]
15	**Diversity and solidarity** *(Fosters diversity and solidarity among peoples)*	Diversity in the staff; more opportunities for youth, Abenakis, and New Americans participation and integration	54	15.00	2.08	15
8	**Climate change resilience and adaptation** *(Advances resilience and adaptation to climate change)*	Flooding and greenhouse gases emissions concerns	45	12.50	1.73	14
9	**Biodiversity and soil challenge** *(Nourishing biodiversity and soils)*	Invasive species control and eradication; high levels phosphorous in the soil; tilling; ostrich fern overharvesting	37	10.28	1.42	14
4	**Land access and control; production of seeds** *(Supports access to and control of resources like land, seeds…)*	Incubator program elimination disappointment; opportunity for the production of seeds; some land ownership concerns	32	8.89	1.23	13
6	**Public policies and investments** *(Has supportive public policies and investments)*	Political activism dilemma; road infrastructure improvements; provision of incentives for ecosystem services; restrictions with land use	32	8.89	1.23	12
13	**Strengthening community relationship** *(Strengthens local food producers and communities)*	Additional opportunities to increase educational role, inclusiveness, and spiritual experiences for the community	27	7.50	1.04	10
5	**Communication and integration for better governance** *(Fosters decentralized, collective, participatory governance)*	More integration of the community gardeners; better communication for collective decision-making	27	7.50	1.04	5
7	**Participation of producers and consumers** *(Encourages participation of producers and consumers)*	Stronger participation of producer and consumers in decision-making; farmers on the board of directors	24	6.67	0.92	10
11	**Agroecosystem integration and management** *(Integrates agroecosystem elements)*	Some livestock integration; more attention to wildlife integration and management (including deer population)	21	5.83	0.81	11
10	**Use of fossil fuels** *(Eliminates the use of agrochemicals)*	Use of plastics / fossil fuels	21	5.83	0.81	9
3	**Social and solidarity economy purpose** *(Powers local markets; builds a social and solidarity economy)*	Social enterprise role versus the expansion of revenues (growth paradigm)	17	4.72	0.65	7
14	**Farmers' livelihood** *(Nurtures healthy diets and livelihoods)*	More economic support for farmers' livelihoods	14	3.89	0.54	7
12	**Farmer-to-farmer exchanges** *(Promotes farmer-to-farmer exchanges for sharing knowledge)*	Concern for the continuity of farmer-to-farmer exchanges	5	1.39	0.19	5
2	**Diversification of incomes** *(Increases economic resilience and autonomy)*	Limits to diversify incomes in a floodplain; opportunities for other sources of income for the NGO (e.g., educational tours; production of seeds)	4	1.11	0.15	3
1	*Builds transparent and short distribution webs*	No concerns	0			
		Total number of coded references	360			

ECONOMIC	POLITICAL	ENVIRONMENTAL	SOCIO-CULTURAL

[1] One reference is a separate instance a concern/opportunity related to a principle was coded (i.e., mentioned by a participant during the interview to provide at least one example of a challenge or opportunity).
[2] The percentage of references for each principle out of the total number of coded references (360).
[3] Coded references per principle divided by the total number of participants (mean).
[4] Number of participants who referenced a concern/opportunity related to the principle at least once.

Table 9.1: Participants' Concerns and Opportunities at the Intervale

significance among participants. Participants expressed concerns about diversity in staff, creating more opportunity for youth, Abenaki and immigrants' participation and integration into the daily life of the Intervale. *Fostering diversity and solidarity* is related to the transformation domain of equity (Anderson et al., 2021, 2019).[42] Domains of transformation in agroecology are the interrelated and intersecting links between agroecology and the prevalent hegemonic agri-food system that have enabling and disabling conditions, and where changes are important for agroecological transformations (Anderson et al., 2021, 2019). In these domains of transformation in agroecology, leverage points (i.e., points to intervene in a system) can be identified to incite changes (Meadows, 2008).

The aspect of equity (e.g., dealing fairly and equally with all peoples, no matter gender, age, race, religion, etc.) is crucial because the practice of agroecology "develops mostly through networking and community-self organizing" so to transform the prevalent agri-food regime, agroecologists need to tackle "equity at multiple levels" (Anderson et al., 2019: 13).

The diverse voices of participants (farmers, the non-profit employees, and collaborators) attest to the importance of working with *diversity and solidarity* (P15) at the Intervale. In the words of farmers Andy Jones (2019), Manager of the Intervale Community Farm:

> "I think that the Intervale could be much more inclusive and reflective of the Burlington community. In the last 15 years there have been a lot of New American families resettling in Burlington. Many of these people are from agricultural societies.… Some things are happening out at the Ethan Allen Homestead[43] and there are some small commercial plots here as well, but I think that's a big opportunity, and an area where we could really do much better in terms of involving more of the Burlington community. I really do think that there's a huge opportunity… A lot of things we're already doing, but what are the other things that we want to really look at over the next 30 years?"

[42] Anderson et al. (2021, 2019) proposes six domains of transformation that have different enabling and disabling conditions for agroecology: access to natural resources; knowledge and culture; systems of exchange; networks; equity; and discourse.

[43] Ethan Allen Homestead and Museum is a 294-acre public park and museum owned and managed by the Winooski Valley Park District, a public non-profit corporation. It is located at the northwest side of the Intervale.

Hillary Martin (2019), co-owner of Diggers' Mirth Collective Farm, reflects on the history of the Intervale:

> "I don't think the Intervale Center would be here if it weren't for powerful white men and the relationships that they have, and the doors that they open for each other… I think that those guys are really nice, but they weren't necessarily thinking about diversity and solidarity among people. That was not the goal of the people who created the Intervale Center. I don't think that they intentionally excluded this, but they're just powerful white men doing the things that they do… And, so, when you do those things and you're not thinking about those questions of access and solidarity and diversity, then you do exclude people. I think it's important to acknowledge that and to think about how we can do better… It's an issue in Vermont. It's an issue in our country. When you look at Summervale, for example, a community event [at the Intervale] – beautiful, lovely summer evenings – it's the image of happy white people. How do we make the Intervale something more than that? How do we make it regularly a party for not just white people?"

Even top management personnel at the Intervale non-profit are aware that they could do more to address diversity. Comments from the Executive Director, Travis Marcotte (2019), and Mandy Fisher (2019), Director of Development and Special Projects, of the Intervale confirm that:

> "Staff, I think we could do better. It's a pretty white staff. We could think about how we market the Intervale, how we present the Intervale Center so it feels more open and welcoming… Vermont is a very white state but how can we position ourselves as a more open inclusive organization? Organizationally, it's on our mind quite a bit. How do we approach that? How do we do it in all of our job hiring? We all did some training on that, so we changed the way we wrote our job descriptions. A lot of that was looking at gender bias but, also, how do we present the organization in our social media, our website, our print material? Are there people of color in the pictures? Does it feel like a welcoming place? If people are looking at a job description, would you be able to picture yourself working here? We've been thinking about that a lot. A lot of organizations are struggling to be

> better around inclusion and diversity at the organizational level and, certainly, around the landscape. It's a very diverse landscape when you look at the community gardens, the New Americans' farm here, and across the river**" (**Marcotte, 2019).

> "This is an area where we could and should do more. We could have a stronger stance -which is maybe my hesitation to say we do it because I would want to do it more boldly… This is an area of growth for us. There are some ways that we've done that in the past or that we're currently doing it but not with much intention. This has not been something that we have intentionally sought to do. We have been working with New Farms for New Americans for about 10 years and we do have their greenhouse here and we rent land to New American farmers. That's why I gave it a squiggly [mark]… I see opportunities for growth because the organizational mindset is: 'we're business, we do farm viability', we're on this straight and narrow thing. It all goes together in terms of power and privilege, and also spirituality and culture. I see it all. We're operating like a conventional business and there's these other things that need to come in" (Fisher, 2019).

Other employees at the Intervale are aware of this opportunity for transformation. For example, the response to *diversity and solidarity* (P15) of the Community Relations Coordinator, Abby Portman (2019), whose main job responsibility is broadly to help the organization connect and interact successfully with the surrounding community, was:

> "I think it's hard in Vermont because it's a pretty white place to really encourage diversity, but I think that there are more things that the Intervale Center can do. One small thing is that we have unpaid interns throughout the entire summer which is not something a lot of people can afford to do and I think that that limits the amount of people we can bring in, the diversity of minds that we can have on our staff. An internship isn't a guarantee that you get a job but it's a really good way to get your foot in the door. That's how I got a job here. So, that could be a really positive way to increase the diversity, with these summer interns or potentially new staff members."

Farmers and staff members at the Intervale are well aware of the lack of racial diversity and related racialized issues in Vermont. Duncan Murdoch (2019), Natural Areas Stewardship Coordinator at the Intervale plainly summarizes the dilemma with this issue:

> "Here we are Caucasian, New Englanders, Americans, with a certain level of education… I think we could definitely be more inclusive. I mean, we try, we just don't know how, really. It would be nice to have more ethnic cultural diversity here… I think diversity is really the biggest challenge, and then having this place be accessible to people of lower income… We could help bring more people here and have more educational opportunities for the people."

Travis, Portman, and Murdoch's comments above about the relatively high percentage of white population are legitimate. The U.S. Census Bureau (2019a, 2019b) data shows that 83% of the population in Burlington is white and this percentage goes up to 93% in the state of Vermont. The median household annual income is $51,394 in Burlington and $61,973 in the state. In Burlington, where the Intervale is embedded, an online platform of real estate data posits that "Burlington is a decidedly white-collar city, with fully 87.83% of the workforce employed in white-collar jobs, well above the national average" (Location Inc., 2020-2021). So, diversity definitely represents a challenge to the Intervale if they want to foster *diversity and solidarity* (P15) in their activities. On the other hand, Jones' comment about the Intervale's potential for being "much more inclusive and reflective of the Burlington community" is also legitimate. In Burlington, the Old North End, located at the south end of the Intervale, is considered the neighborhood that has most income and racial diversity in Burlington. Even though Burlington is an all-New England enclave, it is also being recognized as one of the country's most attractive locations for immigrants (Sisson, 2016). It is prudent to quote Sisson (2016) who captures the diversity in the North Street of Burlington's Old North End neighborhood:

> "The strip of stores and small businesses symbolize how a growing immigrant population has become interwoven into this traditional blue-collar enclave, and in turn, helped spark a renaissance… The commercial center of a rapidly revitalizing Old North End neighborhood, North Street isn't like the rest of Vermont, a state known for its liberal leanings and a homogenous, mostly white

> population. Due in large part to the city's strong safety net and progressive beliefs, this region was targeted by refugee programs as a reliable entry point for those fleeing war and persecution… An afternoon stroll down North Street can feel like a cross-cultural odyssey, akin to traveling along a bustling boulevard in Queens, New York. Nepalese delis and dumpling stores, Somali-run halal markets, and Indian clothing stores fill rows of storefronts with bright, boisterous colors and the pungent smells of spices. In old school taverns such as the Olde Northender Pub, Bhutanese immigrants nurse commemorative Budweiser bottles with the limited edition 'America' labeling. Women in brightly-printed Ghanaian and Somali dresses walk by chatting, their smartphones strategically wrapped into headscarves offering a new take on hands-free."

As a resident of the Old North End since fall of 2018, I can testify to that concentrated diversity (Figure 9.1).

The locally well-known non-profit Association of Africans Living in Vermont (AALV) is at the heart of the Old North End neighborhood. As the AALV (2017) webpage states, with the support of a multicultural and multilingual staff, the non-profit helps refugees and immigrants from all parts of the world "gain independence in their new communities through a range of integration services" so they can live and work in Vermont. AALV and residents refer to these refugees and immigrants as 'New Americans.'

It should be noted that not only Burlington but also adjacent Winooski[44], (located to the east-southeast side of the Intervale on the other side of the Winooski River) are considered and promoted as the most diverse areas to live in the state of Vermont (Niche.com Inc., 2021). Thus, even when taking into consideration the high percentage of white population, the fact that the Intervale is surrounded by the two most diverse areas to live in Vermont provides to the non-profit the opportunity to be a lighthouse in *encouraging diversity and solidarity among peoples* (P15) as part of their ongoing agroecological transformation.

[44] The population of Winooski is estimated to be 7,333 people (U.S. Census Bureau, 2019b).

Figure 9.1: Old North End: A Diverse Neighborhood
(Source: M. Juncos-Gautier, 2019-2020)

It should be noted that not only Burlington but also adjacent Winooski[45], (located to the east-southeast side of the Intervale on the other side of the Winooski River) are considered and promoted as the most diverse areas to live in the state of Vermont (Niche.com Inc., 2021). Thus, even when taking into consideration the high percentage of white population, the fact that the Intervale is surrounded by the two most diverse areas to live in Vermont provides to the non-profit the opportunity to be a lighthouse in *encouraging diversity and solidarity among peoples* (P15) as part of their ongoing agroecological transformation.

[45] The population of Winooski is estimated to be 7,333 people (U.S. Census Bureau, 2019b).

Andrea Solazzo (2019), Agriculture and Community Outreach Manager of the Vermont Foodbank, one of the key collaborators of the Intervale, explains:

> "Burlington community is really rich in diversity and culture but there's no integration of those cultures at the Intervale. The Intervale Center has a completely white staff of upper middle-class people and that's who's making all the decisions… The Intervale Center exists in too much of a bubble and that's kind of the main complaint I hear..."

Another topic of interest to the participants related to *diversity and solidarity among peoples* (P15) is the opportunity to increase the recognition and presence of the Abenaki community, the original habitants of the region before the Europeans invaded, seized, and privatized the lands where they used to live. The Abenakis that still live in Vermont are divided in four state-recognized Western Abenaki groups**:** the Elnu Abenaki Tribe, the Koasek Traditional Band of the Koas Abenaki Nation, the Nulhegan Band of the Coosuk Abenaki Nation, and the St. Francis-Sokoki Band of the Abenaki Nation of Missisquoi (UVM and Shelburne Farm, n.d.-d)**.** Even with these four recognized groups, U.S. Census Bureau (2019b) data indicates that only 0.4% (around 2,500 people) of Vermonters classify themselves as American Indians. Yet, the Intervale has an interesting initiative, the Abenaki Heritage Garden, which has been running for several years now. This garden has a lot of potential to pay respect to the existing Abenaki people and to increase their recognition and presence at the Intervale. It is however a relatively small garden, occupying less than half an acre. The intention of the Intervale is obvious, but there is a lot of opportunity to expand this initiative. Patrick Dunseith (2019), Land Manager of the Intervale in charge of the Garden, recognizes this enormous potential. They also connect the Abenaki Heritage Garden to P4 *supports access to and control of resources like land and seeds.* They explain**:**

> "I tied P4 and P15 to the Abenaki Heritage Garden working with that community and preserving seed varieties. And that has a lot of room to grow… I think this is exactly where we have to challenge ourselves a lot" (Dunseith, 2019).

Chelsea Frisbee (2019), former Development Manager of the Intervale, stresses the importance of recognizing more the socio-cultural contribution of the Abenakis to the history of the

Intervale. She also admits the need to figure out how to integrate different racialized people that live in Burlington into the Intervale programming:

> "I would love to see more collaboration with the Abenaki community. I think the narrative has been very much about the white man and Will Rapp who is the founder, and his vision is being carried out now. It is amazing but there is a bigger story that can be connected back to women who have farmed there for many years and back to the Abenaki who were there for hundreds of years and were pushed off the lands and now are only able to access it in very limited ways. There's more opportunity there to put more control of the Intervale specifically in the hands of the people whose land it was originally**.** The challenge is there's a lot of competing needs… We are not a social justice organization, so it is geared around farmers as a constituent. I think there is opportunity to do more around seeds and lands getting back into the hands of the Abenaki people. I don't think that is a focus of the organization right now, but I think there is always opportunity to do more… There is an opportunity to do more with people of color, with different segments of the population that don't naturally fit into our constituent groups."

Last but not least, the integration of the younger members of the community is another area of growth for the Intervale for *fostering diversity and solidarity among peoples* (P15). The Executive Director of the Intervale, Travis Marcotte (2019), recognizes the potential of developing more activities that directly involve the youth population and assures that the Intervale may find ways to do it:

> "We're probably not doing as much with youth as we have in the past. We used to run a program called Healthy City, it was like a youth farm, and it was targeted to the Burlington's Farm-to-School Program. It's now embedded in the schools [school system] so we don't do it anymore. We have some opportunities to engage youth in just everything that we do as the leaders of tomorrow. I think that's an area where we don't have a lot of active programming. I think youth come through the school system to visit the farms. ICF [Intervale Community Farm] has a greenhouse that's through the school system. We've got kids and school groups constantly coming to go to the Frog

> Pond or to walk through the forest and learn, but it's not an active… I think we could do it."

During the reflection meeting held on February 14, 2020, to wrap-up my fieldwork with the subsample of key participants, Hannah Baxter (2020), Manager of the Intervale Gleaning and Food Rescue program, and Annalise Carington (2020), Conservation Specialist at the Intervale, shared ideas on how to *foster diversity and solidarity among peoples* (P15) in the Intervale (Figure 9.2). Diversity could potentially be increased by hosting different types of community events, not just Summervale. In their view, the Intervale has gotten a little pigeonholed with Summervale and the Intervale could think about what else can be hosted and where inside the property to capture a more diverse group of people. Diversity could also be foster by bringing new attention and energy to the Abenaki Heritage Garden which has not been done lately. Engaging more directly with school districts in Burlington, Winooski, and

Figure 9. 2: Baxter and Carington on How to Foster More Diversity and Solidarity.
(Source: M. Juncos-Gautier, 2020)

South Burlington would provide an opportunity to capture diversity across the community. The Intervale used to work with public schools in the past but there can be new opportunities to finding advocates and partners within the school districts, maybe farm-to-school coordinators, that the Intervale can lean on to help facilitate connections and bringing youth to the Intervale.

This could be done through after school programs or summer camps run by schools. The Intervale can also set a goal to engaging youth by planning a specific number of field trips throughout the year to help in the gleaning season or trail maintenance or the Conservation Nursery. Finally, offering paid internships would allow the Intervale to increase the diversity of college students interested in the possibility of working at the Intervale. The fact that the majority of the internships are unpaid limits who can access to the opportunity of working at the non-profit.

Enhancing Resilience for Climate Change, Biodiversity and Soils

In the environmental domain, the opportunities for advancement in *climate change resilience and adaptation* (P8) are tightly interrelated to the practices of *nourishing biodiversity and soil* (P9). Opportunities related to these two principles are second and third in substantive significance from the concerns and narratives of the participants (Table 9.1). Concerns include flooding and greenhouse gases emissions (related to P8), invasive species control and eradication, high levels phosphorous in the soil, soil tilling, and ostrich fern overharvesting (related mostly to P9). Concerns also arise for the two other principles in the environmental domain even though they were not on the top of participants' concerns: *agroecosystem integration and management* (P11), specifically the issue of integrating some livestock and, at the same time, paying more attention to wildlife; and *the use of fossil fuels*, specifically the use of plastics (as it related to P10, *the elimination of the use of agrochemicals*).

As mentioned before, agroecological principles are interdependent and interrelated to create a whole when assessing an agro-socioecological system. This is even more so for the principles in the environmental domain which are related to the science of ecology. So, the opportunities for the ongoing process of transformation in the environmental principles are all inevitably intertwined in this discussion.

The Intervale has an unavoidable reality: their agroecosystem is immersed in the floodplain of the Winooski River. The risk of flooding is a constant concern at the Intervale and adapting their practices to this ecosystem is the only solution. The whole area is protected as an important native floodplain forest and there are legal restrictions with the conservation easement agreement and

the U.S. Federal Emergency Management Agency (FEMA). The Intervale has in place a Flood Preparation Plan that serves as guidance. They also follow FEMA's guidelines set out in the Vermont Flood Hazard Area and River Corridor Rule, and Patrick Dunseith (2021), Land Manager at the Intervale, works with the Regional Floodplain Manager of the Vermont Department of Environmental Conservation when there are flood warnings. In 2011, after tropical storm Irene, which was particularly devastating for the Intervale, the organization did climate resilience surveys and studies of the land to figure out how to adapt. As a result, the Intervale stopped renting the most flood-prone parcels to farmers because it was too risky. They also surveyed the farmers to see how they were changing their management practices to reduce their risks during flooding events (C. Frisbee, personal communication, 2019).

Maggie Cotter (2019), Production and Volunteers Coordinator of the Intervale Conservation Nursery, explains the Intervale's floodplain ecosystem reality:

> "That's farming in a floodplain, it is just one of the risks that a lot of the vegetable farmers take down here. It doesn't really impact the [Conservation] Nursery that much because our trees are meant to be on a riverbank and be flooded anyway. I like to call it training for the trees when that happens. Obviously, it's really stressful for the farmers who work down here, and it has definitely impacted them at least this year specifically. There was a lot of spring flooding and it never really seemed to give up. Even with the buffers it still happens but it's not as bad as it would be if there were no buffers. So, I think, overall, this [floodplain] system is functioning the way that you would hope that it would but farming in a floodplain you still run the risk of it flooding on you every year… I would assume they [the farmers] understand the risks that come with farming down in the floodplain, but I think, overall, it's a very well forested riparian area and it's just one of those things. This is where all the good soil is, so it makes a lot of sense that people are farming. It's a balancing act."

Beyond the floodplain risks, the challenge of climate change is expected to exacerbate the frequency and intensity of flooding events -as well as of droughts. This is a reality that all communities around the world have to deal with, not only the Intervale farming community. From the interviews with participants, *adapting to be more resilient* (P8) is a constant task. I already

discussed some of the participants' responses regarding this issue in Chapter 7. Nevertheless, there is always a lot of room to actively do more work on *resilience and adaptation to climate change* (P8), (Dunseith, personal communication, 2019).

Another concern the Intervale community has in relation *to resilience and adaptation to climate change* (P8) is their contribution to greenhouse gas emissions because of their dependence on fossil fuels to run their tractors. They need tractors because they have a high volume of production in the largest farms like the Intervale Community Farm and the Intervale Conservation Nursery. Again, Maddie Cotter (2019), Production and Volunteers Coordinator of the Conservation Nursery, whose main responsibilities are working daily in the field, shared her concern and a photo (Figure 9.3) of some of the tractors and implements they use at Intervale:

> "We do use a tractor to do a good amount of our field work, just like prepping the field and tilling the fields. So, there are certain practices that we still do that rely on fossil fuels and it's mostly the tractor work I would say. I think eliminating the dependence on agrochemicals is definitely our biggest challenge. I can't even fathom working our field without a tractor. I have no idea how we would do that… It would be hard to work in a system where we didn't have access to a tractor and fossil fuels. We wouldn't be able to grow eighty thousand trees a year. So, it's that catch-22 of what do you do.… We also need to mow the lawn, so we do a lot of lawn mowing and weed whacking. I really don't know how we would manage the system without the use of those things. That is really for me the biggest challenge I would say. We really try to use as little as possible but that's a challenge. I feel that overall, we have a pretty good handle on the other things."

Figure 9.3: Tractors and Implements Yard
(Source: M. Cotter, 2019)

As Cotter mentioned above, the dependence on fossil fuel is also related to P10 *eliminating the use of agrochemicals*. This dependence, according to Cotter, is the biggest challenge at the Intervale. Nevertheless, the Conservation Nursery and the farms at the Intervale do not use synthetic pesticides or herbicides inputs, they all use organic/ecological methods in their production. This is one of the first levels of transformation towards agroecology in agroecosystems, and certainly in whole food systems (Gliessman, 2016). Participants are also aware and concern of their dependence in fossil fuels for motor vehicles, as all farms working with sustainable practices must be. Andy Jones is already exploring alternatives with electric tractors with the help of engineers from the University of Vermont (see Figure 8.4). This is an issue where there are no immediate and affordable alternatives for most farmers, at the moment, especially with the volume of production at the Intervale. So, in the meanwhile, it is clearly a trade-off and transition process. As Jones (2019) plainly puts:

> "How do we come up with a farming system that isn't dependent on petroleum inputs? … We're not using pesticides, but we use diesel fuel for our tractors. I would love to see a de-mechanization and having more people in the fields… I think the transitional step is probably to stay sort of fairly mechanized and improve the biological basis of what

> we're doing in farming. Also, to change the power inputs to electric, which could come from sustainable sources -solar, wind, and other similar things. So, it's a complicated picture, and I think that's another area. There's lots of these things that we're continuing to grow and to work on."

Related also to *eliminating the use of agrochemicals* (P10), the other concern is their use of too much plastic products. The Intervale is aware that they are using too much plastic for packing their greens and are already looking for alternatives that can be safe and affordable. They also use silage tarps (Figure 9.4) and other type of materials made out of plastic to control weeds and pests in their fields. Since they don't use herbicides or pesticides inputs, this can be considered a trade-off as well as a process of transition while better alternatives are available for their level of production. The use of plastic silage tarps also reduces the need to use the cultivation tractor which, on the positive side, helps them reduce their emissions of greenhouse gases. Farmer and co-owner of Pitchfork Farm, Eric Seith (2019), when asked about the use of silage tarps responded: "it's a give and take, in the grand scheme of things, though, it's better." The responses by Brian Teed (2019), Operation Lead of the Intervale Food Hub, and Hilary Martin (2019), co-owner and farmer of Diggers' Mirth Collective Farm, summarize well their general concerns and the trade off with the use of plastics:

> "A lot of people come to us saying, 'hey, you guys use so much plastic', which is a challenge. All the farmers use plastic to bag their lettuce or put a radish bunches in or whatever... But we recognize that as a challenge. And we just switched. Two or three weeks ago we bought bio bags. They're made from corn, I think, and they're biodegradable, compostable bags... They're a bit more expensive. It's like 5 cents, and then the plastic bag is like 1 cent or something like that" (Teed, 2019).

> "That's a silage tarp and that's a form of weed control. The idea is that we're trying to use the cultivation tractor less. What that does is you lay it down and it encourages weed growth underneath the plastic [because it heats the soil] and then immediately smothers them. So, we used to use a cultivating tractor to prepare beds and we would run

Figure 9.4: Plastic Silage Tarp for Weed Smothering
(Source: M. Juncos-Gautier, 2019)

through two to three times for each bed. But now we run through it once and then we lay down that plastic. The practice is known as tarping and it's relatively new**.** Then there's black plastic mulch, which looks similar to the tarp, but it's black plastic film which does the same thing. It heats the soil and smother weeds. We use black plastic for our fruiting crops, essentially, like cucumbers and watermelon, and sweet potatoes actually like it as well. We use black plastic, we use silage tarps, we use reemay cloth or row cover, which is also a petrochemical product, that's what we use for pest control. It's a physical barrier for pests. And then all of our salad greens go into plastic bags so there's plastic everywhere" (Martin, 2019).

"Then this winter I was like, 'Oh my God, this is insane'… So, then I researched biodegradable or compostable bags, and it's seven times the expense of what we pay for a regular bag. I got some samples, I put some vegetables in it, and then immediately the side tore down. It was like 'I don't know what we're going to do.' Maybe one day we'll go cold turkey. But if you don't put your stuff into bags, at the store people are going to buy the stuff in bags from some other farm. You get caught up in trying to make sure that you're keeping up with the demand" (Martin, 2019).

When it comes to *nourishing biodiversity and soil* (9) in agroecology, based on the response of the participants, their major concerns related to sustainable farming practices are high levels phosphorous in the soil and the practice of tilling with tractors. Farmers are aware of the high level of phosphorus in the soil at the Intervale. I had access to four soil test reports from different sites at the Intervale provided by the Land Manager. With the help a farmer that collaborates with the Agroecology and Livelihood Collaborative group at the University of Vermont, I was able to interpret the reports. Except for phosphorous, all other soil health indicators were between acceptable and manageable ranges. The recommended optimum range (or average values) for phosphorous is between 4 and 7 ppm. Three of the soil test reports showed phosphorous levels at more than 17 ppm, the fourth showed a level of 114.5 ppm, which is excessive. Farmers and citizens in Vermont are concerned with the high level of phosphorus pollution from run-off that is affecting the health of the Lake Champlain water and overall ecosystem. So, there are numerous public and private initiatives, including educational campaigns and research going on at the University of Vermont to address this issue. Again, Hillary Martin (2019), farmer and co-owner of Diggers' Mirth Collective Farm, expresses her awareness and concern to find solutions:

> "I would like to get better at our cover cropping and having more diversity in our cover crops as well. We are working on our nutrient management plan and trying to reduce the phosphorus that we're putting into the soil. Because currently we have very excessive phosphorus in our soils and we're adding a lot with the amendments that we use. So, I'm hoping to steer ourselves away from that in the next year or two… The Intervale in the last year has been like, 'wow, we really need to change our practices.' And I think it would be good, actually, if the Intervale as a whole focuses on that because we are surrounded by water and we're so close to the lake, which is in a crisis situation. At UVM Extension I have a close friend who's working on that and working with farmers around us."

Two important points need to be remembered regarding the issue of phosphorous in the Intervale soil. The first is that as a low-laying floodplain of the Winooski River, the Intervale may be receiving loads of phosphorous from the runoff of other upstream farms when there is a flood event. I could not find any study about how flooding might be affecting the level of phosphorous

at the Intervale but is a reasonable hypothesis. Also, the Intervale used to run a composting enterprise for more than 20 years in 16 acres inside the property (Green Mountain Compost, 2021a, 2021b; Ives, 2007). Such compost operation must have been a phosphorous pollution hotspot for the watershed (Small et al., 2019) and must have contributed to the high level of phosphorous build up in their soil, at least in and around the fields where the compost was located. The Vermont Required Agricultural Practices Rule (Vermont Agency of Agriculture, Food & Market, 2018) has some good recommendations for farmers on how to reduce the impact of agricultural activities to water quality. Also, as Martin mentioned, the Intervale can reach for some help at the University of Vermont to do some studies and help them manage better this challenge.

One of the other legitimate concerns related to farming at the Intervale is tillage. Agroecology promotes low-tillage or no-tillage to protect soils. As Brian Teed (2019), Operation Lead at the Intervale Food Hub, who used to work at the Pitchfork Farm, explains:

> "It's not just what's above the ground, it's also what's below the ground a lot. I'm sure every farm does tilling here. Taking big tines on the tractor and spinning them really fast to turn up the soil, that is not good for the soil if it's used heavily. That's why a lot of farms have to put so much input in terms of compost…The more you till, the more worms you're killing, the more micro-bacteria you're killing, the more microbiology that you're disturbing. It's an area for improvement, for sure. But a lot of these bigger farms down here, they don't have time for it."

Andy Jones (2019), Manager of the Intervale Community Farm, also talked openly about this issue:

> "I think figuring out more ways for no-till agriculture with organic farming, there are people experimenting with it. We've done a little experimenting but there's a whole lot that we don't have figured out yet… Mules, horses, draft horses. We did have somebody in the 90s who did some portion of our field work with draft horses. So, I do think draft animals could be a part of it… It's tricky, again, all these multiple goals of wanting to be able to do de-mechanization."

Figure 9.5: Gleaning Potatoes After Harvesting with a Tractor
(Source: M. Juncos-Gautier, 2019)

Tilling, as it relates to *nourishing biodiversity and soils* (P9), can be considered as an area of trade off and in the process of experimentation and transitioning at the Intervale. From my experience while doing participatory observation in the fields of the Intervale, farmers' practices can be generally described as low till agriculture. Per low till practice, farmers leave a substantial amount of crop residue on the soil surface. This practice helps reduce water movement, and thus potentially increases infiltration and reduces soil erosion. Figure 9.5 shows a voluntary team of gleaners gathering some of the potatoes left in one of the farm fields after harvesting with a tractor. In addition, farmers at the Intervale do not leave bare soil unattended. They use cover cropping and green manure, crop rotation, winter cover crops, and annually leave some of their fields in fallow to restore their fertility.

When it comes to *enhancing the integration of various elements of the agroecosystem* (P11) in the farms, which includes the integration of livestock animals, the different farms at the Intervale are a polyculture of vegetables, fruits, honey and flowers, but they do not have livestock. In the past, the Intervale Community Farm (ICF) used to have chickens. In the near

future, livestock integration can be a possibility again as Travis Marcotte, Executive Director of the Intervale, and Andy Jones, Manager and farmer of the ICF explain:

> "This place is not integrated with animals. I mean, one of the things I'd like to see more would be some animal agriculture" (Marcotte, 2019).

> "We've had chickens in the past at times. But they've always been partnership arrangements where there are people that wanted to raise chickens and then they've run them on our fields, so they have looked after the chickens. We could do that ourselves but it's another business. We talk about it now and then. We were benefiting from the manure. Our CSA members were really happy to get eggs and meat that were from right here. It was great. So, we may well look for that partner again at some future point or maybe that person will come to us" (Jones, 2019).

Nevertheless, because the farms located at the Intervale are embedded in a low floodplain ecosystem, animal husbandry could represent a challenge with the potential of more frequent and severe flooding due to climate change. When practicing agroecology, farmers have to adapt to the reality of the ecological system they are inserted in for the design and management of sustainable agroecosystems. As Adam Hausmann, farmer and owner of Adam's Berry Farm in Charlotte, Vermont, which started as an incubator farm at the Intervale, confesses:

> "Animals have proven challenging because of the flooding. People lost animals in floods. And in the past, perennials have proved challenging [berries are perennials]. There are some fruits and things that are not able to be there. They have diversity of vegetables but it's a certain number of vegetables. There is diversity within those farms but not from a broader farming scope."

Managing a complex peri-urban agroecosystem like the Intervale, where there are also areas of protected floodplain forest and wetlands encircling the farm fields, brings other additional concerns that are also related to *nourishing biodiversity and soils* (P8) and *integrating the different elements of the agroecosystem* (P11). This is especially true for those participants managing the natural areas. Patrick Dunseith, Land Manager, and Duncan Murdoch, Natural Areas Stewardship Coordinator, have concerns related to the natural areas surrounding the farm

fields. This is part of the balancing act of allowing farming activities and, at the same time, protecting the local natural resources. For Dunseith and Murdoch, their most important concerns, and areas of opportunities in the ongoing process of enhancing their practices are:

- the proliferation of invasive species in the Intervale's landscape (e.g., Japanese knotweed (*Reynoutria japonica*), purple loosestrife (*Lythrum salicaria*) (Figure 9.6) but also Asian bittersweet (*Celastrus orbiculatus*), wild chervil (*Anthriscus sylvestris*), multiflora rose (*Rosa multiflora*), goutweed (*Aegopodium podagraria*), Japanese hop (*Humulus japonicus*), buckthorn (*Rhamnus cathartica*), and garlic mustard (*Alliaria petiolata*);

Figure 9.6: Purple Loosestrife, an Invasive Plant at the Intervale
(Source: P. Dunseith, 2019)

- the overharvesting of ostrich ferns (*Matteuccia*) which are part of the understory of the native silver maple-ostrich fern riverine floodplain forest;
- the need to pay more attention to wildlife integration and management in general, and particularly the issue of deer population.

Comments on invasive species by Murdoch, Natural Areas Stewardship Coordinator, Dunseith, Land Manager, and Carolina Lucak, Garden Education Manager at the Vermont Community Garden Network (VCGN) who manages the VCGN garden at the Tommy Thompson Community Garden in the Intervale, provide a good synopsis of the challenges above:

> "I do my best at controlling invasives. That involves removal with volunteer force primarily, and also assessment and keeping track of the health of the ecosystem without chemical treatment" (Murdoch, 2019).

> "We're promoting sustainable and healthy food choices which includes wild grafting and foraging but then there's an overabundance of fiddlehead harvesting and now this is almost entirely goutweed, it's all invasives now… This is where we have to do the work, to try to understand invasive species, but that's a multi-year-long process… There's a lot of public access to the Intervale, which is awesome, but something failed on how to educate people about overharvest of fiddleheads… This area here is listed as riverine maple-ostrich fern forest. In the Agency of Natural Resources, it's listed as a sensitive community because it's an example of a unique ecosystem, but the fiddlehead is not a part of it right now. Very small patches, right? So, that is the result of management decisions, or just lack of awareness to the potential impact" (Dunseith, 2019).

> "It's definitely been a problem to grow food here because of the deer. We tried building a fence, but they went right through it. …We'd love to see the community garden invest more in deer protection. Whether it's putting in a bigger fence or some kind of a border... When we see the footprints, they're always coming from that direction and going that way. So, I think that's essential in order for us to be able to use the space and grow food and not be disappointed" (Lucak, 2019).

Participants' concerns and actions to address invasive plants proliferation, native plants overharvesting, and control of deer population will definitely benefit the *whole agroecosystem with the healthy integration of its elements* (P11) as they protect and manage wisely the *biodiversity of the floodplain ecosystem* (P9). Dunseith is very critical about his role in dealing with the above issues given his position as Land Manager. Being critical is important as part of the ongoing transformation process at the Intervale. As Dunseith (2020) expressed during the wrap-up reflection meeting:

> "We talked about where we are not and where we are doing good. We are doing a lot of positive things. We have a diverse landscape. There are hedges, forests, trails and different people here. We have a lot of work going on but what is the composition of the diversity? We see invasives in a lot of places. We have an incredible deer problem. Could we be doing better? Could we be sharing this issue with more people and bring that into the conversation? We talked about goals for what's next. We are lucky to be in a good place where some of these challenges we are making a lot of movement on. We talked about hedgerows, not just maintaining these spaces but regular actions to bring more diversity, try to bring more balance overall. We were all at the invasive planning meeting and learned the difference between rehabilitating and restoring the landscape. The world we live in now is different than the ecosystem that was trying to survive 500 years ago. We are never going to restore the landscape, but we might just rehabilitate it."

Towards Greater Farmers Participation and Knowledge Exchange

Encouraging participation of producers and consumers (P7) in the political domain is the next key opportunity in the process of ongoing transformation at the Intervale. I also discuss P7 in relation to *promoting farmer-to-farmer exchanges for sharing knowledge* (P12) in the socio-cultural domain. Both of these principles, as noted by participants in the wrap-up reflection meeting, have a lot of potential as leverage points in the socioecological system. Participants also noted that in order to *promote more producers and consumers participation* (P7) and *farmer-to-farmer exchanges* (P12) there have to be in place *supportive public policies and investments* (P6) that are geared toward *fostering decentralized, collective, participatory governance* (P5) at multiple levels, and *strengthening local food producers and communities* (P13). It is all related.

One of the opportunities the Intervale has for specifically *encouraging more participation of food producers* (P7) and for *fostering decentralized, collective, participatory governance* (P5) of the agri-food system is having farmers in leadership decision making level, and explicitly on

the Board of Directors.[46] As Abby Portman (2019), Intervale's Community Relations Coordinator, and Brian Teed, Intervale Food Hub's Operation Lead, attest:

> "I mean, to *encourage new forms of decentralized collective effort for a participatory governance of food system*, I think to our Board. We are a pretty large organization. We have a lot of power within the community, and I think it would be great to have farmers and people who are directly affected by our programs also making decisions for the organization… Our entire Board, at this point, has turned into a tool for development which can be pretty frustrating. I think that it would be great to have farmers on our Board, to have more people who are able to speak to what our programs are, not just necessarily speak to potential donors. So that's one major area that I think can be improved" (Portman, 2019).

> "Sometimes the farmers don't have a ton of say in our decisions, but at the same time, we're a separate business and we kind of make our own decisions. For example, we just moved to doing home deliveries really early in the morning. We leave at 3:00 AM and get done by 7:00 AM. This changed the schedule of deliveries. So, farmers are now having to deliver a bit earlier, which shifts their schedule around. I put that as a challenge because maybe it could have been talked about, like 'we're thinking about making this decision, it will switch up your schedule, is that okay?' So, I feel like we haven't really nailed down this" (Teed, 2109).

One of the Intervale's close collaborators from the Vermont Foodbank, Andrea Solazzo (2019), Agricultural and Community Outreach Manager of the Foodbank, openly shares her opinion:

> **"**I think the Intervale Center needs to do a better job of taking in farmers input. I've so many friends that worked there over the years, I've been very good friends with all the farmers there for almost ten years, and there's a disconnect. So, I don't understand why there's not farmers on the Intervale Center's Board. There should be at least two farmers on the Board. How could you be representing and raising

[46] During my research fieldwork in 2019-2020, there were no farmers at the Intervale's Board of Directors.

> money for farmers? I don't understand why the Intervale Center doesn't share the power with the farmers… I think that there has to be more collective decision-making… Related to other issues, I think the Intervale Center has done so much for the farmers."

The reason why there are no farmers on the Intervale Board of Directors is not clear -I asked but did not receive a clear answer besides Travis Marcotte (2019), Executive Director of the Intervale, arguing that "you struggle in Vermont to get farmers to be on boards from a power standpoint." Definitely, the concern of having or not having farmers on the Intervale's Board is an area of more ponderation for the non-profit.

The issue of *greater participation of farmers in decision-making* (P7) is also an equity domain issue (Anderson et al., 2021, 2019). As mentioned before, equity is important in agroecological transformations as it entails the inclusion and involvement of all the agri-food system workers, as well as the local consumers who can positively or negatively be impacted by the decisions made in the system. Increasing participation to foster equity is particularly related to the type of governance that enables or disables *decentralized, collective, participatory governance in the agri-food system* (P5). As Anderson et al. (2019: 17) postulates:

> "Indeed, governance and power emerged as critical elements in all the domains and represent a 'sticky' and omnipresent dynamic that will ultimately determine to what extend agroecology will follow a transformative pathway based on processes of community self-organization or one that approximates the power relations, politics, and governance structure of the current dominant regime, which is generally dominated by elite and corporate governance processes. Within each of the domains, the issue of governance emerges as the critical determinant of the nature and strength of agroecology transformations and especially the extent to which food producers and their communities (urban and rural) can develop and reap the multifunctional benefits of agroecology. Governance determines how agroecology amplification is supported and strengthen across sectors, regions, countries as well as its alignment (or not) with wider food, water, energy, trade, and environmental policies."

Agroecology is not only a science and a practice, but it is also a social countermovement (Wezel et al., 2009) that embraces the ecology of the whole food system (Francis et al., 2003). This countermovement aims to tackle and counter the powerful control of the prevalent agri-food industrial conglomerate structures that are impacting communities around the globe. But the context remains extremely important and in the case of the Intervale, it is clear that it benefitted from Burlington's history of strong social democratic inclinations among its constituents and progressive politics. The state of Vermont, in general, has progressive policies in its food economy. The Intervale's success has been largely possible because it rooted, grew, and flourished in this socio-political progressive culture. At the end of the wrap-up Reflection Meeting, Mandy Fisher (2020), Director of Development and Special Projects at the Intervale, shared with the group of participants where the Intervale stands in their process of transformation:

> "It's hard to limit participation and decision making just to the Intervale land base and the Centre and not immediately jump to bigger decisions within the food system and then trying to get producer and consumer involvement in those decisions. How to get more diversity and a farmer on our board? For eleven years it has been on everyone's mind. Around decision making models, do others know how decisions are made and can we create a rubric to explain how decisions are made, and how different groups of people are triggered? How do those communications or information flows create power dynamics in the communication channels and in our work programs? So, we have this opportunity to talk about how decisions are made with the farming community down here, and what are the ones they would like to be involved in or feel comfortable making. … Then on the consumer side of it we already have a lot of models in the Intervale, like the ICF [Intervale Community Farm], a member owned co-op, and the Food Hub that really tries to balance the needs of consumers and producers. How do we highlight those good things we are doing? How do we expand on that work?"

Lastly but not least, *promoting farmer-to farmer exchanges for sharing knowledge* (P12) is pivotal in agroecology as a knowledge-intense discipline based on transdisciplinary and participatory approaches that generate, share, and mobilize knowledge for agroecological

transitions and transformations (Anderson et al., 2021, 2019; Méndez et al., 2013, 2016). Also, as Paulo Freire (2001) has clearly demonstrated, there is a strong link between knowledge and power. As stated by Anderson et al. (2019: 8), those recognized as "holders and producers of knowledge" are the ones that "shape the potential for transformations in agroecology." Furthermore, since agroecological systems are so inherently diverse and grounded in local and unique contexts, the acknowledgement and inclusion of "intimate, place-based, lived knowledge and wisdom" which "often exist outside the formal (educational) institutions" are required to create the "dynamics and conditions for the development of agroecological knowledge" (Anderson et al., 2019: 9). This particular agroecological knowledge can be found in the horizontal networks of different knowledge dialogues (*diálogo de sabers*, as promoted by *La Via Campesina*) that already exist in local communities and organizations of food producers (Anderson et al., 2021, 2019; Martínez-Torres and Rosset, 2014; McCune and Sánchez, 2019). The Intervale Center, as a successful non-profit organization with strong collaborative ties with the University of Vermont, and as an important socioecological system within the Burlington community, can have an influential role in facilitating this horizontal knowledge dialogues between *farmer-to farmer* (P12). Hence, at the Intervale there is an enormous potential for transformation in the knowledge and culture domain, as proposed by Anderson et al. (2019, 2021). As this research demonstrates, CIDSE's socio-cultural principles of agroecology are very meaningful at the Intervale from the perspective of participants.

Travis Marcotte (2019), Executive Director of the Intervale, however sees that *farmer-to-farmers exchanges for sharing knowledge* (P12) was more common in the past but is something they can be revived somehow to reinforce the presence of this principles at the Intervale:

> "It's interesting because I think we promoted more farmer-to-farmer exchanges in Intervale historically than we do today. There's like a maturation of the relationships of the farmers in the Intervale where we don't have farmers meetings. We used to have farmers meetings, now we don't really do that, and it seems to work. But I'm curious as you interview folks is there is a gap, is there some missing communication that we… I don't know, maybe we are missing some management that could… and it won't take a whole lot."

Brian Teed (2019), Operation Lead for the Intervale Food Hub, confirms Marcotte's comment above when he shares a story he heard about how the Intervale used to proactively facilitate more of these exchanges between farmers: "I know in the past before my time they were better about having farmers parties or farmers meetings. I don't think it's much of a thing anymore, which is unfortunate."

It is important to highlight that based on the results of this research, *farmer-to-farmer exchanges* (P12) are still happening but in an informal way between the farmers that are well-established at the Intervale. The reasons for these informal exchanges between farmers are due mostly to proximity in the same agroecosystem; farmers bump into each other during workdays and they collectively managed equipment, implements, and some facilities by being members of the Intervale Farmer Equipment Company, LLC. On the other hand, the reason why the *farmer-to-farmer exchanges for sharing knowledge* (P12) used to happen more frequently and formally in the past, as expressed above by Marcotte and Teed, can be found in farmer Adam Hausmann's reaction to the termination of the incubator program a the Intervale in 2018 (Intervale Center, n.d.-l). Hausmann started as an incubator farm at the Intervale and leased farmland for 12 years. Now he owns a successful farm, Adam's Berry Farm, in Charlotte, Vermont. According to Hausmann (2019), thanks to the mentoring and networking provided by the well-established and mentor farms (i.e., those established at the Intervale before 2005), and the Intervale Center actively facilitating these exchanges of knowledge through their Farm Business Planning program, *farmer-to-farmer exchanges for sharing knowledge* (P12) was more common prior to 2018 (Intervale Centre, 2017, n.d., a) since it was an integral part of one of the organization's programmatic areas. As Hausmann (2019) explains:

> "When we started there, there was the incubator enterprise and then mentorship farms. I really think it was one of the most positive parts of the Intervale… It was quite the collection of different growers and a strong community of support, collective support, and exchange of information as well at that point in the Intervale's history. It was a combination of things where it was the collective energy of an area with other people working at crazy hours and sharing the same experiences, maybe different crops, but the same rhythms of the natural world… If you had questions or problems, you could usually

> find someone within the day down there that had experienced or could steer you in the direction you needed. That was really positive. Then one thing that a lot of younger growers struggle with is some of the isolation of farming at times and the loneliness of it... One of the most positive aspects, especially as a young farmer down there, was that *farmer-to farmer exchange*. That's both information network and support network. Those were the two pillars I felt continually… And then within that, we were surrounded by a greater community where you went down to the Intervale for your day and then you returned in the evening to Burlington. It was interesting in that manner as far as operating an urban farm… And there being connected to the Intervale certainly opened a lot of doors as far as different support networks outside of the Intervale community within the greater Vermont farming and food community. The Intervale opened a lot of doors that way, and that was incredibly positive. So that was more of our incubator experience there… And to hear about the demise of the incubator program, I was really upset about that because I look at all these other farms around that the reason why they were successful was that they were able to hone their farming skills, establish markets, and gain the confidence and knowledge of what they were doing at the Intervale. That couldn't have happened otherwise."

The non-profit has its reasons to close the incubator program at the 340-acre property and focus their efforts in helping beginning farmers throughout Vermont, which is part of their outreach work. Under their Farm Business Planning program, a beginning farmer business planning and coaching subprogram offers "information, assistance, and encouragement to beginning and aspiring farmers in the state of Vermont through one-on-one coaching and business planning" (Intervale Center, n.d.-e). Patrick Dunseith (2019), Land Manager, explains:

> "Resources might be better spent in supporting land access, farm transitions, and farm business planning across the state, and not diverting some of our resources and efforts just to having a couple farms try to farm in the Intervale and then having to move five years down the road. How can we create farms that are going to be where they are forever in all of the state with partners there that also want to make that happen?"

The important point for the non-profit is that, if they want, they can keep *promoting* more formal *farmer-to-farmer exchanges for sharing knowledge* (P12) between the farmers located at their property in Burlington. Since this is a key principle of agroecology, there are many ways to facilitate this horizontal knowledge dialogues without the incubator program and with the support, for example, of the University of Vermont academic community and the Northeast Organic Farming Association (NOFA-VT). The Intervale collaborates closely with both institutions. *Enhancing resilience and adaptation to climate change* (P8) above the challenge of farming at a floodplain, sharing experiences and advancements with low till farming methods as well as best management practices to deal with the high level of phosphorous in the soil to *protect soil biodiversity and health* (P9), and exploring ways to gradually reduce the use of plastics or their *dependence in agrochemicals inputs* (P10) based on what is available in the market, are just a few of the topics that could help promote more formal *farmer-to-farmer sharing of knowledge* at the property. This can be done during the winter season when the farmers are not producing in their fields. Again, quoting Dunseith (2019), the Land Manager, exchange can be accomplished by creating "a sense of understanding from a bird's-eye view of how the whole landscape is being managed… I think the farms are all doing a great job but creating a space for them to share. I think there is room for helping the farmers compare their management strategies."

The Intervale's Community Relations Coordinator, Abby Portman (2019) highlights the importance of creating an efficient record-keeping method for all the research work done at the Intervale and related educational materials that could be useful for supporting and promoting *farmer-to-farmer knowledge exchanges* (P12):

> "There's definitely a lot of research and a lot of things that have been done in the Intervale that could be really useful to farmers but there really hasn't been an efficient record-keeping system for any of this. So, it's really hard to distribute and disseminate information that we've received over the years as a useful tool for the farmers."

The participants representing the Tommy Thompson Community Garden (TTCG) at the Intervale also showed some concerns and signaled areas of opportunities for what they called *farmer-to-gardener* and even *gardener-to gardener exchange*s *for sharing knowledge*, as it

related to P12. Their concerns can also be associated with opportunities for the improvement of communication and integration for better *decentralized, collective, participatory governance* (P5) under the political domain, as well *strengthening the relationship of local food producers and community* (P13). Dan Cahill, Land Steward of Burlington Parks, Recreation & Waterfront, has an important recommendation that the Intervale Center and this local government may want to explore for new opportunities of transformation at the socioecological system:

> "Maybe the question is, how do community gardeners fit into the mission of the Intervale? There is some disconnect between the way that community gardening practices are acknowledged, juxtaposed to farmers. At best the farmers stay out of the way. There is a bit of a disconnect between the farming community and the gardening community. I think there could be more exchange and support from the leadership that farmers provide as experts within the growing field… There's a missing opportunity within the agroecological landscape. These farmers exist, these gardeners exist, but there is not a lot of connectivity or support happening between those groups. What could that look like? Full respect for Hillary and Andy and the other growers. Obviously, they are very busy. Asking them to guide gardeners is not necessarily what I am saying. It is just an observation: *farmer-to-gardener* connections… My workplan is very aligned with the Intervale Center's mission. It should be very easy to work together, find a strategy and to mobilize. There is probably some way we could maximize the way the community garden fits into the larger Intervale community."

Between some of the gardeners, the feeling is the same when it comes to promoting *gardener-to-gardener sharing of knowledge* (P12) at the TTCG. Informally, and between plot, the gardeners do exchange knowledge and learn from each other. But should Burlington Parks, Recreation & Waterfront officially help to coordinate this type of knowledge exchanges between gardeners as a branch of the municipal government that works directly with the public? Community gardener and volunteer coordinator Fred Schmidt (2019) believes this is an opportunity Burlington Parks, Recreation & Waterfront should explore for a positive transformation in the culture and knowledge domain (Anderson et al., 2019, 2020) at the TTCG:

> "To my recollection we're not doing anything systematically as gardens to respond to climate change. We have had to abandon

several plots because they're too wet in the spring, especially this year and, to give us credit or to give the management credit, we are turning those into pollinator gardens. Last year they were treated with cover crops… To my knowledge we've done nothing systematically and formally to share our experience about what works right on the garden plots. We do talk a lot about animal control. We've done very little collectively and many of the gardens have deer issues… We do a lot of informally sharing about what grows and what mixes, and what are companion plants but to my knowledge, we've done no formal workshops or even garden visits looking at the best practices on the different gardens… Rob Kropp and I do a little bit of education in composting. One of the things that we're interested in is the potato beetle. We're doing nothing collectively to address the potato beetle issue. We'd share information individually but not as a group. We don't have a systematic discussion… It'd be nice to have some workshops and discussion about what works and what doesn't work. We could do a lot more in terms of [principle] number 12, *gardener-to-gardener*… So, there's a lot more that could be done formally, but certainly that's going on informally… At one point we were sharing with the Congolese [gardener] some of their field corn, a coarser corn that they were growing. They were enthusiastic to show us and for a while they were demonstrating. They were also growing African eggplant. It didn't look anything like our eggplants. But all these was not really systematic and, again, I'm so sorry that we don't have more time from Parks and Rec officials to work on things like that."

Figure 9.7: Potato Beetles: An Opportunity for Exchanging Knowledge
(Source: M. Juncos-Gautier, 2021)

This discussion of concern and opportunities for the ongoing process of agroecological transformation in P15 *encourages diversity and solidarity among peoples* (under the socio-cultural domain), P8, P9, P10 and P11 respectively *supports resilience and adaptation to climate change*, *nourishes biodiversity and soils*, *eliminates the use of agrochemicals*, and *enhances the integration of the various element of the agroecosystem* (under the environmental domain), P7 *encourages stronger participation of food producers and consumers* with the focus on producers (in the political domain), and P12 *promotes farmer-to-farmer exchanges for sharing knowledge* as well as farmer-to-gardener and gardener-to-gardener exchanges (in the socio-cultural domain) are ultimately the principles that resulted with the highest awareness and concerns among participants. The environmental principles are related to a "multi-year-long process," as Land Manager Patrick Dunseith (2019) admits. Nevertheless, there are a lot of opportunities for experimentation and learning. This experimentation and learning can be done by organizing more formal exchanges for sharing knowledge between farmers and gardeners at the Intervale to learn about new innovative and sustainable methods, equipment, and materials. The political and socio-cultural principles above, P7, P12 and P15, are 'food for thought' for the Intervale. These agroecological principles, as proposed by CIDSE (2018), have clear leverage points in the self-organization and goals of the non-profit (Meadows, 2008) for agroecological transformation in the equity, and knowledge and culture domains proposed by Anderson et al. (2021, 2019).

Other General Concerns

Some of the participants also expressed concerns about land ownership at the Intervale, as it related to P4, *having access and putting control of land and seeds in the hands of people* (see Table 9.1). Securing access to natural resources, which includes the issue of land tenure, is essential for the livelihood and agroecological transformation of smallholders (Anderson et al., 2021, 2019). Nevertheless, contextual thinking (Bell and Bellon, 2018) in this principle is important, and there are trade off to consider. The Intervale Center, as a non-profit in the social economy, has the role of holding in trust for public use the 340-acre property enclaved in an important native floodplain forest via a conservation easement agreement (Figure 9.8) for the

protection of natural resources, and for organic agriculture and passive recreation for the community.

Figure 9.8: Holding in Trust for Public Use: The Conservation Easement
(Source: M. Juncos Gautier, 2020)

Nevertheless, the Intervale leases farmland at rates lower than the market average, which the farmers interviewed consider fair – and so do community gardeners who consider that $60 for a plot at the Tommy Thompson Community Garden (TTCG), for the whole growing season, is more than fair. Also, Burlington Parks Recreation & Waterfront provides discounts and plots for free for those gardeners that volunteer as site coordinators. Additionally, gardeners and farmers have access to water (Figure 9.9), a vital resource for farming. Gardeners do not have to pay a monthly fee for the use of the water. Burlington Parks Recreation & Waterfront provides gardeners access to water at no cost as a public service. Farmers that lease farm fields to the west side of the property do pay for irrigation water when they use the well, pump, and lines the Intervale maintains through an annual fee of approximately $300/meter and a gallon rate of $0.0051 (P. Dunseith personal communication, 2021). The Intervale bills them at the end of the year. The field equipment for irrigation remains the responsibility of each farm. To the east side

of the property, where Winooski River flows, farms use their own pumps directly from the river. The Intervale has another well at the agricultural complex that serves the greenhouses, but the farms do not have to pay for the use of this well at the greenhouses. The Intervale Community Farm has two wells of its own (P. Dunseith personal communication, 2021).

Figure 9.9: Access to Water for Gardeners at the TTCG
(Source: M. Juncos-Gautier, 2020)

Finally, *access and control of seeds* (P4) seems not to be a problem at all for farmers in the context of Vermont, even though they do not grow their own seeds. Gardeners at the Tommy Thompson Community Garden do a lot of seed swapping and the Intervale Conservation Nursery collects its own seeds. Farmers buy most of their seed from High Mowing Organic Seeds (2021), which make "available to home gardeners and commercial growers over 600 heirloom, open-pollinated and hybrid varieties of vegetable, fruit, herb and flower seed" and source many of their varieties "directly from independent, passionate organic seed farmers." They also believe, according to their website, "in a deeper understanding of how re-built food systems can support health on all levels – healthy environments, healthy economies, healthy communities and healthy bodies" by providing "an essential component in the re-building of our healthy food systems: the seeds" (High Mowing Organic Seeds, 2021). The seed topic reveals, again, the importance of context when studying an agroecosystem. And as Travis Marcotte (2019), Executive Director of the Intervale, explains:

> "On the seed side we don't do a ton with seeds, we do a little bit with the Abenaki Heritage Garden. That's the newer work that I think has some huge, huge implications. It's really exciting to think about the ownership of seeds but, also back to resilience, by having all these different seeds varieties that are of the region and people just don't grow commercially. I mean, Vermont is also interesting because we have a pretty good-sized seed company in Vermont that also has been thoughtful in that realm."

In closing, I want to touch on one last thing in the list of concerns from participants as presented in Table 9.1.: their political activism dilemma under P6 for *supportive public policies and investments.* As discussed before, this is an important topic since agroecology is also a countermovement for local sustainable and just agri-food systems. Travis Marcotte (2019), Executive Director of the Intervale, expressed that the Intervale is "not an advocacy organization… but I think if we're going to be successful, we've got to shift the policies in the United States, in Vermont, quite a bit." So Marcotte knows this is a challenge, especially when the mission of the non-profit is to "strengthen community food systems" in a sustainable way, which aligns with many of the agroecological principles as it has been evidenced. Jessica Sanford (2019), former farmer at the Intervale and owner with her husband, Adam Hausmann, of Adam's Berry Farm, may have an answer for this concern:

> "I don't think the Intervale has defined it as their mission to work on policy initiatives, like Rural Vermont or NOFA [Northeast Organic Farming Association] … Not that they don't play supportive roles to those organizations, but they've not chosen to make it as a focus. But they're very much in communication with those people working on policies. Those entities have ideas of how to move different policy initiatives forward. So, it's that they've taken a supportive role."

This is a point of intervention that is clearly related to changes in the goal of the non-profit, and it is a decision the Intervale community has the right to make among themselves. This decision corresponds to two domains of transformation: the 'discourse' to "frame debates, policy, and actions" for the powerful mobilization of "collective political action in policy arenas" (Anderson et al., 2019: 15) and the multi-actor 'networks' to strengthen community-self organization to coordinate actions at multiple-scales (Anderson et al., 2019, 2021). Since

agroecology is also a countermovement with a clear political agenda against the hegemony of the globalized agri-food industrial conglomerates, one way of being part of this countermovement is, as Sanford explains, keeping an active supporting role to advance the work of organizations that do focus on advocacy *for supportive public policies and investments* (P6).

Concerns brought up by informed participants are issues that the Intervale can address for their ongoing agroecological transformation. This baseline principles-focused assessment provides the starting point for the Intervale's agroecological path. Based on the practices and knowledge of participants, the Intervale has key areas related to equity, knowledge, and culture in the domains of agroecology transformation (Anderson et al., 2019, 2021) with identifiable leverage points (Meadow, 2008) in the goals and style of governance of the non-profit. Other areas of concern in the domains of transformation could be addressed by continuing the participatory action research process that started with this baseline assessment with the collaboration of the University of Vermont. Current employees will likely support such transformation given that many points raised come from them.

Nevertheless, as discussed before, the Intervale is also well-known in the United States for providing a living testimony of how a successful sustainable peri-urban agri-food system can operate with the support of a progressive local government and community. Thus, because of its proven leadership and successful operations for more than 30 years, the Intervale has the potential to become one of the "'agroecological lighthouses' from which agroecological principles radiate out to the community and farmers from other regions" (Nicholls and Altieri, 2018: 1176). Serving as an example to scale agroecology is also a way of being *supportive of positive changes in public policies and investments* (P6). The world needs these living testimonies as inspiration to move policies in the right direction because, as the World Social Forum has asserted over the years, "another world is possible."

CONCLUSION

The time to amplify agroecology has never been more critical.[47] As I write this final section of my dissertation, the 2021 UN Food System Summit held in New York on September 23 showed the interest of powerful economic players. The call for this Summit did not emerge from the Food and Agriculture Organization (FAO) or the UN Committee on World Food Security (CFS). Rather, before the Summit, the UN Secretary General signed a strategic partnership with the World Economic Forum to develop a vision of 'food systems transformation' in alliance with multinational corporations, powerful philanthropies, and export-oriented countries aiming at public-private partnerships (Montenegro de Wit et al., 2021; Canfield et al., 2021). Rooted in the autonomy and knowledge of pluricultural communities around the world to sustain their own local ecological agri-food systems (IPES-Food, 2016; Francis et al., 2003), the agroecological movement, more than ever, needs agroecological lighthouses, as once proposed by Nicholls and Altieri (2018). These lighthouses can inspire communities on how to move forward against the hegemony of the agro-industrial conglomerates hungry to capture the agroecological narrative of food systems transformation with coopting tropes such as 'nature-positive production' or 'climate-smart agriculture' (Montenegro de Wit et al., 2021; Canfield et al., 2021).

My research endeavor provides a robust participatory framework to do a context-sensitive and principles-focused baseline assessment (inspired by Patton, 2018; 2015a, 2015b) of exemplary agri-food initiatives with the potential to become an agroecological lighthouse. Furthermore, since there is an urgent need to feed an urban world (The Chicago Council on Global Affairs, 2013), the results of my research show how a peri-urban case study is practicing and expressing agroecological principles in an array of ways for the much-needed urban agroecology lighthouse in North America and other regions around the world.

[47] A recent article by McGreevy et al. (2021: 4) defines the amplification of agroecology as the process "through which agroecological practices are initiated and scaled up and out at the farm, community, and regional levels" via social interactions of individual and community knowledge networks to enable "the creation of policies and markets supportive of agroecology."

Key Findings

My research shows that the fifteen principles of agroecology, as presented by CIDSE (2018), are all found in the Intervale's 340-acre peri-urban socioecological system within a range of contextualized practices and expressions. Prominently, the Intervale has had an essential role in *strengthening the local community (and its producers, knowledge, culture…)* (P13)*, empowering the local market, and building on a social/solidarity economy* (P3), and in *nourishing biodiversity and soils* (P9). According to participants' responses and my observations, these three principles are most prevalent in the collective practices and expressions at the Intervale. These principles are evidenced in the organization's social economy mission and vision that includes its public trust responsibility (to conserve fertile farmland and the natural resources around it for the community), its strategic areas of action for strengthening the community food system, and, consequently, the multifunctionality of its agroecosystem. The farms and community gardens embedded in this agroecosystem embody these three principles as well. The progressive socio-political context of Burlington, which allows the social economy to thrive, and the strong culture around protecting and promoting local organic farming in Vermont are important governance-related enabling factors that facilitate the success of the Intervale as a potential urban agroecology lighthouse.

As a general trend, it is noteworthy that the practices related to the principles under the socio-cultural domain, when combined and analyzed as a whole, point to the role of the Intervale in this domain as having the most substantive significance. Following closely in substantive significance are the practices and role of the non-profit under the environmental domain principles. The economic and political principles were respectively third and fourth in the participants' narratives, which concurred with my general observations. These general results add up since the 340-acres peri-urban socioecological farming system is overseen by a non-profit with a clear public trust mission for the community. It also supports the literature reviewed which always emphasizes the social and environmental function and benefits urban and peri-urban farming has for communities beyond food production.

Since scholars and practitioners of agroecology agree that agroecology is an ongoing transformation process, not a specific end target, there are areas with identifiable leverage

points at the Intervale's organization and goals (Meadows 2008) where changes can be made to strengthen agroecology. Opportunity areas most signaled by participants relate to *fostering more diversity and solidarity among peoples* (P15) in the equity domain of transformation for agroecology (Anderson et al., 2019, 2021). Participants admitted that they would like to see diversity in the staff, recommended exploring other activities at the property that may appeal to more diverse audiences, and recognized the need to further develop their initiative with the Indigenous Abenaki community. Other areas with identifiable leverage points are the participation of farmers on the Intervale's Board of Directors to *encourage stronger participation or food producers* (P7) in the decision-making process and promoting more formal *farmer-to-farmer exchanges* (P12) with local farmers' organizations and academia for the horizontal co-creation of knowledge. Participants also signaled the need for more 'farmer-to-gardener' and 'gardener-to-gardener' exchanges, as well as activities to build a stronger sense of community at the Intervale.

Participants also revealed general concerns related to climate change, its expected exacerbated impacts inside the Intervale's floodplain, and the enhancement of their ecological practices. Based on the literature reviewed on resilience and sustainability, their environmental concerns are prevalent in most farming communities, especially in those practicing organic/sustainable agriculture. The Intervale participants were really aware of environmental issues, and they were exploring and studying alternatives which showed their ongoing transformation process. More formal *farmer-to-farmer exchanges for sharing knowledge* (P12) (and 'farmer-to-gardener' and 'gardener-to gardener') can help address these environmental concerns to enhance the producers' practices, resilience, sense of community, and the overall quality of the agroecosystem matrix at the Intervale. Ergo, based on my two research questions, I conclude that the Intervale is a peri-urban agroecological organization. Research results presented in the previous chapters provide ample evidence of the why and how. However, to strengthen agroecology at the Intervale, participants identified areas of opportunities with some distinct leverage points.

Lessons Learned

> "I have yet to see any problem, however complicated, which, when looked at in the right way, did not become still more complicated" (Poul Anderson in Meadows, 2008: 11).[48]

There are many lessons learned from this research, but the first important lesson is that assessing agroecology from a multidimensional and transdisciplinary lens is complicated. This complexity is expected when studying agroecosystems as a socioecological system, with all its different components, even with well-defined boundaries framing the research endeavor. It was not easy to combine the context and systems thinking lenses (Bell and Bellon, 2018) to 'see the big picture' with the multidimensional principles. Concurrently, the process further complicated when I started to connect this contextual 'big picture' with the details of the day-to-day practices experienced and gathered from participants' responses and my observations. Comprehensive and compounded principles were a real challenge in the content and thematic analysis process. Most expressions and practices of these principles are interconnected and co-dependent. As Patton (2018: 85) argues, most principles are not independent items from a "pick-and-choose list," but "constitute an interrelated, mutually reinforcing, dynamically interconnected whole," conveying "a systemic way of thinking." The principles-focused baseline assessment that I conducted at the Intervale, while providing separate results per principle, also depicted the wholeness of the Intervale. The Intervale exists because the different component parts of its agroecosystem/ socioecological system work together to form a coherent whole. The intended use of the interconnected and interdependent principles of agroecology to guide practices is to help appreciate this whole. As a researcher, I was able to deal with the challenge of interconnectedness and interdependence of principles by auditing my coding process with the support of other qualitative researchers for coding rigor. The auditing provided soundness and confirmability in the resulting content and thematic analysis. Even when using NVivo qualitative

[48] Meadow (2008) quotes Poul Anderson, an American science fiction author (1928-2001), from the 1967 book by Arthur Koestler's *The Ghost in the Machine*.

data analysis software, any similar principles-based assessment benefits from additional expertise to guarantee a robust qualitative analysis process.

A second important lesson is that the iterative process of participatory action research (PAR) with the different visual exercises was a remarkable learning process. The 'primary intender users' (Patton 2018, 2015a, 2015b) were able to 'connect the dots' for an eye-opening experience of the Intervale. They were able to 'see' the agroecosystem/socioecological system beyond the boundaries of the individual farms and the different programmatic areas of the organization. Also, the multidimensional and cross-disciplinary principles used, as portrayed by CIDSE (2018) in their attractively designed infographic, were effective for the agroecological assessment. In addition to helping 'connect the dots,' the CIDSE principles helped participants find points of intervention in their socioecological system for their ongoing agroecological transformations. This eye-opening process was an important lesson learned in my research, which indicates that CIDSE's principles are effective and can be helpful for the agroecological assessment of other similar initiatives. Responses from participants showed how important the participatory process was in combination with the use of CIDSE's principles. While I received similar feedback from many participants, the following two comments capture the importance of the exercise:

> "I thought it was pretty eye-opening. As you can see in my chart, I get narrow or one-track-minded in some ways... I'm just not really thinking about the bigger picture. Doing this exercise really opened my eyes to all of the different levels and tiers we're doing down here, from farming to the community aspect. Just who we are. Talking with María and walking through [the PAR] process was very eye-opening. It's not just farming. It's much, much more that we're involved in. So, I definitely learned something more than I would've if I didn't take this" (Mike Ingalls, Intervale Conservation Nursery Manager, 2020).

> "I think this is a great way of organizing all these thoughts, all the different facets of the future, what we at the Intervale think is a meaningful future of agriculture. It goes hand in hand with all the mission-driven work that I feel comes from just people who are farming in alternative ways. And I do think too it's great to really recognize the details… it brings up the peripheral issues that you can feel part of just by being in the community, the sustainable agriculture community. But really

> to challenge yourself to be at that next level. There are some details in here that really beg the question: 'how much are you really doing?' Like this, P15 [*encouraging diversity and solidarity among people*]. It's easy to be like, 'yeah, great, we're just like pro everybody' and then, what's the actual work that you're doing to really push that ahead, not just being thumbs up, you know? And I think farmers do enough already. But to really integrate food systems work with a lot of other social justice work, it makes everything more powerful. It really goes hand in hand" (Patrick Dunseith, Intervale Land Manager, 2020).

As Patton (2018) proposes in his GUIDE framework for principles, participants' responses evidence that the CIDSE principles can guide (G), be useful (U), inspiring (I), developmental (D), and evaluable I. Appendix 4 provides a figure with Patton's GUIDE framework for effective principles that resonate with the comments from Ingalls and Dunseith presented above.

Contributions

Using CIDSE's (2018) proposed multidimensional principles of agroecology, my principles-focused baseline assessment helps understand the agroecological status of the Intervale case study and provides guidance to enhance their practices. The results of this assessment help to reduce the evidence-based gap that still exists in the literature between the theory supporting the cross-disciplinary principles of agroecology and the actual application of these principles (i.e., praxis). Using these principles as a compass for "generalization without universalization" (Bell and Bellon, 2018: 605), the results of my research also illuminate the understanding of the importance of context and, accordingly, the particular contextualized practices in the Intervale peri-urban agroecosystem to advance urban agroecology.

There are valuable studies on how the ecology-related principles can be used to design and assess the agroecological status and level of resilience of a farm using rubrics with indicators, threshold values, and indexes (e.g., Altieri, 2000; Altieri, 2016; Nicholls et al., 2016, 2020; Tittonell, 2020; Barnes et al., 2020; Cabell and Oelofse, 2012). These same ecology-related principles have been proposed to design and assess agroecology in urban farming (e.g., Nicholls and Altieri, 2019; Altieri and Nicholls 2018; Altieri et al., 2017; Altieri et al. 2014-2016). However, my research goes beyond the farm-level environmental principles and the use of numerical values to try to rank or measure agroecological condition. My research considers the

agroecosystem as a socioecological system that, in addition to the ecological principles in the environmental domain, also incorporates principles of agroecology in the economic, political, and socio-cultural domains, as proposed by CIDSE (2018), for a non-compartmentalized "holistic approach that is at the heart of agroecology" (Anderson et al. 2019: 13). Dumont et al. (2016) proposes principles in the social and economic dimension and focuses on these socioeconomic principles to assess their implementation in two case studies by interviewing key actors. However, my research adopted a more comprehensive socioecological lens without omitting the environmental principles at the farm level. As Kapgen and Roudart (2020: 7-8) affirm, the value of agroecological principles "lies in their combined use or implementation" without isolating single elements.

> "Using agroecology to rebuild the world's food systems requires the joining of cultural, political, economic, social, historical and ecological processes" (McCune and Sánchez, 2019:14).

By combining two clear lines of inquiry with multiple qualitative methods, my study embraces the complex nature of agroecology. It shows how its multi-dimensional and cross-disciplinary principles can be assessed and triangulated for a baseline analysis that also reflects on the inherent "wholeness, interconnectedness and interdependence of agroecology" (Barrios et al. 2020: 232). By combining a practical stream of inquiry with participants using different visual exercises, and a theoretical stream with the researcher connecting theory to practice, my research provided a robust triangulation process with different sources of information, perspectives, and analytical angles to substantiate the practice and expression of the principles of agroecology.

Furthermore, my research goes beyond the common tendency to use universal measuring methods or "reductionist approaches focused on indicators, typically used to evaluate and monitor progress in agriculture" which "are not appropriate for the holistic nature and complex interactions of agroecology, its political-cultural outcomes, and its multifunctional benefits" (Anderson et al. 2019: 10). Accordingly, my research does not focus on developing a type of uniformity but instead on valuing diversity (IPES-Food (2016) by "thinking in terms of consequences of *context*" (Bell and Bellon, 2018: 607, original emphasis). Because "principles guide adaptation" (Patton, 2018: ix), my principles-based study allowed an in-depth

understanding of a contextualized approach for the practice of agroecology by using the theories and narratives behind the discipline of agroecology expressed through its value-driven principles.

Equally importantly for agroecology, another contribution of the methodology used for this assessment is that it incorporates participants' voices and perspectives for collective critical reflection of their day-to-day practices and working environment for the horizontal co-creation of knowledge. As Freire (2005 [1970]: 50) posits:

> "To deny the importance of subjectivity in the process of transforming the world and history is I and simplistic. It is to admit the impossible: a world without people. This objectivistic position is as ingenuous as that of subjectivism, which postulates people without a world. World and human beings do not exist apart from each other, they exist in constant interaction."

Thus, by incorporating the perceptions and responses of participants as co-investigators with different visual exercises, my research assesses how the principles of agroecology are being followed at the Intervale and identifies the strengths and weaknesses of the socioecological system for their ongoing agroecological transformation. Furthermore, it co-created knowledge with participants to inform other similar initiatives in North America.

Certainly, my research helps address the knowledge gaps mentioned in the literature and advances the global discussion on the use of principles in agroecology. It has provided a reasoned and comprehensive methodological approach to address, as Barrios et al. (2020: 241) propose, the need to "facilitate integrative thinking and co-creation processes that recognize the value of linking ecological sciences with social sciences, incorporate knowledge that may originate outside of conventional paradigms of science, and embrace culture and food traditions through participatory and action-oriented approaches to research." From the perspective of "resourcing an agroecological urbanism" (Tornaghi and Dehaena, 2021a), my research provides a robust framework with the use of multi-dimensional and cross-disciplinary principles "to capture the multiple ecological, social, economic and political dimensions of urban farming, beyond yield and profits, enabling those seeking transformative food systems change… a common language and opportunity to… communicate more clearly the multiple benefits worthy of public investment" (Bowen Siegner et al., 2019:22). By "[k]nowing which principles have been adopted, how they

have been interpreted and implemented and by whom," I have shown how agroecology can be assessed in an agri-food initiative beyond the farm level and trace back the historical and context-dependent reasons that made it possible (Kapgen and Roudart, 2020:12). Last, the results of my research contribute, as Egerer and Cohen (2021b) propose, to advance the understanding of how agroecological principles, initially developed for rural agroecosystems, are being followed in urbanized settings. This contribution includes the situated drivers and results of applying the principles to help guide the recent expansion of urban agriculture in cities in the United States and beyond.

Limitations

I identified four primary limitations in my qualitative research. One limitation was the unavailability of the smaller farms at the Intervale to engage in the participatory action research (PAR) process due to their farming responsibilities. Participating farms were the three largest farms at the site: Intervale Community Farm (ICF), Diggers' Mirth Collective Farm, and Pitchfork Farm. These three farms occupy a total of 96 acres or ~82% of the land being cultivated (including the land managed by the Intervale Conservation Nursery and the Tommy Thompson Community Garden), which provided enough information to assess the overall farming practices in combination with the Land Use Protocols. Nevertheless, I could not include the viewpoints of the small farms, which might have been important.

A second limitation was that, as a socioecological system, the Intervale is very dynamic and was constantly changing. In only one year, while conducting my fieldwork, I observed many organizational and landscape changes. My PAR interactive process covers a time span of 11 months from March 2019 to February 2020. After February 2020, I mainly worked on geomatics and ground-truthing with GPS and did some additional participatory observation as a volunteer. Hence, my agroecological assessment with participants represents just a snapshot of the Intervale's agroecological status between spring of 2020 and winter of 2021.

The third limitation was that I wanted to engage racialized people, including New Americans and Indigenous peoples, in my research. Regarding New Americans, I only had the opportunity to recruit two New Americans as part of my sample. One was a community gardener

from the Tommy Thompson Community Garden. The other was a farmer at the Intervale's 2.5 acres assigned land area for New Americans in collaboration with the Association of Africans Living in Vermont (AALC). Despite some language barriers, I obtained enough information to understand their general practices and relationship with the Intervale. However, I could have obtained much richer information with the support of a translator.

Regarding the Abenaki Indigenous community, even though there are four state-recognized Western Abenaki groups, the U.S. Census Bureau (2019b) data indicates that only around 2,500 people (0.4% of the population) in the whole state of Vermont classify themselves as Indigenous (or American Indian), thus engaging them in my research was a challenge from the beginning. That is why I focused my participatory research efforts with local community members collaborating directly with or working at the Intervale. When the Intervale initiated the Abenaki Heritage Garden with the cooperation of other Burlington community members a few years ago, they did so with the support of the St. Francis/Sokoki band of the Abenaki Nation at Missisquoi. Notwithstanding, this initiative has not progressed with the involvement of the Abenakis. The participation and engagement of the Abenakis is an area that deserves focused attention and research on its own with Indigenous knowledge literature since this is a sensitive issue with a historically oppressed community. Such research would serve to emphasize the importance of Indigenous knowledge in the development and applications of agroecology -- and urban agroecology in particular. However, this focused attention is beyond the scope of this baseline principles-based assessment. I mentioned in Chapter 9 that *fostering more diversity and solidarity among peoples* (P15) is an area of growth and opportunity at the Intervale mainly because the information obtained about P15 came from the Intervale's North American white staff, farmers, and collaborators. Thus, my baseline assessment is very limited in the voices and perspectives of racialized and Indigenous peoples. More concerted attention to the inclusion of New Americans and Abenakis at the Intervale will also help *to strengthen local knowledge, culture, and spirituality* (P13).

Finally, and not less important, was my positionality as a researcher. As a Latina, Puerto Rican, and academic researcher, I am an outsider (i.e., racialized as non-white with a Spanish accent, not from Vermont, and not a farmer and/or someone working at the Intervale). In the

beginning, I admit that it was hard to build trust and open communication – from both sides – with the Intervale's actors. I am not sure if I could have obtained more information from participants if I were an insider (i.e., white, from Vermont or at least from Northeast region of the United States, spoke English without an accent, were a farmer and/or worked at the Intervale), especially when discussing concerns and areas of opportunity. Doing participatory observation as a volunteer in most of the Intervale's activities opened doors and eased the outsider-insider tension for reciprocal collaboration, as Herr and Anderson (2005) discusses. Months of participatory observation as a volunteer generated trust and facilitated communication and information.

Recommendations

The sky is the limit for the multifunctional Intervale in terms of future areas of research, reflection, and action in agroecology. There will always be opportunities to reach new heights in their ongoing agroecological transformation. Nevertheless, some areas seem to have priority in the participants' concerns based on the principles of agroecology.

When it comes to equity, an area of research interest would be to develop with the Intervale a participatory assessment focused on how they can improve their community outreach efforts to be more equitable, inclusive, and accessible to New Americans and other non-white Americans, including Abenakis in Vermont. The goal of this assessment would be to strengthen their role in *fostering more diversity and solidarity among peoples* (P15), which would, consequently, *strengthen the local community, producers, culture, knowledge, and spirituality* (P13). The Intervale could do this assessment, for example, in and around the Old North End and Winooski (the two urban settlements surrounding the Intervale with the most diverse population in Vermont) with the collaboration of the University of Vermont and local non-profit organizations like Peace and Justice Center, the Association of African Living in Vermont (AALV), and the state-recognized Western Abenaki tribes.

Other recommended participatory assessment focused on producers at the Intervale, including the community gardeners with Burlington Parks, Recreation and Waterfront, could explore how the Intervale can more formally *promote exchanges for sharing knowledge between farmer-to-farmer* (P12), farmer-to-gardener, and gardener-to gardener, to *strengthen*

relationships between their community of producers (P13). This assessment could also include questions on alternatives to *encourage more vigorous participation of producers and consumers in the Intervale's decision-making processes* (P7) for *decentralized, collective, and participatory governance* of the Intervale's agri-food system (P5).

Related to the environmental domain principles, there could be opportunities to work with the University of Vermont in longitudinal studies to address their most pressing concerns related to these principles. Future research in this arena could be done via grants and interdisciplinary teams of researchers for the co-creation of knowledge with the Intervale's actors. These concerns include:

- the issue of dealing with flooding that is expected to worsen with climate change,
- the control of invasive species and ostrich fern overharvesting to safeguard the diversity of the native forest,
- the reduction of the high level of phosphorus in the soil,
- exploring alternatives for low-tillage and non-tillage practices taking into consideration the high volume of production in the farms,
- possible viable alternatives to reduce the use of plastics and greenhouse gas emissions,
- and how to better integrate the farmland and wildlife habitat of the surrounding forest to enhance the sustainability of agroecosystem matrix, including how to deal with the deer population affecting the farms.

Not related to the main areas of concern of participants at the Intervale, but an area of interest for advancing urban agroecology is to compare and position the Intervale within the broader national context. While doing my fieldwork at the Intervale, I did an online survey with selected sustainability-oriented farming initiatives or organizations in urbanized areas in the United States. I selected these farming initiatives because they have an active presence on the internet or social media or are referenced as good examples in scholarly or news articles. The survey's main objective was to examine the practices and expressions of CIDSE's agroecological principles in other exemplary urban/peri-urban farming endeavors in the United States. So, a next path of research for me is to compare/contrast the Intervale with these other initiatives to

see the trends and to help amplify urban agroecology. Although I have yet to compile the final results, based on a general review of the results, it appears that the principles under the socio-cultural and environmental domains are showing prominence on the responses of the surveyed participants, which is consistent with the general results at the Intervale.

Another research avenue is to extend the principles-based assessment methodology used for this research to guide the development of a similar sustainable peri-urban farming initiative – notably in Puerto Rico, my homeland. I am presently part of a multidisciplinary group of professionals from Puerto Rico exploring alternatives to strengthen local food system networks, urban farming, and food security on the island. A possible research opportunity is identifying funding, the right partners, and a promising peri-urban farming endeavor in Puerto Rico to develop a similar undertaking like the Intervale in the Caribbean.

In conclusion, the Intervale is well-positioned to lead in the path of agroecological transformation – and be a lighthouse (Nicholls and Altieri, 2018; McGreevy et al., 2021), as well as a 'protective embodied space' for urban agroecology (Smith and Raven, 2012; Anderson et al., 2019; Nicklay et al., 2020). A recently published article by McGreevy et al. (2021) provides a rubric with a list of indicators to do on-farm assessments of exemplary farmer and their farms that have the potential of amplifying agroecology. After conducting a preliminary cross-referencing of McGreevy et al.'s indicators with my results of CIDSE principles-based assessment, I see that the Intervale socioecological system scores high as an agroecological lighthouse beyond the farms level.[49] The Intervale could explore using this rubric to assess themselves in the future (another possible area of research, reflection, and action). Through the Intervale's outreach initiatives and

[49] McGreevy et al.'s (2001: 8-9) indicators are: 1) motivations to search for alternatives sustainable methods; 2) level of social connections and organization; 3) participation in networks for sharing experience and knowledge; 4) use of effective, efficient and accessible traditional and modern agroecological practices; 5) level of autonomy from external inputs, markets, and policies; 6) leadership in mobilizing discourse, encourage and influence the community by example, and generate enthusiasm; 7) level of collaboration with external allies, including universities, NGOs, extension agents, etc.; 8) benefit from the use of local/national conductive policies; 9) participation in alternative food networks with more direct links to consumers; and 10) knowledgeable and focused on principles and process of agroecology.

their leadership in farm business planning and conservation of agroecosystems in Vermont, the non-profit already has an ample opportunity in this direction.

Furthermore, 'protective spaces' (Smith and Raven; 2012; Anderson et al., 2019) are case studies that, for several reasons, have grown, matured, and survived in niches somehow sheltered from the aggressive pressure of the agri-food industrial regime. These 'protective spaces' can help amplify agroecology as an alternative to the global industrial hegemony. The Intervale is one of these protective spaces. Since its foundation in 1988, the Intervale has benefited from the progressive sociopolitical environment of Burlington and the general culture in Vermont of valuing the working landscape and having access to healthy, locally produced food. The Intervale socioecological system enclaved in Burlington also represents a model for food system governance, which is pivotal for agroecology to flourishing and amplify because governance intersects all the domains of agroecological transformation (Anderson et al., 2019, 2021).

My research has also served as an opportunity to see the Intervale as an 'embodied space' for learning about urban agroecology (Nicklay, 2020). These 'embodied spaces' are built from community-university alliances that facilitate in-depth transformative learning:

> "Together, relationships, co-creation, and embodied spaces create interactions from which transformative learning and socio-ecological changes emerge" (Nicklay, 2020: 16).

By connecting multiple strong relationships between academia and the non-profit for the horizontal co-creation of knowledge, the Intervale also provides a perfect embodied learning space to study and experience urban agroecology with the aim of inciting transformations in other similar socioecological systems. Urban agroecology is the epitome of positively altering the unsustainable rural-urban rift and dichotomy that have predominated in society since the industrial capital-intensive hegemonies took power. Urban agroecology embraces the rich complex rural-urban continuum where multifunctionality and holistic transdisciplinary approaches are most valued.

BIBLIOGRAPHY

AALV, Inc. [Association of Africans Living in Vermont] (2017). *New Americans find independence*. https://www.aalv-vt.org/about

Adidja, M. W., Mwine, J., Majaliwa, J. G. M., Ssekandi, J. (2019). The contribution of agroecology as a solution to hunger in the world: a review. *Asian Journal of Agricultural Extension, Economics & Sociology*, 33(2), 1-22.

Advameg, Inc. (2021). *Burlington: Economy*. City-Data.org, Advameg, Inc. http://www.city-data.com/us-cities/The-Northeast/Burlington-Economy.html

ALC (Agroecology and Livelihoods Collaborative). (n.d.). *Agroecology: transdisciplinary and transformative.* ALC-University of Vermont. Retrieved from: https://www.uvm.edu/agroecology/our-approach/agroecology/

Altieri, M. (1994). *Biodiversity and pest management in agroecosystem*. Haworth Press.

Altieri, M. A. (Ed.). (1995a). *Agroecology: The science of sustainable agriculture* (2nd ed.). Westview Press Inc.

Altieri, M. A. (1995b). Designing sustainable agroecosystems. In M. A. Altieri (Ed.), *Agroecology: The science of sustainable agriculture* (2nd ed., pp. 89-106). Westview Press Inc.

Altieri, M. A, (1999). The ecological role of biodiversity in agroecosystems. *Agriculture, Ecosystems and Environment,* 74, 19-31.

Altieri, M. A. (2000). Agroecology: principles and strategies for designing sustainable farming systems. *Agroecology in Action*. University of California, Berkely. http://nature.berkeley.edu/~miguel-alt/principles_and_strategies.html

Altieri, M. A. (2002). Agroecology: The science of natural resources management for poor farmers in marginal environments. *Agriculture, Ecosystems and Environment*, 93(1-3), 1-24.

Altieri, M. A. (2016). Developing and promoting agroecological innovations with country programs strategies to address agroecosystems relicense in production landscapes: a guide. http://foodfirst.org/wp-content/uploads/2016/02/latest-version-guidance-note-GEF-SGP.pdf

Altieri, M. A. (2019, February 13). How urban agriculture can improve food security in US cities. *The Conversation.* https://theconversation.com/how-urban-agriculture-can-improve-food-security-in-us-cities-106435

Altieri, M. A., Companioni, N., Cañizares, K., Murphy, C., Rosset, P., Bourque, M., and Nicholls, C. I. (1999). The greening of the "barrios" urban agriculture for food security in Cuba. *Agriculture and Human Values*, 16, 131-140.

Altieri, M.A. and Nicholls, C. I. (2005). *Agroecology and the search for a truly sustainable agriculture* (1st ed.). UNEP, Environmental Training Network for Latin America and the Caribbean. Retrieved http://www.agroeco.org/doc/agroecology-engl-PNUMA.pdf

Altieri, M.A. and Nicholls, C.I. (2018). Urban agroecology: designing biodiverse, productive and resilient city farms. *Agro Sur* 46(2), 49-60.

Altieri, M. A. and Nicholls, C. I. (2017) Agroecology: a brief account of its origins and currents of thought in Latin America. *Agroecology and Sustainable Food Systems*, 41(3-4), 231-237.

Altieri, M. A., and Nicholls, C. I. (2008). Scaling up agroecological approaches for food sovereignty in Latin America. *Development,* 51(4), 472–480.

Altieri, M. A. and Nicholls, C.I. (2000). Applying agroecological concepts to development of ecologically based pest management strategies. In *Professional societies and ecologically based pest management: Proceedings of a workshop of the National Research Council* (pp. 14-19). The National Academy Press.

Altieri, M. A., Nicholls, C. I., Henao, A., and Lana, M. A. (2015). Agroecology and the design of climate change-resilient farming systems. *Agronomy for Sustainable Development*, 35(3), 869-890.

Altieri, M. A., Nicholls, C. I., Rogé, P., and Arnold, J. (2017). Urban agroecology: principles and potential. In F. Hoekstra and C. Tornaghi (Eds), Urban agroecology*, UA Magazine No. 33* (pp. 18-20). RUAF Foundation and CAWR. https://ruaf.org/document/urban-agriculture-magazine-no-33-urban-agroecology/

Altieri, M.A. and Holt-Giménez, E. (2016). *Can agroecology survive without being co-opted in the Global North?* [SOCLA paper]. SOCLA. Retrieved from https://www.researchgate.net/publication/309385013_Can_agroecology_survive_without_being_coopted_in_the_Global_North

Altieri, M. A, Pallud, C., Arnold, J., Glettner, C., and Matzen, S. (2014- 2016). *An agroecological survey of urban farms in the Eastern Bay Area to explore their potential to enhance food security* (Report to Berkeley Food Institute). University of California, Berkely. https://food.berkeley.edu/programs/research/seed-grants/agroecological-survey-urban-farms/

Altieri, M. A., and Toledo, V. M. (2011). The agroecological revolution in Latin America: rescuing nature, ensuring food sovereignty and empowering peasants, *Journal of Peasant Studies*, 38 (3), 587-612.

Amekawa, Y., Seguya, H., Onzere, S., and Carranza, I. (2010). Delineating the multifunctional role of agroecological practices: toward sustainable livelihoods for smallholder farmers in developing countries. *Journal of Sustainable Agriculture*, 34, 202- 228.

Amin, A. (2009). Locating the social economy. In A. Amid (Ed.), *The social economy: International perspectives on economic solidarity* (pp. 2-21). Zed Books.

Anderson, C. (2017). Policy from below: politicising urban agriculture for food sovereignty. In F. Hoekstra and C. Tornaghi (Eds), Urban agroecology*, UA Magazine No. 33* (pp. 72-74). RUAF Foundation and CAWR. https://ruaf.org/document/urban-agriculture-magazine-no-33-urban-agroecology/

Anderson, C.R., Bruil, J., Chappell, M.J., Kiss, C., Pimbert, M.P. (2019). From transition to domains of transformation: getting to sustainable and just food systems through agroecology. *Sustainability, 11 (9),* Article 5272.

Anderson, C. R., Bruil, J., Chappell, M. J., Kiss, C., Pimbert, M. P. (2021). *Agroecology Now! Transformations towards more just and sustainable food system*. Palgrave Macmillan. https://www.palgrave.com/gp/book/9783030613143

Anderson, C.R., Pimbert, M.P., Chappell, M.J., Brem-Wilson, J., Claeys, P., Kiss, C., Maughan, C., Milgroom, J., McAllister, G., Moeller, N., and Singh, J. (2020). Agroecology now - connecting the dots to enable agroecology transformations. *Agroecology and Sustainable Food Systems*, 44 (5), 561-565.

Amekawa, Y., Seguya, H., Onzere, S., and Carranza, I. (2010). Delineating the multifunctional role of agroecological practices: toward sustainable livelihoods for smallholder farmers in developing countries. *Journal of Sustainable Agriculture*, 34, 202-228.

Araghi, F. (2008). The invisible hand and visible foot: peasants, dispossession and globalization. In A. H. Akram-Lodhi and C. Kay (Eds), *Peasants and globalization: Political economy, rural transformation and the agrarian question* (pp. 111-147). Routledge, Taylor and Francis Group.

ARC [Agroecology Research-Action Collective] (2021). *About ARC*. https://agroecologyresearchaction.org/a-history-of-arc/

Arroyo, C. (2018, July 24). Sustainable agriculture to end world hunger. *Inter Press Service News Agency (IPS)*. http://www.ipsnews.net/2018/07/sustainable-agriculture-end-world-hunger/

Bacon, C., Méndez, V.E., and Brown, M. (2005). *Participatory action-research and support for community development and conservation: examples from shade coffee landscapes of El Salvador and Nicaragua* (CASFS Research Brief No. 6, Spring 2005). The Center for Agroecology and Sustainable Food Systems Research, University of California, Santa Cruz. https://escholarship.org/uc/item/1qv2r5d8

Banister, L., and Watts, R. (2018, May 19). History space: Community gardens born in Burlington. *Burlington Free Press*. https://eu.burlingtonfreepress.com/story/news/2018/05/19/history-space-community-gardens-born-burlington/35083281/

Barnes, M.L., Wang, P., Cinner, J.E., Graham, N.A.J., Guerrero, A.M., Jasny, L., Lau, J., Sutcliffe S. R., and Zamborain-Mason, J. (2020). Social determinants of adaptive and transformative responses to climate change. *Nature Climate Change,* 10, 823–828.

Barrios, E., Gemmill-Herren B., Bicksler, A. Siliprandi, E., Brathwaite, R., Moller, S., Batello, C., and Tittonell, P. (2020) The 10 elements of agroecology: enabling transitions towards sustainable agriculture and food systems through visual narratives. *Ecosystems and People*, 16(1), 230-247.

Bazeley, P. and Jackson, K. (2013). *Qualitative data analysis with* NVivo (2nd ed.). SAGE.

Bell, M. M., Bellon, S. (2018). Generalization without universalization: Towards an agroecology theory. *Agroecology and Sustainable Food Systems*, 42(6), 605-611.

Berman, E. A. (2011). *Creating a community food system: The Intervale Center* (University Libraries Faculty and Staff Publications, Paper 32). University of Vermont, ScholarWorks. http://scholarworks.uvm.edu/libfacpub/32

Bland, W. L., and Bell, M.M. (2007). A holon approach to agroecology. *International Journal of Agricultural Sustainability*, 5(4), 280-294.

Boettinger, J.L. (2005). Alluvium and alluvial soils. In D. Hillel, C. Rosenzweig, D. Powlson, K. Scow, M. Singer, and D. Sparks (Eds). *Encyclopedia of soils in the environment*, *Vol. 1* (pp. 45-49). Academic Press and Elsevier Ltd.

Boone, N. (1992, August 6). Nancy Bonner, Architecture Section Chief at the Division for Historic Preservation, Vermont's Agency of Development and Community Affairs, to Doug Hoffer, Burlington's Community and Economic Development Office, August 6, 1992 [Letter]. In B. Tonn (2017). *Historic resources of the Intervale Center*. Prepared for the Intervale Center.

Bowen Siegner, A., Acey, C., and Sowerwine, J. (2019). Producing urban agroecology in the East Bay: from soil health to community empowerment. *Agroecology and Sustainable Food Systems,* 44(5), 566-593.

Brinkley, C. (2012). Evaluating the benefits of peri-urban agriculture. *Journal of Planning Literature,* 27(3), 259-269.

Brooks, J., Cervantes-Godoy, D., and Jonasson, E. (2009, June 26-27). *Strategies for smallholders in developing countries: commercialisation, diversification and exit* [Conference paper/presentation]. 111th Seminar, European Association of Agricultural Economists (EAAE) and International Association for Applied Economics (IAAE), Canterbury, UK. https://ageconsearch.umn.edu/record/52867

Brooks, N. and Schramm, R. (2010, November). *Jobs and people IV: Towards a sustainable economy* (Report to the Community and Economic Development Office). Community and Economic Development Office, City of Burlington, Vermont. https://www.burlingtonvt.gov/search/google/Jobs%20%26%20People

Bunch, M., McCarthy, D., and Waltner-Toews (2008). A family of origin for an ecosystem approach to managing for sustainability. In D. Waltner-Toews, J.J. Kay and N.E. Lister (Eds), *The ecosystem approach: Complexity, uncertainty, and managing for sustainability* (pp. 109-124). Columbia University Press.

Burlington Farmers Market (2020). *Burlington Farmers Market*. https://burlingtonfarmersmarket.org/

Burlington Parks, Recreation & Waterfront (n.d.-a). *Tommy Thompson Community Garden*. Retrieved December 10, 2020, from https://enjoyburlington.com/place/tommy-thompson-garden/

Burlington Parks, Recreation & Waterfront (n.d.-b). *About our community gardens*. Retrieved December 10, 2020, from https://enjoyburlington.com/about-our-community-gardens/

Burlington Parks, Recreation & Waterfront (n.d.-c). *Become a BACG gardener*. Retrieved December 10, 2020, from https://enjoyburlington.com/become-a-bacg-gardener/

Burlington Parks, Recreation & Waterfront (n.d.-c) *Tommy Thompson Community Garden Guidelines & Site Rules.* Burlington Area Community Gardens [Brochure].

Burns, D. (2014). Systemic action research: Changing system dynamics to support sustainable change. *Action Research*, 12(1), 3–18.

Burns, D. (2012, May). Participatory Systemic Inquiry. In D. Burns (Ed.), *Action Research for development and social change* 43(3), 88-100. IDS Bulletin. https://bulletin.ids.ac.uk/index.php/idsbo/issue/view/31

Burns, D. (2007). *Systemic Action Research: A strategy for whole system change.* The Policy Press.

Burns, D., Harvey, B. and Ortiz Aragón, A. (2012, May). Introduction: Action Research for development and social change. In D. Burns (Ed.), *Action Research for development and social change*, 43(3), 1-17. IDS Bulletin. https://bulletin.ids.ac.uk/index.php/idsbo/issue/view/31

Cabell, J. and Oelofse, M. (2012). An indicator framework for assessing agroecosystem resilience. *Ecology and Society*, 17(1),18.

Cabrera, D., Colosi, L., and Loddell, C. (2008). Systems thinking. *Evaluation and Program Planning*, 31, 299-310.

Camps-Calvet, M., Langemeyer, J., Calvet-Mir, L., and Gómez-Baggethund, E. (2016). Ecosystem services provided by urban gardens in Barcelona, Spain: Insights for policy and planning. *Environmental Science and Policy* 62, 14-23.

Canfield, M., Anderson, M.D., and McMichael, P. (2021). UN Food System Summit 2021: Dismantling democracy and resetting corporate control of food system. *Frontiers in Sustainable Food Systems,* 13, Article 661552.

Casasbuenas, C. (2016). *La Costanza: Urban agroecology in a quickly urbanizing place. Let's make a national minga together!* [Case study report]. FAO, Agroecology Knowledge Hub. http://www.fao.org/agroecology/database/detail/en/c/443576/

Caswell, M., Méndez, V. E., Juncos-Gautier, M. A., Hurley, S. E., Gould, R. K., Márquez Sánchez, D., & Lewis, S. (2021). Agroecological transformations in urban contexts: transdisciplinary research frameworks and participatory approaches in Burlington, Vermont. In M. Egerer and H. Cohen (Eds), *Urban agroecology: interdisciplinary research and future directions* (pp. 299-319). CRC Press, Taylor and Francis Group.

Cederlöf, G. (2016). Low-carbon food supply: the ecological geography of Cuban urban agriculture and agroecological theory. *Agriculture and Human Values,* 33, 771–784

Center for Agriculture and Food System (n.d.). *Farmer story: Diggers' Mirth*. Vermont Law School, Farm Access Legal Toolkit. Retrieved December 20, 2020, from https://farmlandaccess.org/diggers-mirth/

Chappell, M. J., Bernhart, A., Bechmann, L., Gonçlaves, A. L., Seck, S., Nandul, P., and Cristo dos Santos, A. (2018). Agroecology as a pathway towards sustainable food systems. MISEREOR IHR Hilfswerk.https://www.misereor.org/fileadmin/user_upload_misereororg/publication/en/foodsecurity/synthesis-report-agroecology.pdf

Chappell, J., Araujo, S., and Méndez, E. (2019, September 2). Re/New alliances: Working towards farmer-scholar collaboration for food sovereignty in North America. *Agroecology Now!* Center for Agroecology and Water Resilience. https://www.agroecologynow.com/farmer-scholar-collaboration-for-food-sovereignty/

Checkland, P. (1985). From optimizing to learning: a development of systems thinking for the 1990s. *Journal of the Operational Research Society*, 36(9), 757-767.

Checkland, P. (1999). *System thinking, systems practice*. *Includes a 30-year retrospective.* John Wiley & Sons Ltd.

Checkland, P. and Poulter, J. (2010). Soft systems methodology. In M. Reynolds and S. Holwell (Eds), *Systems approaches to managing change: A practical guide* (pp. 191-242). The Open University and Springer-Verlag London Limited.

Checkland, P. and Poulter, J. (2006). *Learning for action: A short definitive account of soft systems methodology, and its use for practitioners, teachers and students*. John Wiley & Sons Inc.

Church, S., Dunn, M., and Prokopy, L. (2019). Benefits to qualitative data quality with multiple coders: two case studies in multi-coder data analysis. *Journal of Rural Social Sciences*, 34(1), Article 2.

CIDSE (n.d.). *Vision and values.* https://www.cidse.org/mission-and-values/

CIDSE (2018). *The principles of agroecology: Towards just, resilient and sustainable food aystems.* CIDSE. https://www.cidse.org/2018/04/03/the-principles-of-agroecology/.

City Market Onion River Coop (n.d.-a). *About the Co-op*. https://www.citymarket.coop/about

City Market Onion River Coop (n.d.-b). *Local food gaps at City Market*. Retrieved January 8, 2021, from https://www.citymarket.coop/local-products-gap

City of Burlington (n.d.). *CEDO Strategic Plan 2019*. Retrieved January 10, 2021, from https://www.burlingtonvt.gov/cedo/strategic-plan-2019

Clendenning, J., Dressler, W. H., and Richards, C. (2016). Food justice or food sovereignty? Understanding the rise of urban food movements in the USA. *Agriculture and Human Values*, 33, 165-177.

Cockburn, J., Cundill, G., Shackleton, S., Cele, A., Cornelius, S. F., Koopman, V., le Roux, J., McLeod, N., Rouget, M., Schroder, S., Van den Broeck, D., Wright, D. R., and Zwinkels, M. (2020a) Relational hubs for collaborative landscape stewardship. *Society & Natural Resources*, 33 (5), 681-693.

Cockburn, J., Schoon, M., Cundill, G., Robinson, C., Aburto, J. A., Alexander, S.M., Baggio, J.A., Barnaud, C., Chapman, M., Garcia Llorente, M., García-López, G. A., Hill, R., Speranza, C., I., Lee, J., Meek, C. L., Rosenberg, E., Schultz, L., and Thondhlana, G. (2020b). Understanding the context of multifaceted collaborations for social-ecological sustainability: a methodology for cross-case analysis. *Ecology and Society* 25(3), Article 7.

Cockburn, J., Cundill, G., Shackleton, S., Rouget, M., Zwinkels, M., Cornelius, S., Metcalfe, L., & van den Broeck, D. (2019). Collaborative stewardship in multifunctional landscapes: toward relational, pluralistic approaches. *Ecology and Society* 24(4), Article 32.

Comen, T. (2013). *Multifunctionality and the evolving American landscape: a case study of the Intervale landscape*. [Unpublished doctoral dissertation]. University of Vermont. https://www.uvm.edu/rsenr/rubenstein_school_doctoral_dissertations

Corbeels, M., Naudin, K., Whitbread, A.M., Kühne, R., and Letourmy, O. (2020). Limits of conservation agriculture to overcome low crop yields in sub-Saharan Africa. *Nature Food* 1, 447–454.

Cornell Lab of Ornithology. (n.d.). *Vermont, United States*, *sightings*. eBird. Retrieved January 13, 2021, https://ebird.org/region/US-VT

Cornwall, A. and Jewkes, R. (1995). What is participatory research? *Social Science Medicine*, 41(12), 1667-1676.

Creswell, J. W. (2014). *Research design: qualitative, quantitative, and mixed methods approaches* (4th ed.). SAGE Publications, Inc.

Curtis, S., Gesler, W., Smith G., and Washburn, S. (2000). Approaches to sampling and case selection in qualitative research: Examples in geography of health. *Social Sciences and Medicine,* 50, 1001-1014.

Daly, B. (n.d.). *Farming the floodplain: Farm incubation in Burlington's Intervale*. Retrieved December 10, 2020, from http://web.mit.edu/nature/projects_12/pdfs/BrianDaly-Intervale.pdf

D'Annolfo, R., Gemmill-Herren, B., Graeub, B.E., and Garibaldi, L. (2017). A review of social and economic performance of agroecology. *International Journal of Agricultural Sustainability, 15*, 632 - 644.

DeCuir-Gundy, J. T., Marshall, P.L., and McCulloch, A. W. (2011). Developing and using a codebook for the analysis of interview data: An example from a professional development research project. *Field Methods*, 23(2), 136-155.

Dehaene, M. Tornaghi, C., and Sage, C. (2016). Mending the metabolic rift: Placing the 'urban' in urban agriculture. In Lohrber, F., Licka, L., Scazzosi, L., and Timpe, A. (Eds). *Urban Agriculture Europe* (pp. 174-177). Jovies Pulbushers.

Deh-Tor, C.M. (2017). From agriculture in the city to an agroecological urbanism: The transformative pathway of urban [political] agroecology. In F. Hoekstra and C. Tornaghi (Eds),

Urban agroecology*, UA Magazine No. 33* (pp. 8-10). RUAF Foundation and CAWR. https://ruaf.org/document/urban-agriculture-magazine-no-33-urban-agroecology/

Deh-tor, C.M. (2021). Food as an urban question, and the foundations of a reproductive, agroecological urbanism. In C. Tornaghi and M. Dehaene (Eds), *Resourcing and agroecological urbanism: political, transformational and territorial dimensions* (pp. 12-33). Earthscan from Routledge

DeSantis L. and Noel Ugarriza D. (2000). The concept of themes as used in qualitative nursing research. *Western Journal of Nursing Research*, 22, 351-372.

Diekmann L.O., Gray L.C., and Baker, G.A. (2020). Growing 'good food': urban gardens, culturally acceptable produce and food security. *Renewable Agriculture and Food Systems* 35, 169–181.

Diggers' Mirth Collective Farm (n.d.). https://www.diggersmirth.com/

Dimuro, P. G., Soler Montiel, M., and de Manuel Jerez, E. (2013). La agricultura urbana en Sevilla: entre el derecho a la ciudad y la agroecología. *Hábitat y Sociedad* (6), 41-60.

Dixon, J., Taniguchi, K., Wattenbach, H., and Tanyeri-Arbur, A. (2004). *Smallholders, globalization and policy analysis* (AGSF Occasional Paper 5). FAO, Rome. http://www.fao.org/3/y5784e/y5784e00.htm

Doering, K. (2013, August 7). *Kristen Doering: My Internship at the Abenaki Heritage Garden.* Rubenstein School of Environment and Natural Resource, University of Vermont. https://www.uvm.edu/news/rsenr/kristen-doering-my-internship-abenaki-heritage-garden

Driscoll, L. (2017, August). *Urban farms: bringing innovations in agriculture and food security to the city* (Policy Brief, Berkley Food Institute*).* University of California, Berkley. https://food.berkeley.edu/wp-content/uploads/2015/06/BFI_UrbanAgPolicyBrief_WEB_Final.pdf

Dubbeling, M., Renting H., and Hoekstra, F. (Eds) (2015). City region food systems. *UA Magazine No. 29*. RUAF Foundation. https://ruaf.org/document/urban-agriculture-magazine-no-29-city-region-food-systems/

Dumont, A. M., Vanloqueren, G., Stassart, P.M., and Baret. P.V. (2016). Clarifying the socioeconomic dimensions of agroecology: Between principles and practices. *Agroecology and Sustainable Food Systems*, 40 (1), 24–47.

Dwight, A. (2003). *A clear vision of Burlington area community gardens: collecting gardeners' feedback.* [Unpublished B.S. degree thesis]. University of Vermont.

Egerer, M. and Cohen, H. (Eds). (2021a). *Urban agroecology: interdisciplinary research and future directions*. CRC Press, Taylor and Francis Group.

Egerer, M. and Cohen, H. (2021b). Introduction: the role of agroecology in cities. In M. Egerer and H. Cohen (Eds), *Urban agroecology: interdisciplinary research and future directions* (pp. 1-15). CRC Press, Taylor and Francis Group

Elliot, V. (2018). Thinking about coding process in qualitative data analysis. *The Qualitative Report*, 23 (11), 2850-2861.

Estrin, H., Poleman, W., Alonso-Rodríguez, A. M., González, E., Juncos-Gautier, M. A., Nytch, C. J., Thompson, E. (2021). A cross-cultural, participatory approach for measuring and cultivating residence on small and medium farms [White paper]. Agricultural Research Center for Food System Research, University of Vermont, ScholarWorks. https://scholarworks.uvm.edu/cgi/viewcontent.cgi?article=1005&context=arsfoodsystems

ETC Group (2017, October 16). *Who will feed us? The industrial food chain versus the peasant food web* (3rd ed.). https://www.etcgroup.org/content/who-will-feed-us-industrial-food-chain-vs-peasant-food-web

Ethen Allen Homestead Museum (2021). *About*. https://ethanallenhomestead.org/about/

Fals-Borda, O. (2006). Participatory (action) research in social theory: Origins and challenges. In P. Reason and H. Bradbury (Eds). *Handbook of Action Research*. SAGE.

FAO (2021). *Food for the Cities Initiative* reports. http://www.fao.org/fcit/fcit-home/en/

FAO (2015). Agroecology for food security and nutrition. *Proceedings of the FAO International Symposium, Biodiversity & Ecosystem Services in Agricultural Production Systems*, *18-19 September 2014*. FAO, Rome. http://www.fao.org/3/a-i4729e.pdf

FAO (2014). *Building a common vision for sustainable food and agriculture: principles and approaches.* FAO, Rome. http://www.fao.org/3/a-i3940e.pdf.

FAO (2017). *Defining small scale food producers to monitor target 2.3 of the 2030 Agenda for Sustainable Development* [Working Paper Series ESS / 17-12]. FAO Statistics Division, Rome. http://www.fao.org/3/i6858e/i6858e.pdf

FAO (2018). *The 10 elements of agroecology: Guiding the transition to sustainable food and agricultural systems.* FAO, Rome. http://www.fao.org/documents/card/en/c/I9037EN/

FAO (2019). *The ten elements of agroecology* (FAO CL 163/13 Rev.1., Council 163rd Session, December 2-6, 2019). FAO, Rome. http://www.fao.org/3/ca7173en/ca7173en.pdf

FAO (2013) *Smallholders and family farmers* [Fact sheet]. FAO. http://www.fao.org/family-farming/detail/en/c/273864/

FAO (2008). *An introduction to the basic concepts of food security* [Fact sheet]. EC-FAO Food Security Programme. https://www.fao.org/3/al936e/al936e.pdf

American Farmland Trust (2021). *Vermont data and statistics*. Farmland Information Center, American Farmland Trust. https://farmlandinfo.org/statistics/vermont-statistics/#Census%20of%20Agriculture

Ferguson, B. G., Aldasoro Maya, M., Giraldo, O., Mier, M. Giménez Cacho, T., Morales, H., and Rosset, P. (2019). Special issue editorial: What do we mean by agroecological scaling? *Agroecology and Sustainable Food Systems*, 43 (7-8), 722-723.

Fernández, M., Goodall, K., Olson, M., and Méndez, E. V. (2013). Agroecology and alternative agri-food movements in the United States: toward a sustainable agri-food system. *Agroecology and Sustainable Food Systems*, 37(1), 115-126.

Fernández, M., Méndez, V.E., Mares, T., and Schattman, R. (2016). Agroecology, food sovereignty, and urban agriculture in the United States. In V.E. Méndez, C.M. Beacon, R. Cohen, and S.P. Gliessman (Eds) *Agroecology: A transdisciplinary, participatory and action-oriented approach* (pp. 161-175). CRC Press.

Figueroa-Helland, L., Thomas, C., and Pérez Aguilera, A. (2018). Decolonizing food system: food sovereignty, Indigenous revitalization, and agroecology as counter-hegemonic movements. *Perspectives in Global Development and Technology*, 17(1-2), 173-201.

Flint, J. (2001). *Thirty years of community gardening in Burlington: A rich heritage and challenging future! Weed 'Em and Reap* [Brochure]. Burlington Area Community Garden.

Flood, R. L. (2010). The relationship of 'systems thinking' to action research. *Systems Practice and Action Research,* 23, 269-284.

Flood, R.L. (2006). The relationship of 'systems thinking' to action research. In P. Reason and H. Bradbury (Eds), *Handbook of Action Research* (pp. 117-128). SAGE.

Food First (n.d.). *Green Revolution*. [Issue premier brief]. Food First. Retrieved March 16, 2021, from https://foodfirst.org/issue-area/green-revolution/

Foster, J.B. (1999). Marx's theory of the metabolic rift: classical foundations for environmental sociology. *American Journal of Sociology*, 105(2), 366–405.

Forster, T. and Escudero, A.G. (2014). *City regions as landscapes for people, food and nature*. EcoAgriculture Partners, Washington, D.C., on behalf of the Landscapes for People, Food and Nature Initiative. https://ecoagriculture.org/publication/city-regions-as-landscapes-for-people-food-and-nature/

Forster, T., Hussein, K. and Mattheisen, E. (2015). City region food systems: An inclusive and integrated approach to improving food systems and urban-rural linkages. In M. Dubbeling, H. Renting, and F. Hockstra (Eds), City region food systems. *UA Magazine*, *No. 29* (pp. 8-11). RUAF Foundation. https://ruaf.org/document/urban-agriculture-magazine-no-29-city-region-food-systems/

Francis C., Lieblein, G., Gliessman, S., Breland, T.A., Creamer, N., Harwood, R., Salomonsson, L., Helenius, J., Rickerl, D., Salvador, R., Wiedenhoeft, M., Simmons, S., Allen, P., Altieri, M., Flora, C., and Poincelot, R. (2003) Agroecology: the ecology of food systems. *Journal of Sustainable Agriculture*, 22 (3), 99-118.

Francis, C. A., Lieblein, G., Breland, T.A., Salomonsson, L., Geber, U., Sriskandarajah, N., and Langer, V. (2008). Transdisciplinary research for a sustainable agriculture and food sector. *Agronomy Journal,* 100 (3), 771-776.

Fredrickson, E. (2018, February 15). Can lesson from Vermont keep local agriculture alive in Montana? *UVM Food Feed: Sustainable Food System & The University of Vermont*. https://learn.uvm.edu/foodsystemsblog/2018/02/15/vermont-land-access/

Freire, P. (2001). *Pedagogy of freedom: ethics, democracy, and civic courage.* Rowman & Littlefield Publishers, Inc. PDF version: http://abahlali.org/wp-content/uploads/2012/08/Paulo-Freire-Pedagogy-of-Freedom-Ethics-Democracy-and-Civic-Courage-2000.pdf

Freire, P. (2005 [1970]). *Pedagogy of the Oppress.* 30th Anniversary Edition. New York and London: The Continuum International Publishing Group Inc.

Gladkikh, T. (2021) Why do people care? Insights from cultural ecosystem services and relational values to understand stewardship [Unpublished doctoral dissertation]. University of Vermont.

Giraldo, O.F. and McCune, N. (2019) Can the state take agroecology to scale? Public policy experiences in agroecological territorialization from Latin America. *Agroecology and Sustainable Food Systems*, 43 (7-8), 785-809.

Giraldo, O.F. and Rosset, P.M. (2018) Agroecology as a territory in dispute: between institutionality and social movements. *The Journal of Peasant Studies*, 45(3), 545-564.

Gliessman, S. R. (1998). *Agroecology: Ecological processes in sustainable agriculture*. Ann Arbor Press.

Gliessman, S. (2004). Agroecology and agroecosystems. In D. Rickerl and C. Francis, *Agroecosystem Analysis*, *Volume 43* (pp.19-30). American Society of Agronomy, Inc., Crop

Science Society of America, Soil Science Society of America, Inc. https://acsess.onlinelibrary.wiley.com/doi/book/10.2134/agronmonogr43

Gliessman, S. R. (2015a). Introduction. Agroecology: a global movement for food security and sovereignty. In FAO, Agroecology for food security and nutrition. *Proceedings of the FAO International Symposium, Biodiversity & Ecosystem Services in Agricultural Production Systems*, *18-19 September 2014* (pp. 1-13). FAO, Rome. http://www.fao.org/3/a-i4729e.pdf

Gliessman, S. (2015b). *Agroecology: the ecology of sustainable food systems* (3rd ed.). CRC Press, Taylor and Francis Group.

Gliessman, S. (2016) Transforming food systems with agroecology. *Agroecology and Sustainable Food Systems*, 40(3), 187-189.

Gliessman, S. R. (2018a). Defining agroecology. *Agroecology and Sustainable Food Systems*, 42(6), 599-600.

Gliessman, S. R. (2018b). Scaling-out and scaling-up agroecology. *Agroecology and Sustainable Food Systems*, 42 (8), 841-842.

Greene, J. C. (2015). Preserving distinctions within the multimethod and mixed methods research merger. In S. N. Hesse-Biber and R. B. Johnson, *The Oxford Handbook of Multimethod and Mixed Methods Research Inquiry* (pp. 606-615). Oxford University Press. https://www.oxfordhandbooks.com/view/10.1093/oxfordhb/9780199933624.001.0001/oxfordhb-9780199933624

Green Mountain Compost (2021a) *Our roots*. Green Mountain Compost, Chittenden Solid Waste District (CSWD). https://www.greenmountaincompost.com/about/our-roots/

Green Mountain Compost (2021b). *Our facility in Williston*. Green Mountain Compost, Chittenden Solid Waste District (CSWD). https://www.greenmountaincompost.com/about/our-new-facility-in-williston/

Gregory, M.M., Leslie, T.W., and Drinkwater, L.E. (2016). Agroecological and social characteristics of New York city community gardens: Contributions to urban food security, ecosystem services, and environmental education. *Urban Ecosystems*, 19, 763-794.

Gustavsen, B. (2003). Action research and the problem of the single case. *Concepts and Transformations*, 8(1), 93-99.

Guta, M. (2019, May 3). *Small farms on the rise in the U.S., but it's not all good news*. Small Business Trends. https://smallbiztrends.com/2019/05/2017-census-of-agriculture.html

Sisson, P. (2016, October 25). Regeneration: How people use existing neighborhoods for new purposes. In Dailey, J., Keith, K., Kraus, M., Polsky, S., Syrkett, A. (Eds), *10 Streets that Define America. CURBED, Vox Media Inc.* https://archive.curbed.com/a/10-streets-that-define-america?05401

Haviland, W. A. and Power, M. W. (1994). *The original Vermonters: Native inhabitants, past and present.* University Press of New England.

Hecht, S. B. (1995). The evolution of agroecological thought. In M. A. Altieri, *Agroecology: The Science of Sustainable Agriculture* (2nd ed., pp. 1-19). Westview Press Inc.

Held, L. (2021, April 20). *Is agroecology being co-opted by big ag?* Civil Eats. https://civileats.com/2021/04/20/is-agroecology-being-co-opted-by-big-ag/

Herr, K. and Anderson, G. L. (2005). *The Action Research dissertation: A guide for students and faculty.* SAGE.

Herrmann D.L., Chuang, W., Schwarz, K., Bowles, T. M., Garmestani A. S., Shuster, W. D., Eason, T., Hopton, M. E., and Allen, C. R. (2018). Agroecology for the shrinking city. *Sustainability*, 10 (675), 1-14.

High Mowing Organic Seeds (2021). About us. https://www.highmowingseeds.com/history-and-philosophy

HLPE [High Level Panel of Experts] (2019). *Agroecological and other innovative approaches for sustainable agriculture and food systems that enhance food security and nutrition*. (HLPE Report 14). High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security, Rome. https://www.fao.org/agroecology/database/detail/en/c/1242141/

Hoekstra, F. and Tornaghi C. (Eds). (2017). Urban agroecology. *UA Magazine, No. 33.* RUAF Foundation and CAWR. https://ruaf.org/document/urban-agriculture-magazine-no-33-urban-agroecology/

Hodgson, K., Fodor, Z., and Khojasteh, M. (2015). City of Burlington and Chittenden County, Vermont: Multi-level governmental support paves the way for local food in Chittenden County, Vermont. In K. Hodgson and S. Raja (Series Eds), Exploring stories of innovation. Growing Food Connections Project, University at Buffalo, School of Architecture and Planning. http://growingfoodconnections.org/research/communities-of-innovation/

Holling, C. S. (2001). Understanding the complexity of economic, ecological and social systems. *Ecosystem* 4, 390-405.

Holt-Giménez, E. and Altieri, M. A. (2013). Agroecology, food sovereignty, and the new Green Revolution. *Agroecology and Sustainable Food Systems*, 37(1), 90-102.

Housekeeper, E. (2017, February 14). UVM graduate student examines the economic impact of food hubs. *UVM Food Feed: Sustainable Food Systems & The University of Vermont.* https://learn.uvm.edu/foodsystemsblog/2017/02/14/vermont-food-hubs-research/

Hunger Free Vermont (n.d.). *Strategies and inspirations.* Retrieved April 28, 2021, from https://www.hungerfreevt.org/strategies-inspiration

Hunter, A. and Brewer, J. (2015). Designing multimethod research. In S. N. Hesse-Biber and R. B. Johnson, *The Oxford Handbook of Multimethod and Mixed Methods Research Inquiry* (pp. 185-205). Oxford University Press.

Hyett, N., Kenny, A., and Dickson-Swift, V. (2014). Methodology or method? A critical review of qualitative case reports. *International Journal of Qualitative Studies on Health and Well-being*, 9(1).

IFAD [International Fund for Agricultural Development] (2013). *Smallholders, food security, and the environment* (Report by IFAD and United Nations Environmental Programme). https://www.fao.org/family-farming/detail/en/c/285693/

IFC [International Finance Corporation] (2019). *Working with smallholders: A handbook for firms building sustainable supply chains.* World Bank Group. https://openknowledge.worldbank.org/handle/10986/29764

International Co-operative Alliance (2018). *What is a cooperative? https://www.ica.coop/en/cooperatives/what-is-a-cooperative*

International Forum for Agroecology, Nyéléni (2015). Declaration of the International Forum for Agroecology, Nyéléni, Mali: 27 February 2015. *Development*, 58(2-3), 163-168.

Intervale Center. (n.d.-a). *About us*. Retrieved December 20, 2020, from https://www.intervale.org/about-us
Intervale Center. (n.d.-b). *Gleaning and food rescue*. Retrieved December 20, 2020, from https://www.intervale.org/intervale-gleaning-food-rescue
Intervale Center (n.d.-c). *About Intervale Conservation Nursery*. Retrieved December 20, 2020, from https://www.intervale.org/programs#land-stew-banner
Intervale Center. (n.d.-d). *About stewarding the Intervale*. Retrieved December 20, 2020, from https://www.intervale.org/programs#land-stew-banner
Intervale Center (n.d.-e). *Farm Business Planning*. Retrieved December 20, 2020, from https://www.intervale.org/programs#farm-biz-banner
Intervale Center (n.d.-f). *Intervale Community Farm*. Retrieved December 20, 2020, from https://www.intervale.org/intervale-community-farm
Intervale Center (n.d.-g). *About Intervale Food Hub*. Retrieved December 20, 2020, from https://www.intervale.org/programs#fh-banner
Intervale Center (n.d.-h). *Diggers' Mirth Collective Farm*. Retrieved December 20, 2020, from https://www.intervale.org/diggers-mirth-collective-farm
Intervale Center (n.d., i). *Pitchfork Farm, LLC*. Retrieved December 20, 2020, from https://www.intervale.org/pitchfork-farm
Intervale Center (n.d.- j). *Intervale farms*. Retrieved December 20, 2020, from https://www.intervale.org/about-us#intervale-farms
Intervale Center (n.d.-k). *Frequently asked questions*. Retrieved January 17, 2021, from: https://www.greenmountaincompost.com/about/our-new-facility-in-williston/
Intervale Center (n.d.-l). *Farm incubator*. Retrieved January 18, 2021, from https://www.intervale.org/farms-incubation
Intervale Center (n.d.-m). Celebrate Intervale! Investing in the beauty, productivity, and accessibility of the beloved Intervale Center [Brochure]. Intervale Center.
Intervale Center (n.d.-n). *Healthy land and water: Because a livable planet starts here* [Leaflet]. Intervale Center. Retrieved on January 21, 2021, from https://www.intervale.org/about-us
Intervale Center (n.d.-o). *The historic Calkins Farmstead: home of the Intervale Center* [Brochure]. Intervale Center.
Intervale Center (n.d.-p). *Nourishing people: Because the harvest should be shared* [Leaflet]. Retrieved on January 21, 2021, from https://www.intervale.org/about-us
Intervale Center (n.d.-q). *Intervale Farmer Equipment Company: Fact sheet* [Leaflet]. Intervale Center. Retrieved December 28, 2020, from https://nesfp.org/resources/intervale-farmer-equipment-company-fact-sheet
Intervale Center. (n.d.-r). *Viable farms: Because farmers feed us all*. [Leaflet]. Retrieved on January 21, 2021, from https://www.intervale.org/about-us
Intervale Center (2017a, March). *The Farms Program Manual: Your guide to farming at the Intervale.* Intervale Center.
Intervale Center (2017b, March). Land Use Protocols. In Intervale Center*, The Farms Program Manual: Your Guide to Farming at the Intervale* (pp.26-28). Intervale Center, Burlington, VT.
Intervale Center (2017c, March). Intervale Farmer Equipment Company, LLC. policies and procedures. Updated April 2013. In Intervale Center*, The Farms Program Manual: Your Guide to Farming at the Intervale* (pp.34-47). Intervale Center.

Intervale Center (2018 a, March 1). Celebrating Intervale history: Our historic farmstead. *Intervale Center Blog*. https://www.intervale.org/blog-source/8rd413iybk3c5mtue64ndxy9q5qcyu

Intervale Center (2018b, October 18). Celebrating Intervale history: Barns at the Intervale. *Intervale Center Blog*. https://www.intervale.org/blog-source/celebrating-intervale-history-barns-of-the-intervale

Intervale Center (2009). *Intervale Center Land Management Plan*. Intervale Center.

Intervale Center (2019). *Your community food system in action* (2019 Impact Report). Intervale Center.

Intervale Centre (2020). *The power of yes*. (2020 Impact Report). Intervale Center. https://www.intervale.org/about-us

ICF [Intervale Community Farm]. (2019a). *About: Growing food is our passion*. https://www.intervalecommunityfarm.com/mission

ICF. (2019b). *Who we are*. https://www.intervalecommunityfarm.com/who-we-are

ICF. (2019c). *Cooking your share*. https://www.intervalecommunityfarm.com/cooking-your-share

ICF. (2019d). *Storing your share*. https://www.intervalecommunityfarm.com/storing-your-share

ICN [Intervale Conservation Nursery] (n.d.). *Field guide: Growing native plants since 2002* [Brochure]. Intervale Center.

Intervale Food Hub (2021a). *About us*. https://www.intervalefoodhub.com/about-us

Intervale Food Hub (2021b). *The Beet*. https://www.intervalefoodhub.com/recipes

IPES-Food (2016). *From uniformity to diversity: a paradigm shift from industrial agriculture to diversified agroecological systems*. International Panel of Experts on Sustainable Food systems. http://www.ipes-food.org/reports/

Isgren, E., and Tibasiima, T. K. (2019, July 15). In defense of agroecology: response to Nassib Mugwanya's "After agroecology". *The Breakthrough Institute Journal, No. 11, Summer 2019.* https://thebreakthrough.org/journal/no-11-summer-2019/in-defense-of-agroecology

Ison, R. (2008). System thinking and practice for action research. In P. Reason and H. Bradbury (Eds), *The Sage handbook of Action Research*: *Participative inquiry and practice* (pp. 139-168). SAGE.

Ives, M. (2007, October 3). *Waste not? Burlington's compost facility tries to digest environmental and aboriginal charges*. Seven Days. https://www.sevendaysvt.com/vermont/waste-not/Content?oid=2132238

Jackson, P. (1993). *Organic food production in Burlington's Intervale: past, present and potential organic agriculture at Burlington's first and last farm*. The Intervale Foundation. Billings Special Collection, University of Vermont.

Jackson, M. C. (1985). Social systems theory and practice: the need for critical approach. *International Journal of General Systems*, 10(2-3), 135-151.

Juncos-Gautier, M. A. (2017, September 9). *About urban and peri-urban agriculture (UPA): A working document for the Agroecology and Livelihoods Collaborative*. [Unpublished manuscript, report to the Agroecology and Livelihoods Collaborative, University of Vermont].

Kapgen, D. & Roudart, L. (2020). Proposal of a principle cum scale analytical framework for analyzing agroecological development projects. *Agroecology and Sustainable Food Systems,* 44 (7), 876-901.

Kay, J.J. and Boyle, M. (2008). Self-organizing, holarchic, open systems (SOHOs). In D. Waltner-Toews, J.J. Kay, and N.E. Lister (Eds), *The Ecosystem approach: Complexity, uncertainty, and managing for sustainability* (pp. 51-78). Columbia University Press.

Keeter, B. (2020, July 31). *Floodplains and wetlands*. Natural Resources Management, NASA. https://www.nasa.gov/emd/nrm-floodplains-and-wetlands

Kim, H., Sefcik, J. S., and Bradway, C. (2017). Characteristics of qualitative descriptive studies: A systematic review. *Research in Nursing Health*, 40(1), 23–24.

Kindon, S., Pain, R., and Kesby, M. (Eds). (2007a). *Participatory action research approaches and methods: Connecting people, participation and place.* Routledge.

Kindon, S., Pain, R. and Kesby, M. (2007b). Introduction: Connecting people, participation and place. In S. Kindon, R. Pain, and M. Kesby, M. (Eds). *Participatory action research approaches and methods* (pp. 1-5). Routledge.

Kindon, S., Pain, R. and Kesby, M. (2007c). Participatory action research: Origins, approaches and methods. In S. Kindon, R. Pain, and M. Kesby, M. (Eds). *Participatory action research approaches and methods: Connecting people, participation and place* (pp. 9-18). Routledge.

Knigge, L., Brimlow, J.N., Metcalf, S.S. (2016) Food hubs: connecting farms with local and regional markets. In J. Gatrell, R. Jensen, M. Patterson, and N. Hoalst-Pullen (Eds), *Urban sustainability: Policy and praxis* (pp 169-184). Geotechnologies and the Environment, 14. Springer, Cham.

Koestler, A. (1967). *The Ghost in the Machine*. Pinguin Group.

Lambert, V.A. and Lambert, C.E. (2012). Qualitative descriptive research: an acceptable design. *Pacific Rim International Journal of Nursing Research*, 16(4), 255-256.

Larum, D. (2021). *What is fallow ground: are there are any benefits of fallowing soil*. Gardening Know How. https://www.gardeningknowhow.com/garden-how-to/soil-fertilizers/what-is-fallow-ground.htm

Lawrence, G. (1995). *Burlington's Intervale: a natural history guide. A guide for everyone, especially teachers, parents and students.* The Intervale Foundation. Billings Special Collection, University of Vermont.

Leitgeb, F., Schneider, S., and Vogl, C.R. (2016). Increasing food sovereignty with urban agriculture in Cuba. *Agriculture and Human Values*, 33, 415-426.

Lerner, A. M. (2021). La agricultura como un componente crítico para la resiliencia urbana. In M. Benítez, T. Rivera-Núñez, and L. García-Barrios, *Agroecología y sistemas complejos: planteamientos epistémicos, casos de estudio y enfoques metodológicos* (pp. 75-84). SOCLA-Mexico, CopIt-arXives.

Levitt A. (2011, November 25). *Mark Bittman and Bernie Sanders visit Burlington Intervale*. Seven Days. https://www.sevendaysvt.com/vermont/mark-bittman-and-bernie-sanders-visitburlington-intervale/Content?oid=2178529

Lin, B. B., Philpott, S. M., and Jha, S. (2015). The future of urban agriculture and biodiversity-ecosystem services: challenges and next steps. *Basic and Applied Ecology*, 16(3), 189-201.

Lin, B.B., Philpott, S. M., Jha, S., and Liere, H. (2017). Urban agriculture as a productive green infrastructure for environmental and social well-being. In P.Y. Tan and C.Y. Jim (Eds), *Greening cities: Forms and functions* (1st ed., pp. 155-179). Springer.

Lindlof, T. R. and Taylor, B. (2011). *Qualitative communication research methods* (3rd ed.). Thousand Oaks, SAGE.

Livability- Journal Communications, Inc. (2010-2021). *10 Best foodie cities. Livability - 2014*. Livability- Journal Communication, Inc. https://livability.com/best-places/10-best-foodie-cities-2014/burlington/

Llewellyn, D. (2020). Effects of long-term fiddlehead harvest on ostrich fern, Matteuccia struthiopteris. *Journal of the National Association of County Agricultural Agents, 3*(1), 1–3. https://www.nacaa.com/journal/index.php?jid=772

Location Inc. (2020-2021). *Burlington, VT*: *Real state & demographic data*. Neighborhood Scout, Location, Inc. https://www.neighborhoodscout.com/vt/burlington

Loker, A. (2020, October 7*). The evolution of agroecology as a practice, discipline and social movement* [Quarterly Lecture Series]. Center for Agroecology and Sustainable Food Systems, University of California, Santa Cruz. https://agroecology.ucsc.edu/news-events/events/quarterly-lecture-series.html

Lovell, S. T. (2010a). Multifunctional urban agriculture for sustainable land use planning in the United States. *Sustainability*, 2, 2499-2522.

Lovell, S.T., DeSantis, S., Nathan, C.A., Olson, M.B., Méndez, V.E., Kominami, H.C., Erickson, D.L., Morris, K.S., and Morris, W.B. (2010b). Integrating agroecology and landscape multifunctionality in Vermont: An evolving framework to evaluate the design of agroecosystems. *Agroforestry Systems*, 103, 327–341.

Lovell, S.T., Mendez, V.E., Erickson, D.L., Nathan, C., and DeSantis, S. (2010c). Extend, pattern, and multifunctionality of agroforestry systems in Vermont, USA. *Agroforestry Systems*, 80, 153-171.

Lowder, S.K., Skoet, J., and Raney, T. (2016). The number, size, and distribution of farms, smallholder farms, and family farms worldwide. *World Development*, 87, 16-29.

Lynas, M. (2020, July 30). *Scientific meta-analysis: Agroecology risks harming the poor and worsening gender inequality in Africa*. Alliance for Science. https://allianceforscience.cornell.edu/blog/2020/07/scientific-meta-analysis-agro-ecology-risks-harming-the-poor-and-worsening-gender-inequality-in-africa/

MacDonald, J. (2021, March 11). Small farms, big difference. *Research and Science*. USDA. https://www.usda.gov/media/blog/2010/05/18/small-farms-big-differences

MacPherson, B. (2020). *Birding at Burlington's Intervale and the Ethan Allen Homestead*. Green Mountain Audubon Society. https://www.greenmountainaudubon.org/burlington

Macias, T (2008). Working toward a just, equitable, and local food system: The social impact of community-based agriculture. *Social Science Quarterly*, 89(5), 1086-1101

Maden, B. (n.d.). *Intervale's Farmer Equipment Company*. City Market Onion River Coop. Retrieve December 20, 2020, from https://www.citymarket.coop/news/co-op-news/2012/4/2/intervale-farmers-equipment-company

Manore, J. L. (2011). The historical erasure of an Indigenous identity in the borderlands: the Western Abenaki of Vermont, New Hampshire, and Quebec. *Journal of Borderlands Studies*, 26(2), 179–196.

Marsden, J. E., and Langdon, R. W. (2012). The history and future of Lake Champlain's fishes and fisheries. *Journal of Great Lakes Research, 38*, 19-34.

Martínez-Torres, M. A. and Rosset, P. (2014). Diálogo de saberes in La Vía Campesina: Agroecology and food sovereignty. *The Journal of Peasant Studies* 41 (6), 979–997.

Marx, K. (1999 [1867]). *Capital*. *A Critique of Political Economy*, *Volume I.* Online version retrieved from Marx/Engels Internet Archive (marxists.org). https://www.marxists.org/archive/marx/works/1867-c1/

Maxwell, J.A., Chmiel, M. and Rogers, S. E. (2015). Designing integration in multimethod and mixed methods research. In S. N. Hesse-Biber and R. B. Johnson, *The Oxford Handbook of Multimethod and Mixed Methods Research Inquiry* (pp. 223-239). Oxford University Press. https://www.oxfordhandbooks.com/view/10.1093/oxfordhb/9780199933624.001.0001/oxfordhb-9780199933624

McClintock, N. (2010). Why farm the city? Theorizing urban agriculture through a lens of metabolic rift. *Cambridge Journal of Regions*, *Economy and Society*, 3 (2), 191–207.

McCune, N. and Sánchez, M. (2019). Teaching the territory: agroecological pedagogy and popular movements. *Agriculture and Human Value*, 36, 595-610.

McGreevy, S.R., Tamura, N., Kobayashi, M., Zollet, S., Hitaka, K., Nicholls, C.I., and Altieri, M.A. (2021). Amplifying agroecological farmer lighthouses in contested territories: navigating historical conditions and forming new clusters in Japan. *Frontiers in Sustainable Food Systems*, 5, Article 699694.

McKeon, L., Schneider, T., and Small, R. (1993). *Burlington Intervale site and gateway study: exploratory schematic plans and designs*. Conway School of Landscape Design, Conway, Massachusetts. Billings Silver Special Collections, University of Vermont.

Meadows, D. H. (2008). *Thinking in systems: A primer*. Sustainability Institute. Chelsea Green Publishing.

Meadows, D. (1997, July 24). *From dump to garden: Burlington's Intervale*. Donella Meadows Archives, The Donella Meadows Project, Academy for Systems Change. https://donellameadows.org/archives/from-dump-to-garden-burlingtons-intervale/

Méndez, V.E. (2010). Agroecology. In B. Warf (Ed.), *Encyclopedia of Geography* (pp. 55-59). SAGE.

Méndez, V.E., Bacon, C.M., and Cohen, R. (2016). Introduction: Agroecology as a transdisciplinary, participatory, and action-oriented approach. In V. E, Méndez, C. M. Bacon, R. Cohen, and S. R. Gliessman (Eds), *Agroecology: A transdisciplinary, participatory and action-oriented approach* (pp. 1-21). CRC Press, Taylor and Francis Group.

Méndez, V. E., Bacon, C.M., and Cohen, R. (2013). Agroecology as a transdisciplinary, participatory, and action-oriented approach. *Agroecology and Sustainable Food Systems*, 37(1), 3-18.

Méndez V.E., Caswell M., Gliessman S.R., and Cohen R. (2017) Integrating agroecology and Participatory Action Research (PAR): lessons from Central America. *Sustainability* 9(5), Article 705.

Merçon, J., Ayala-Orozco, B., and Rosell, J. (2018). Construyendo lo común. In J. Merçon, B., Ayala-Orozco, and J. Rosell, J., *Experiencias de colaboración transdisciplinaria para la sustentabilidad* (pp. 21-26). Colección Conocer y Actuar en Complejidad. Comunidad Editora

Latinoamericana. http://comunidadeditora.org/experiencias-de-colaboracion-transdisciplinaria-para-la-sustentabilidad/
Merçon, J., Escalona Aguilar, M. A., Noriega Armella, M. I., Figueroa Núñez, I., Aketzali Atenco Sánchez, A., and González Méndez, E. D. (2012). Cultivando la educación agroecológica: El huerto colectivo urbano como espacio educativo. *Revista Mexicana de Investigación Educativa*, 17 (55), 1201-1224.
Mier, M., Giménez Cacho, T., Felipe Giraldo, O., Aldasoro, M., Morales, H., Ferguson, B. G., Rosset, P., Khadse, A., and Campos, C. (2018). Bringing agroecology to scale: key drivers and emblematic cases. *Agroecology and Sustainable Food Systems*, 42(6), 637-665.
Milan Urban Food Policy Pact (2015, October 15). MUFPP Secretariat, Milan, Italy. https://www.milanurbanfoodpolicypact.org/the-milan-pact/
Montero de Wit, A. (2014). A lighthouse for urban agriculture: University, community, and redefining expertise in the food system. *Gastronomica,* 14 (1), 9-22.
Montenegro de Wit, M., Anderson, M., Gemmill-Herren B., Duncan, J., McKeon, N., Canfield, M. Iles A., and van der Ploeg, J. D. (2021, July 16). UN Food System Summit plants corporate solutions and plows under people's knowledge. *Agroecology Research-Action Collective*. https://agroecologyresearchaction.org/peoplesknowledge/
Moore, H. (2016, October 9). *Can agroecology feed the world and save the planet?* The Guardian. https://www.theguardian.com/global-development-professionals-network/2016/oct/09/agroecological-farming-feed-world-africa.
Moser, M., Hyman, J., and Schmidt, F. (2008, August 11). *Looking ahead: Vermonter's values and concerns. Summary Report* (Report to the Center for Rural Studies). Center for Rural Studies, College of Agriculture and Life Sciences, University of Vermont. https://www.uvm.edu/crs/project-reports
Mougeot, L.J.A. (2000). Urban agriculture: definition, present potentials and risks. In N. Bakker, M. Dubbeling, S. Gundel, U. Sabel-Koschella & H. de Zeeuw (Eds), *Growing cities, growing food: urban agriculture on the policy agenda* (pp. 1-42). Foundation for International Development (DSE).
Mougeot, L.J.A. (2005). *Agropolis: The social, political and environmental dimensions of urban agriculture*. Earthscan.
Mougeot, L.J.A. (2006). *Growing better cities: Urban agriculture for sustainable development.* International Development Research Center.
Mugwanya, N. (2019, February 4). After agroecology: why traditional agricultural practices can't transform African agriculture. *The Breakthrough Institute Journal, No. 10, Winter 21.* https://thebreakthrough.org/journal/no-10-winter-2019/after-agroecology
Murphy, S. (2012). *Changing perspectives: Small-scale farmers, markets and globalization* (revised ed.). International Institute for Environment and Development/Hivos, London/The Hague. https://pubs.iied.org/sites/default/files/pdfs/migrate/16517IIED.pdf
Niche.com, Inc. (2021). *2021 Most diverse places to live in Vermont*. https://www.niche.com/places-to-live/search/most-diverse-places/s/vermont/
Nicholls, C. I., Altieri, M. A. (2018). Pathways for the amplification of agroecology. *Agroecology and Sustainable Food Systems*, 42 (10), 1170-1193.

Nicholls, C.I. and Altieri, M.A. (2019). Agroecología urbana: Diseño de granjas urbanas biodiversas, productivas y resilientes. *Boletín Científico 2.* CELIA Ediciones. http://celia.agroeco.org/boletin-cientifico/

Nicholls, C. I., Altieri M.A., Kobayashi, M., Tamura, N., McGreevy, S., and Hitaka, K. (2020). Assessing the agroecological status of a farm: a principle-based assessment tool for farmers. *Agro Sur*, 48(2), 29-41.

Nicholls, C.A., Altieri, M.A, and Vazquez, L. (2016). Agroecology: principles for the conversion and redesign of farming. *Journal of Ecosystem and Echography,* S5, Article 010.

Nicklay J.A., Cadieux K.V., Rogers M.A., Jelinski N.A., LaBine K., and Small G.E. (2020). Facilitating spaces of urban agroecology: a learning framework for community-university partnerships. *Frontier for Sustainable Food Systems*, 4, Article 143.

NIFA. [National Institute of Food and Agriculture] (n.d.). *Small and family farms*. NIFA, USDA. https://nifa.usda.gov/topic/small-and-family-farms

NOFA [Northeast Organic Farming Association of Vermont]. (n.d.-a). *Pitchfork Farm*. NOFA. Retrieved December 20, 2020, from https://nofavt.org/csa/pitchfork-farm

NOFA. (n.d.-b). *History.* NOFA. Retrieved March 22, 2021, from https://nofavt.org/about/history

Nonprofit Metrics LLC (2021). *Intervale Center*. Cause IQ, Nonprofit Metrics LLC. https://www.causeiq.com/organizations/intervale-center,030329656/

NRDC [Natural Resources Conservation Service]. (2001, May 22). *Land capability classes by state, 1997*. NRDC, USDA. https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/technical/nra/?cid=nrcs143_014040

Nyéléni Newsletter (2019, April). Agroecology: real innovation from and for people. *Nyéléni Newsletter,* 36. https://nyeleni.org/spip.php?article705#nb1

O'Brien, E. A. (2006). A question of value: what do trees and forests mean to people in Vermont? *Landscape Research, 31*(3), 257–275.

OECD [Organisation for Economic Co-operation and Development] (2001). *Multifunctionality: Towards an analytical framework.* OECD Publication Service, OECD Library. https://read.oecd-ilibrary.org/agriculture-and-food/multifunctionality_9789264192171-en#page1

Oliveira de Almeida, D. A. and Biazoti, A. R. (2017). Urban agroecology: For the city, in the city and from the city. In F. Hoekstra and C. Tornaghi (Eds), Urban agroecology*, UA Magazine No. 33* (pp. 13-14). RUAF Foundation and CAWR. https://ruaf.org/document/urban-agriculture-magazine-no-33-urban-agroecology/

Onwuegbuzie, A. J., and Collins, K. M. (2007). A typology of mixed methods sampling designs in social science research. *The Qualitative Report*, 12(2), 281-316.

Onwuegbuzie, A. J., and Leech, N. L. (2007a). Sampling designs in qualitative research: making the sampling process more public. *The Qualitative Report,*12(2), 238-254

Onwuegbuzie, A. J., and Leech, N. L. (2007b). A call for qualitative power analyses. *Quality & Quantity* 41, 105–121

Opitz, I., Berges, R., Piorr, A., and Krikser, T. (2016). Contributing to food security in urban areas: differences between urban agriculture and peri-urban agriculture in the Global North. *Agriculture and Human Values*, 33, 341-358.

Ostergaard, E., Lieblein, G., Breland, T. A., and Francis, C. (2010). Students learning agroecology: phenomenon-based education for responsible action. *Journal of Agricultural Education and Extension*. 16(1), 23-37.

Ostrom, E. (1996). Crossing the great divide: Coproduction, synergy, and development. *World Development*, 24(6), 1073–1087.

Patton, M.Q. (2018). *Principles-focused evaluation: The guide.* The Guilford Press.

Patton, M. Q. (2015a). The sociological roots of utilization focused evaluation. *The American Sociologist*, 46, 457-462.

Patton, M. Q. (2015b). *Qualitative research and evaluation methods* (4th ed.). SAGE.

People's Knowledge Editorial Collective (Eds). (2017). *Everyday experts: how people's knowledge can transform the food system.* Reclaiming Diversity and Citizens Series. Centre for Agroecology, Water and Resilience (CAWR), Coventry University. https://www.coventry.ac.uk/research/areas-of-research/agroecology-water-resilience/our-publications/reclaiming-diversity-and-citizenship-series/

Peredo Parada, S., Vela Campoy, M., and Jiménez Gómez, A. (2016). Determinación de los niveles de resiliencia/vulnerabilidad en iniciativas de agroecología urbana en el suroeste andaluz. *IDESIA (Chile),* 34 (2), 3-11.

Perfecto, I., Vandermeer, J. & Wright A. (2009). *Nature's matrix: linking agriculture, conservation, and food sovereignty*. Earthscan from Routledge.

Perfecto, I. and Vandermeer, J. (2010). The agroecological matrix as alternative to the land-sparing/agriculture intensification model. *Proceedings of the National Academy of Sciences*, 107(13), 5787-5791.

Permantier, S. (2014). *Scaling up agroecological approaches: what, why and how?* (Discussion paper). Oxfam-Solidarity. https://www.gaiafoundation.org/post-library/scaling-up-agroecological-approaches-what-why-how-oxfam/

Petersen, P., Silveira, L. Bianconi Fernandes, G., and Gomes de Almeida, S. (2020). *Lume: a method for the economic-ecological analysis of agroecosystems.* Reclaiming Diversity and Citizens Series. Centre for Agroecology, Water and Resilience (CAWR), Coventry University. https://www.coventry.ac.uk/research/areas-of-research/agroecology-water-resilience/our-publications/reclaiming-diversity-and-citizenship-series/

Phillips, R., Seifer, B.F., and Antczak, E. (2013) *Sustainable communities: creating a durable economy.* Earthscan from Routledge.

Pimbert, M. (2017). Towards a transformative urban agroecology. In F. Hoekstra and C. Tornaghi (Eds), Urban agroecology*, UA Magazine No. 33* (pp. 15-17). RUAF Foundation and CAWR. https://ruaf.org/document/urban-agriculture-magazine-no-33-urban-agroecology/

Pimbert, M. (2015). Agroecology as an alternative vision to conventional development and climate-smart agriculture. *Development*, 58(2-3), 286-298.

Pitchfork Farm. (n.d.). http://www.pitchforkfarmvt.com/

Pitchfork Pickle. (n.d.). https://www.pitchforkpickle.com/

Polanyi, K. (2001 [1944]). *The Great Transformation: The Political and Economic Origins of Our Time*. Beacon Press.

Pollack, S. (2019, July 30). *Pitchfork Farm extends Its season by pickling produce*. Seven Days. https://www.sevendaysvt.com/vermont/pitchfork-farm-extends-its-season-by-pickling-produce/Content?oid=28108429

Poulsen, M. N., Hulland, K.R.S., Gulas, C. A., Pham H., Dalglish, S. L., Wilkinson, R.K., and Winch, P.J. (2014). Growing an urban oasis: A qualitative study of the perceived benefits of community gardening in Baltimore, Maryland. *Culture, Agriculture, Food and Environment*, 36 (2), 69–82.

Prager, K., Reed, M., and Scott, A. (2012). Encouraging collaboration for the provision of ecosystem services at a landscape scale—Rethinking agri-environmental payments. *Land Use Policy*, 29, 244-249

Pretty, J., Morison, J., and Bragg, R. (2003). Reducing food poverty by increasing agriculture sustainability in developing countries. *Agriculture Ecosystems and Environment*, 95, 217-234.

Preservation Trust of Vermont (2004, December 1). *Calkins Farmstead, Burlington*. https://ptvermont.org/calkins-farmstead-burlington/

Prizendt, S. (2017). Urban agroecology movement (MUA) changes the Brazilian Metropolis. In F. Hoekstra and C. Tornaghi (Eds), Urban agroecology*, UA Magazine No. 33* (pp. 68-69). RUAF Foundation and CAWR. https://ruaf.org/document/urban-agriculture-magazine-no-33-urban-agroecology/

Quiroz, D. (2016, March). Interview with Victor M. Toledo: "Agroecology is an epistemological revolution." *Farming Matters*, 32 (1), 18-21. ILEA, Center for Learning on Sustainable Agriculture. https://www.ileia.org/about-farming-matters/

Raap, W. (2020). *Meet Will Raap, founder and chairman*. Gardener's Supply Company. https://www.gardeners.com/how-to/meet-will-raap/7146.html

Rashed, R. (2018). Urban agriculture: a regenerative urban development practice to decrease the ecological footprint of cities. *International Journal on Environmental Science and Sustainable Development,* 2(2), 85-98

Reason, P. and Bradbury, H. (2006). Introduction: Inquiry and participation in search of a world worthy of human inspiration. In P. Reason, and H. Bradbury (Eds), *Handbook of Action Research* (pp. 1-14). SAGE.

Rekow, L. (2017). Urban agriculture in the Manguinhos Favela of Rio de Janeiro: Laying the groundwork for a greener future. In W. Leal Filho, D. Pociovalisteanu, and A. Quasem Al-Amin (Eds), *Sustainable Economic Development: Green Economy and Green Growth* (p. 155-185). Springer International Publishing.

Reno, R. (1993). *The Burlington Intervale*. An Intervale Community Farm Publication. Billings Special Collection, University of Vermont.

Renting, H. (2017). Exploring urban agroecology as a framework for transitions to sustainable and equitable regional food systems. In F. Hoekstra and C. Tornaghi (Eds), Urban agroecology*, UA Magazine No. 33* (pp. 11-12). RUAF Foundation and CAWR. https://ruaf.org/document/urban-agriculture-magazine-no-33-urban-agroecology/

Ribeiro, S.M., Borgus, C.M., and Wada Watanaba, H.A. (2015). Agroecological urban agriculture from the perspective of health promotion. *Saúde Social São Paulo,* 24(2), 730-774.

Rivera-Ferre, M. G. (2018). The resignification process of Agroecology: Competing narratives from governments, civil society and intergovernmental organizations. *Agroecology and Sustainable Food Systems*, 42(6), 666-685.

Rodríguez Dueñas, A. (2017). Systems of control for agroecological food production and commercialisation in Quito, Ecuador. In F. Hoekstra and C. Tornaghi (Eds), Urban agroecology*,*

UA Magazine No. 33 (pp. 45-47). RUAF Foundation and CAWR. https://ruaf.org/document/urban-agriculture-magazine-no-33-urban-agroecology/
Rosset, P. M. and Altieri, M. A. (2017). *Agroecology: Science and politics*. Fernwood Publishing.
Rosset, P. M., Collins, J., and Lappe, F. M. (2000). Lessons from the Green Revolution: Do We Need New Technology to End Hunger? *Tikkun Magazine*. 15(2), 52-56.
Rosset, P. M., and Martínez-Torres, M. E. (2012). Rural social movements and agroecology: context, theory, and process. *Ecology and Society*, 17(3), Article 17.
Rosset, P.M., Pinheiro Barbosa, L., Val, V., and McCune, N. (2021). Pensamiento latinoamericano agroecológico: the emergence of a critical Latin American agroecology? *Agroecology and Sustainable Food Systems*, 45 (1), 42-64.
Rowe, J. (2016, July 6). *Food justice definitions*. Oregon Tilth. https://tilth.org/stories/food-justice-definitions/
Ruiz-Rosado, O. (2006). Agroecology: A discipline leading towards transdiscipline. *Interciencia*, 31 (2), 140–145.
Saco Fortuna, A. (2017). *La agroecología urbana como herramienta de desarrollo y transformación social: Un mapeo de experiencias en el municipio de Córdoba* (Report, January 2017). Área de Cooperación y Solidaridad, Universidad de Córdoba, and Agencia Andaluza de Cooperación Internacional para el Desarrollo, Consejería de Igualdad y Políticas Sociales. http://www.osala-agroecologia.org/wp-content/uploads/2017/07/TFC-agroecologia-cordoba-alvaro-sf-09012017-v1.pdf
Saldaña J. (2016). *The coding manual for qualitative researchers*. SAGE.
Sánchez Miñarro, M. (2013-2014). Agroecología urbana en la ciudad de Rosario (Argentina): Un breve análisis de una propuesta de gran complejidad. *PAPELES de Relaciones Ecosociales y Cambio Global*, 124 (14), 135-146.
Sanderson Bellamy, A. and Ioris, A.A.R. (2017). Addressing the knowledge gaps in agroecology and identifying guiding principles for transforming conventional agri-food systems. *Sustainability*, 9 (330),1-17.
Sandover, R. (2020). Participatory food cities: scholar activism and the co-production of food knowledge. *Sustainability*, 12(9), 3548.
Sanford, A. W. (2011). Ethics, narrative, and agriculture: transforming agricultural practice through ecological imagination. *Journal of Agriculture Ethics*, 24, 283-303.
Saunders, B., Sim, J., Kingstone, T., Baker, S., Waterfield, J., Bartlam, B., Burroughs, H., and Jinks, C. (2018). Saturation in qualitative research: exploring its conceptualization and operationalization. *Qualitative & Quantitative*, 52, 1893-1907.
Sawyer, S. (2017). Food system lessons from Vermont. In D. Lerch (Ed.). *The community resilience reader: essential resources for and era of upheaval* (pp.227-245). Post Carbon Institute and Island Press. https://reader.resilience.org/
Shiva, V. (2016). *Who really feeds the world? The failures of agribusiness and the promise of agroecology.* North Atlantic Books.
Schumacher Center for a New Economics (2021). *Will Raap*. https://centerforneweconomics.org/people/will-raap/
Shuman, M., Barron A., and Wasserman, W. (2009). *Community food enterprise*: *local success in a global market.* Wallace Center at Winrock International and Business Alliance for Local Living Economies. https://wallacecenter.org/our-work/past-work/community-food-enterprise/

Small, G., Shrestha, P., Metson, G. Z., Polsky, K, Jimenez, I., and Kay, A. (2019). Excess phosphorus from compost applications in urban gardens creates potential pollution hotspots. *Environmental Research Communication,* 1 (9).

Smit, J., Nasr, J., & Ratta, A. (2001). *Urban agriculture: food, jobs and sustainable cities*. The Urban Agriculture Network, Inc. http://jacsmit.com/book.html

Smith, A. and Raven, R. (2012). What is protective space? Reconsidering niches in transitions to sustainability. *Research Policy*, 41 (6), 1025–1036.

Siegner, A. B., Acey, C., and Sowerwine, J. (2020). Producing urban agroecology in the East Bay: from soil health to community empowerment. *Agroecology and Sustainable Food Systems,* 44 (5), 566-593.

Soler Montiel, S. and Renting, H. (2013). Agricultura urbana: prácticas emergentes para un nuevo urbanismo. *Hábitat y Sociedad,* (6),3-7.

Sparker, A. (2005). Narrative analysis: exploring the whats and hows of the personal stories. In I. Holloway (Ed.), *Qualitative Research in Health Care* (1st ed., pp. 191-208). Open University Press.

State of Vermont (2021a). *Parcel Program*. Agency of Digital Services, Vermont Center for Geographic Information. Montpelier, Sate of Vermont. https://vcgi.vermont.gov/data-and-programs/parcel-program

State of Vermont (2021b). *Land Cover*. Vermont Open Geodata Portal, Vermont Center for Geographic Information. Montpelier, State of Vermont. https://geodata.vermont.gov/pages/land-cover#documentation

St. Francis/Sokoki Band of the Abenaki Nation at Missisquoi, Burlington Parks and Recreation, Intervale Center, UVM Environmental Program, USDA Natural Resources Conservation Service, Friends of Burlington Gardens, Sacred Seeds Network & Gardener's Supply (n.d.). *Abenaki Heritage Garden at the Intervale in Burlington, Vermont* [Brochure]. Retrieved September 8, 2020, from: https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb1101651.pdf

Terrile, R. H., Ottmann, G., Guzman, E. S., Lattuca, A., Mariani, S., Timoni, R., Lemos, C., and Asato, E. (2007). Una aproximación al proceso de agroecologización de la agricultura urbana en Rosario, Argentina. *Revista Brasileira de Agroecología,* 2 (2), 1727-1731.

The Chicago Council on Global Affairs (2013, June). *Feeding and urban world: A call for action.https://www.academia.edu/3765750/Feeding_an_Urban_World_A_Call_to_Action*

The Wetland Initiative (n.d.). *Value of wetlands*. Retrieved May 10, 2021, from http://www.wetlands-initiative.org/cleaner-water

Thomson, M. T., Gannon, W. B., Thomas, M. P., and Hayes, G. S. (1964). *Historical floods in New England.* Maine History Documents, The University of Main. DigitalCommons@UMaine. *https://digitalcommons.library.umaine.edu/mainehistory/431/*

Titonell, P. (2020). Assessing resilience and adaptability in agroecological transitions. *Agricultural Systems*, 184.

Tittonell, P., Piñeiro, G., Garibaldi, L.A., Dogliotti, S., Olff, H., and Jobbagy, E.G. (2020). Agroecology in large scale farming—a research agenda. *Frontiers in Sustainable Food Systems*, 4, Article 584605.

Tobi, D. (2014). *Forest Management Plan, property of Intervale Center, Inc*. Don Tobi Forestry Services.

Tonn, B. (2017). *Historic Resources of the Intervale Center*. Prepared for the Intervale Center.
Tornaghi, C. (2017). Urban agriculture in the food disabling city: (Re)defining urban food justice, reimagining a politics of empowerment. *Antipode*, (49)3,781-801.
Tornaghi C. & Dehaene, M. (2020) The prefigurative power of urban political agroecology: rethinking the urbanisms of agroecological transitions for food system transformation. *Agroecology and Sustainable Food Systems*, 44 (5), 594-610.
Tornaghi C. and Dehaene, M. (Eds). (2021a). *Resourcing and agroecological urbanism: political, transformational and territorial dimensions*. Earthscan from Routledge.
Tornaghi C. and Dehaene, M. (2021b). Introduction: Embracing political agroecology, transforming sustainable food planning. In C. Tornaghi and M. Dehaene (Eds), *Resourcing and agroecological urbanism: political, transformational and territorial dimensions* (pp. 1-11). Earthscan from Routledge
Tornaghi C. and Hoekstra, F. (Eds) (2017a). Urban agroecology*, UA Magazine No. 33*. RUAF Foundation and CAWR. https://ruaf.org/document/urban-agriculture-magazine-no-33-urban-agroecology/
Tornaghi, C. and Hoekstra, F. (2017b). Editorial. In F. Hoekstra and C. Tornaghi (Eds), Urban agroecology*, UA Magazine No. 33* (pp. 3-4). RUAF Foundation and CAWR. https://ruaf.org/document/urban-agriculture-magazine-no-33-urban-agroecology/
United Nations (2016, October 20). *The New Urban Agenda*. United Nations Conference on Housing and Sustainable Urban Development (Habitat III). https://habitat3.org/the-new-urban-agenda/
United Plant Savers (2018, April 4). *Sacred seeds at the Intervale Center: The Abenaki Heritage Garden*. United Plant Savers. https://unitedplantsavers.org/sacred-seeds-at-the-the-intervale-cente-the-abenaki-heritage-garden/
University of Michigan (2009, April). *Building a community-based sustainable food system: case studies and recommendations.* University of Michigan Urban & Reginal Planning Capstone Project. https://louisville.edu/cepm/project-areas-1/sustainable-community-capacity-building/food-system-workshop/files/building-a-community-based-sustainable-food-system-univ.-michigan
University of Minnesota Extension. (n.d.). *Boxelder*. UMN Extension. Retrieved January 17, 2021, from https://extension.umn.edu/trees-and-shrubs/boxelder
U. S. Census Bureau (2019a). *QuickFacts, Burlington city, Vermont*. U.S. Department of Commerce. https://www.census.gov/quickfacts/burlingtoncityvermont
U. S. Census Bureau (2019b). *QuickFacts, Vermont*. U.S. Department of Commerce. https://www.census.gov/quickfacts/VT#qf-headnote-a
USDA [U.S. Department of Agriculture]. (2019). *Census of Agriculture: 2017 State and County Profiles – Vermont*. National Agricultural Statistic Service, USDA. https://www.nass.usda.gov/Publications/AgCensus/2017/Online_Resources/County_Profiles/Vermont/index.php
USDA (n.d.-a), *PLANTS Database: Plant list of accepted nomenclature, taxonomy, and symbols*. Natural Resources Conservation Services, USDA. Retrieved January 12, 2021, from https://plants.usda.gov
USDA (n.d.-b). *Integrated Pest Management*. USDA. Retrieved May 25, 2021, from https://www.usda.gov/oce/pest/integrated-pest-management#

USDA (2020, February). *Farms and land in farms, 2019 summary.* National Agricultural Statistics Services, USDA. https://www.nass.usda.gov/Publications/Todays_Reports/reports/fnlo0220.pdf

USDA (2017). *U.S. Census of Agriculture: Summary and state data, geographic area series, Volume 1, Part 51* (AC-17-A-51). National Agricultural Statistics Services, USDA. https://www.nass.usda.gov/Publications/AgCensus/2017/index.php

U.S. Department of the Interior (2004). *Prehistoric and historic resources of Shelburne, Vermont. National Register of Historic Places*. National Park Service, U.S. Department of the Interior. https://npgallery.nps.gov/GetAsset/c1b86f60-c949-4915-801b-c87b98bb6c45

UVM [University of Vermont] (2021). *Food Systems at UVM*. https://www.uvm.edu/foodsystems

UVM Spatial Analysis Laboratory (2019). Vermont high resolution land cover dataset. University of Vermont.

UVM and Shelburne Farm (n.d.-a). *Focal places in Burlington*. *The Intervale*. Burlington Geographic, PLACE Program. Retrieved January 12, 202, from https://www.uvm.edu/place/burlingtongeographic/focalplaces/intervale.php

UVM and Shelburne Farm (n.d.-b). *Focal places in Burlington. The Intervale: Cultural context.* Burlington Geographic, PLACE Program. Retrieved January 12, 2021, from https://www.uvm.edu/place/burlingtongeographic/focalplaces/int-context.php

UVM and Shelburne Farm (n.d.-c). *Focal places in Burlington. The Intervale: Natural history and ecology.* Burlington Geographic, PLACE Program. Retrieved January 12, 2021, from https://www.uvm.edu/place/burlingtongeographic/focalplaces/int-ecology.php

UVM and Shelburne Farm (n.d.-d). *Greensboro Bend*: *Abenaki people*. Burlington Geographic, PLACE Program. Retrieved January 12, 2021, from https://www.uvm.edu/place/towns/greensborobend/abenaki.php

Vaarst, M., Escudero, A.G., Chappell, M.J., Brinkley, C., Nijbroek, R., Arraes, N.A.M., Andreasen, L., Gattinger, A., Fonseca De Almeida, G., Bossio, D., and Halberg, N. (2018). Exploring the concept of agroecological food systems in a city-region context. *Agroecology and Sustainable Food Systems*. 42(6), 686-711.

Vaismoradi, M., Turunen, H., and Bondas, T. (2013). Content analysis and thematic analysis: Implications for conducting a qualitative descriptive study. *Nursing and Health Science*, *15*, 398-405.

Val, V., Rosset, P.M., Zamora Lomelí, C., Giraldo, O. F., and Rocheleau, D. (2019). Agroecology and La Via Campesina I. The symbolic and material construction of agroecology through the dispositive of "peasant-to-peasant" processes. *Agroecology and Sustainable Food Systems*, 43 (7-8), 872-894.

Vandermeer J. and Perfecto, I. (2017) Ecological complexity and agroecosystems: seven themes from theory. *Agroecology and Sustainable Food Systems*, 41(7), 697-722.

Van Dyck, B., Maughan, N., Vankeerberghen, A., and Visser, M. (2017). Why we need urban agroecology. In F. Hoekstra and C. Tornaghi (Eds), Urban agroecology*, UA Magazine No. 33* (pp. 5-6). RUAF Foundation and CAWR. https://ruaf.org/document/urban-agriculture-magazine-no-33-urban-agroecology/

Vanloqueren, G. (2011). The new Green Revolution: how twenty-first-century science can feed the world. *Solutions*, 2(4), 33-44.

Vermont Agency of Agriculture, Food & Market (2018). *Vermont Required Agricultural Practices Rule for the Agricultural Nonpoint Source Pollution Control Program.* Water Quality Division, Vermont Agency of Agriculture, Food & Market, State of Vermont. https://agriculture.vermont.gov/rap

Vermont Agency of Agriculture, Food and Markets, and Farm to Plate (2020). *Vermont Agriculture and Food System Plan: 2020. Part One* (Agriculture Strategic Plan Report to the Vermont Legislature and Governor Phil Scott). Vermont Agency of Agriculture, Food & Market, State of Vermont. https://agriculture.vermont.gov/document/vermont-agriculture-and-food-system-plan-2020

Vermont Agency of Commerce and Community Development, Vermont CEDS Committee, and the Garnet Consulting Group. (2016). *Vermont 2020. Comprehensive Economic Development Strategy*. Agency of Commerce and Community Development, State of Vermont. https://accd.vermont.gov/economic-development/major-initiatives/ceds

Vermont Business for Social Responsibility (n.d.) *Local First Vermont*. Retrieved January 10, 2021, from: https://vbsr.org/local-first-vermont/

Vermont Community Garden Network (2021). *History of community gardens in Burlington*. https://vcgn.org/history-of-community-gardens-in-burlington/

Vermont Fish and Wildlife Dept. (n.d.-a). *Intervale Wildlife Management Area* [Fact sheet]. Agency of Natural Resources. Retrieved January 13, 2021, from: https://vtfishandwildlife.com/sites/fishandwildlife/files/documents/Where%20to%20Hunt/Essex%20District/Intervale%20WMA.pdf

Vermont Fish and Wildlife Dept, (n.d.-b). *Floodplain Forest* [Fact sheet]. Agency of Natural Resources. Retrieved from March 3, 2021, from: https://vtfishandwildlife.com/sites/fishandwildlife/files/documents/Learn%20More/Library/BOOKS/WETLANDS-WOODLANDS-WILDLANDS-2005/7.%20PART%204/3.WETLANDS/2.FORESTED%20WETLANDS/2.FLOODPLAIN%20FOREST.pdf

Vermont Housing and Conservation Board (n.d.). *Vermont Farm and Forest Viability Program*. Retrieved December 28, 2020, from https://www.vhcb.org/viability

Vermont Land Link (n.d.). *About.* Intervale Center and Vermont Farmland Access Task Force. Retrieved January 19, 2021, from https://vermontlandlink.org/about

Vermont Land Trust (2020) *About*. https://vlt.org/

Vermont Land Trust, Vermont Agency of Agriculture, Food and Markets, and Vermont Housing and Conservation Board. (2007, June 19). *Grant of Development Rights and Conservation Restrictions*. *Intervale Conservation Restrictions*. Vermont Land Trust, Inc.

Vermont Progressive Party (n.d.) *Our story*. Retrieved December 20, 2020, from https://www.progressiveparty.org/our-story

Vermont Sustainable Jobs Fund (2021a). *Farm to Plate: Straightening Vermont food system*. from https://www.vtfarmtoplate.com/

Vermont Sustainable Jobs Fund (2021b). *Background*. https://www.vsjf.org/about-vsjf-vermont/background-history/

Vickers, G. (1983). *Human systems are different.* Harper and Row.

VHB [Vanasse Hangen Brustlin, Inc.] (2019). *Historic Land Use Report. Lower Winooski River Valley Land Use Planning Project: Burlington, Colchester and Winooski, VT* (Report prepared by VHB for the Intervale Center).

Vitalyst Health Foundation (2017). *Urban Farming: An introduction to urban farming, from types and benefits to strategies and regulations* (Workbook). Vitalyst Health Foundation and The Elemental Group. http://vitalysthealth.org/workbook-urban-farming/

Wallace, A. (2020, November 29). *Farm succession planners work to preserve Vermont's agricultural heritage*. VTDigger. https://vtdigger.org/2020/11/29/farm-succession-planners-work-to-preserve-vermonts-agricultural-heritage/

Wang C. and Burris M.A. (1997). Photovoice: concept, methodology, and use for participatory needs assessment. *Health Education & Behavior*, 24(3), 369-387.

Wiget, M., Müller, A., and Hilbeck, A. (2019). Main challenges and key features of indicator-based agroecological assessment frameworks in the context of international cooperation. *Ecology and Society,* 25(3), Article 25.

Weiner, J. (2003). Ecology -the science of agriculture in the 21st century. *Journal of Agricultural Science*, 141, 371-377.

Wezel, A., Bellon, S., Dore, T., Francis, C., Vallod, D., and David, C. (2009). Agroecology as a science, a movement and a practice. A review. *Agronomy for Sustainable Development,* 29(4), 503–515.

Wezel. A., Gemmill Herren, B., Bezner Kerr, R., Barrios, E., Rodrigues Gonçalves, A. L., and Sinclair, F. (2020). Agroecological principles and elements and their implications for transitioning to sustainable food system. A review. *Agronomy for Sustainable Development,* 40, Article 40.

Wezel, A., Goris, M., Bruil, J., Félix, G.F., Peeters, A., Bàrberi, P., Bellon, S., and Migliorini, P. (2018). Challenges and action points to amplify agroecology in Europe. *Sustainability*, *10(5), Article* 1598.

Wezel, A., and Soldat, V. (2009). A quantitative and qualitative historical analysis of the scientific discipline of agroecology. *International Journal of Agricultural Sustainability*, 7 (1), 3-18.

Wijeratne, A. (2018). *Agroecology: Scaling-up, scaling-out* (Report). ActionAid. http://www.fao.org/agroecology/database/detail/en/c/1198110/

Wilson, B. (2001). *Soft systems methodology. A conceptual model building and its contribution.* John Wiley and Sons.

Wilson, E. O. (1992). *The Diversity of Life*. W. W. Norton & Company.

Yin, R.K. (2003) *Case study design: Research and methods* (3rd ed.). SAGE.

Zaman, G. and Goschin, Z. (2010). Multidisciplinarity, interdisciplinarity and transdisciplinarity: theoretical approaches and implications for the strategy of post-crisis sustainable development. *Theoretical and Applied Economics,* XVII (12) 553, 5-20.

Zasada, I. (2011). Multifunctional peri-urban agriculture—A review of societal demands and the provision of goods and services by farming. *Land Use Policy*, 28 (4), 639-648

Zeunert, J. (2018). Dimensions of urban agriculture. In J. Zeunert and T. Waterman (Eds), *Routledge handbook of landscape and food* (pp. 160-184). Routledge, Taylor and Francis.

Zucker, D. M. (2009). How to do case study research. *Teaching research methods in social sciences*, 2. University of Massachusetts Amherst. ScholarWorks@UMass Amherst. https://scholarworks.umass.edu/nursing_faculty_pubs/2/

APPENDIX 1

MULTIDISCIPLINARY v. INTERDISCIPLINARITY v. TRANSDISCIPLINARITY

Multi-, inter- and transdisciplinary approaches in research are not incompatible. On the contrary, these approaches often complement each other because their common goal is to understand intricate issues using different paradigms, premises and methodologies.

Multidisciplinarity means using different academic or scientific disciplines collaboratively to examine a complex issue without changing their specific paradigms, premisses and methodologies. Hence, multidisciplinary research agglomerate the different disciplines using different researchers that independently preserve their unique views and practices and contribute to the research analysis. This approach does not integrate or combine disciplines. The knowledge created is more cumulative than interactive because the issue is examined from different fields of view. The benefit of this research approach is that it can reveal several distinct angles of a complex issue (Zaman and Goschin, 2010).

An **interdisciplinary** approach, on the other hand, surpasses academic or scientific disciplines along with their particular premises and methodologies. This research approach, which in somewhat similar to the transdisciplinary one, intersect the boundaries of conventional disciplines by intentionally connecting and combining their premises and methodologies to modify, improve or create new methods that can be adapted to the contextualized needs of the research. The aim of this approach is overcoming the limits of single disciplines to have a more thorough understanding of complex contextualized issues by allowing the creative use and combination of different disciplines and their methodologies for more robust results (Zaman and Goschin, 2010).

The difference between transdisciplinary (as defined at the beginning of this section) and interdisciplinary approaches is that the former approach is more radical by aiming to *unify and transcend* the different disciplinary logics beyond the confinement of conventional academic departments. Transdisciplinarity is even considered a philosophical reaction against the highly specialized academic or scientific disciplines. Although interdisciplinarity does combine and integrate disciplines for a holistic outlook, it "always remains within the framework of disciplinary research" (Zaman and Goschin, 2010: 7).

APPENDIX 2

SYNERGIES BETWEEN AGROECOLOGY AND URBAN/PERI-URBAN AGRICULTURE

Similarly, to agroecology, urban and peri-urban agriculture (UPA):

- Gained strength as an innovative area of study in academic circles —as well as a movement for urban sustainability and for strengthening local agri-food systems—around the end of the 20th century and the beginning of this century. Thus, it is a relatively new area of research interest, especially in food provisioning, resilience and sustainability.
- Recent resurgence and expansion is usually a reaction against the globalized, unsustainable and disenfranchised system of the monolithic, corporate-controlled agri-food industry. Most UPA initiatives are trying to reclaim food security and sovereignty from the corporate-controlled industry by re-embedding food production and consumption within the social and environmental dimensions of sustainability in urban landscapes for the benefit of city dwellers.
- Prioritizes environmental and human health, social justice and wellbeing. Instead of just maximizing production and profits, UPA prioritizes the enhancement of the qualitative dimension in the input and output processes of production. Industrial agribusinesses use conventional economics to produce food at unsustainable mass production scales with a minimum of labor. This is the result of the application of the reductionist dogmas for efficiency and economies of scale for the constant increase of production and profit. Therefore, the success of UPA, like the success of agroecological projects/initiatives, can't be measured by only using conventional economic premises.
- Has been evolving, mostly, as heterogeneous and polyculture systems of small to medium-scale enterprises managed by limited-resources farmers.
- As agroecosystems and socioecological systems nested in intra-urban or peri-urban environments are usually highly multifunctional concurrently providing ecological, economic, and socio-cultural services, a quality promoted by agroecology.
- Is usually community-based, focusing on helping to strengthen local economies, livelihoods and the quality of life. One of its most important goals is to empower local urban communities by making them less dependent on the hegemonic agri-food industry and by increasing the local economic multiplier effect.
- Emphasizes the development of more personal, direct, transparent, and just networks of collaboration and exchange, from the producer to the end consumer. UPA's productive activities help to strengthen the autonomy of local markets and economies.
- Intertwines with urban ecology and urban political ecology studies in the same way as agroecology intertwines with ecology and political ecology's underpinnings and critical approaches. UPA engages in ecological issues as well as in political-economic issues at local, regional and global scales because it recognizes that local agri-food systems are open subsystems encircled by the influences of larger systems of ecological relevance, power

structures, relations, and access to productive assets. Thus, it uses multidimensional and multisectoral frameworks.

- Involves experimental, creative and local knowledge to develop appropriate, sustainable technologies -- particularly, for its suitability to the realities of small-scale spaces and food production near by or inside urban environments in proximity to urban infrastructures.
- Needs integrated comprehensive planning (e.g., urban, regional and environmental planning) and participatory approaches to guarantee food justice and inclusiveness of local communities, as well as long-term/intergenerational benefits (i.e., sustainability).
- Can be environmentally restorative for socioecological systems. In the case of cities, these could be brownfields and other abandoned post-industrial areas.

References: Mougeot (2000, 2005, 2006); Smit, Nasr, and Ratta (2001); Amekawa et al. (2010), Lovell (2010), Lovell et al. (2010), Zasada (2011), McClintock (2014, 2017), Poulsen et al. (2014), Camps-Calvet et al. (2016), Clendenning et al. (2016); Fernández et al. (2016), Opitz et al. (2016), Leitgeb et al. (2016), Tornaghi and Hoekstra (2017a), Vitalyst Health Foundation (2017), Lin et al. (2017), Zeunert (2018), Rashed (2018), Altieri (2019), Diekmann et al. (2020).

APPENDIX 3

PRINCIPLES OF AGROECOLOGY (compiled by M. Juncos-Gautier, 2021)

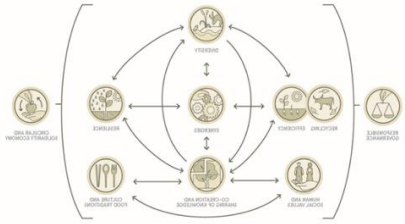
Proponents	Proposed Principles	Comments
Patton, M.Q. (2018). *Principles-focused evaluation: the guide.* New York: Guilford Press (Chapter 30, "Principles defining the emergent field of agroecology: how principles inform and GUIDE practices." pp. 276-285)	1. **Conserve and enhance agroecosystem diversity at multiple levels:** Preserve and enhance crop diversity, preserve and enhance crop genetic diversity 2. **Conserve and enhance soil health and nutrient cycling:** Manage all soil properties: biological, physical, and chemical, conserve and enhance soil organic matter 3. **Conserve and enhance natural/ecological pest and disease-regulating mechanisms**: Minimize use of synthetic pesticides; manage habitat to enhance natural enemies 4. **Minimize dependence on external synthetic inputs:** Minimize use of synthetic pesticides, minimize use of synthetic fertilizer 5. **Enhance agroecosystem performance without compromising the natural resource base:** Improve ecological agroecosystem management efficiency, improve economic agroecosystem management efficiency 6. **Diversify livelihoods to manage and mitigate risk:** Balance cash and subsistence production, balance number of income sources 7. **Prioritize and enhance local food production for food security and food sovereignty:** Link livelihood strategies for food security/food sovereignty 8. **Strengthen local organizations:** Support democratic farmer organizing, strengthen farmer organization networks 9. **Integrate farmer/local and scientific knowledge:** Create farmer scientist teams, generate space for respectful dialogue 10. **Maximize use of renewable resources and energy:** Use on-farm or local resources, minimize fossil fuel use	Patton (2018) also provides examples of practices. Evaluated by: Agroecology and Livelihoods Collaborative (ALC), University of Vermont (UVM) Kapgen, D. & Roudart L. (2020): Proposal of a principle cum scale analytical framework for analyzing agroecological development projects, *Agroecology and Sustainable Food Systems,* DOI: 10.1080/21683565.2020.1724582 provides similar principles originally developed by Community Agroecology Network -CAN: 1. Use renewable resources 2. Minimize toxics 3. Conserve resources 4. Manage Ecological relationships 5. Adjust to local environments 6. Diversify landscapes 7. Empower people 8. Manage whole systems 9. Maximize long-term benefits 10. Value health.

	11. Conserve and optimize use of water: **R**educe water waste/improve capture, minimize water waste.	
Altieri, M. A. (1995). Designing sustainable agroecosystems. In M. A. Altieri, *Agroecology: The Science of Sustainable Agriculture*. 2nd Ed. (pp. 89-106). Boulder: Westview Press. **Altieri, M.** (2001). Agroecología: principios y estrategias para diseñar una agricultura que conserva recursos naturales y asegura la soberanía alimentaria. https://www.projetovidanocampo.com.br/agroecologia/livro_do_altieri.pdf **Altieri, M.A.** (2005). Agroecology: principles and strategies for designing sustainable farming systems. *Biosafety Information Centre.* https://biosafety-info.net/articles/sustainable-systems/ecological-agriculture-food-security/agroecology-principles-and-strategies-for-designing-sustainable-farming-systems/ **Altieri, M.A. and Nicholls, C. I.** (2005). *Agroecology and the search for a truly sustainable agriculture*. UNEP. Environmental Training Network for Latin America and the Caribbean.	**1.** Enhance the recycling of biomass, with a view to optimizing organic matter decomposition and nutrient cycling over time; **2.** Strengthen the "immune system" of agricultural systems through enhancement of functional biodiversity (natural enemies, antagonists, etc.) by creating appropriate habitats; **3.** Provide most favorable soil conditions for plant growth, particularly by managing organic matter and by enhancing soil biological activity; **4.** Minimize losses of energy, water, nutrients and genetic resources by enhancing conservation and regeneration of soil and water resources and agro-biodiversity; **5.** Diversify species and genetic resources in agroecosystems over time and space at the field and landscape level; **6.** Enhance beneficial biological interactions and synergies among the components of agrobiodiversity, thereby promoting key ecological processes and services. 1.	These are ecology-based principles focused on science and sustainable management of farms or agroecosystems. Altieri and Nicholls present the same agroecological principles in many publications with minor variations. Similar principles appear in: Development Fund/ Utviklingsfondet, Norway (2011) *A Viable Food Future*. https://www.utviklingsfondet.no/files/uf/documents/A_Viable_Food_Future_updated_web.pdf Varghese, S. & Hansen-Kuhn, K. (2013) *Scaling up agroecology: toward the realization of the right to food*. Institute for Agriculture and Trade Policy (IATP), Minnesota, USA. Retrieved from: https://www.iatp.org/documents/scaling-agroecology-0 Reijntjes, C.B., Haverkort, B. & Waters-Bayer. A. (1992). *Farming for the future*. London: MacMillan Press. Third World Network (TWN) and Sociedad Científica Latinoamericana de Agroecología (SOCLA) (2015) *Agroecology: key concepts, principles and practices*. Penang, Malaysia: Jutaprint. (7-8). https://www.researchgate.net/publication/284158848_Agroecology_key_concepts_principles_and_practices

http://www.agroeco.org/doc/agroecology-engl-PNUMA.pdf **Nicholls C.I., Altieri M.A., & Vazquez L.** (2016). Agroecology: principles for the conversion and redesign of farming systems. *Journal of Ecosystem and Echography* doi:10.4172/2157-7625.S5-010 **Nicholls, C. I., Altieri M.A., Kobayashi, M., Tamura, N., McGreevy, S., and Hitaka, K.** (2020). Assessing the agroecological status of a farm: a principle-based assessment tool for farmers *Agro Sur* 48(2): 29-41		
Bell. M.M. & Stéphane Bellon, S. (2018) Generalization without universalization: Towards an agroecology theory, *Agroecology and Sustainable Food Systems*, 42(6), 605-611	**BIOPHYSICAL** **1.** Recycling of nutrients **2.** Species diversification **3.** Synergy between species **SOCIAL** **4.** Social learning and dialogue **5.** Openness to change and creativity **6.** Justice **CONTEXTUAL** **7.** Complexity **8.** Interactiveness **9.** consequence	
CIDSE (2018). *The Principles of Agroecology: Towards Just, Resilient and Sustainable Food Systems*. Brussels, Belgium: CIDSE Retrieved from: https://www.cidse.org/2018/04/03/the-principles-of-agroecology/	Principles organized in 4 domains of sustainability: **ECONOMIC** **1.** Promotes fair, short, distribution webs, producers and consumers working together **2.** Increases resilience through diversification of farm incomes and strengthens community autonomy	CIDSE (2018) provides detailed explanation of the fifteen principles (pages 6-9) CIDSE principles provide a more comprehensive agri-food/socio-ecological system perspective (beyond ecological management to guide (transition) practices of farmers.

	3. Aims to enhance the power of local markets and build on a social and solidarity economy vision **POLITICAL** **4.** Aims to put control of seeds, land and territories in the hands of people **5.** Encourages new forms of decentralized, collective, participatory governance of food systems **6.** Requires supportive public policies and investments **7.** Encourages stronger participation of food producers/consumers in decision making **ENVIRONMENTAL** **8.** Supports resilience and adaptation to climate change **9.** Nourishes biodiversity and soils **10.** Eliminates use of and dependence on agrochemicals **11.** Enhances integration of various elements of agro-ecosystems (plants, animals, ...) **SOCIO-CULTURAL** **12.** Promotes farmer to farmer exchanges for sharing knowledge together **13.** Strengthen food producers, local communities, culture, knowledge, and spirituality. **14.** Promotes healthy diets and livelihoods **15.** Encourages diversity and solidarity among peoples, encourages women and youth empowerment	Provides infographic for a comprehensive understanding of the agri-food system  Principles are interrelated which complicates the use of the proposed principles, especially for the development of metrics or for quantitative methods. Evaluation of CIDSE principles in Juncos-Gautier, M. A. (2021). Urbanizing Agroecological Principles in North America: A Multimethod Research and a Participatory Approach with a Peri-Urban Case Study in Burlington, Vermont. Dissertation. Faculty of Environmental and Urban Change, York University, Toronto.
Dumont, A. M., G. Vanloqueren, G., Stassart, P.M. and Baret. P.V. (2016). Clarifying the socioeconomic dimensions of agroecology: Between principles and practices. *Agroecology and Sustainable Food Systems* 40, 1:24–47. doi:10.1080/21683565.2015.1089967 .	**1. Environmental equity** (enhanced by taking the negative environmental externalities in each economic choice into account) **2. Financial independence** (farmers and agricultural organizations are in control of the economic and technical decisions that they take, even if that means limiting the amounts of inputs used. This theme does not concern independence from the customers of the agricultural organization in question, which is considered a separate theme) **3. Market access and autonomy** (access to and independence from markets for	Focus on the social and economic domains of agroecology.

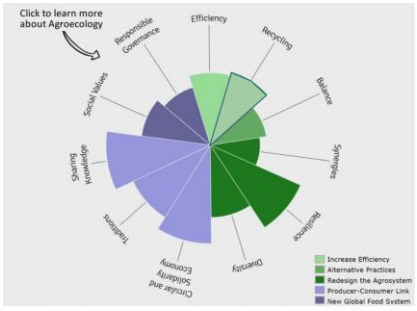
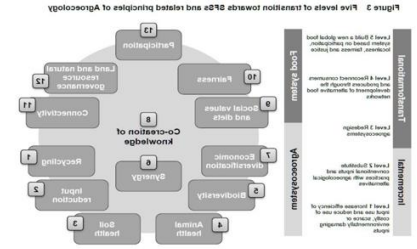
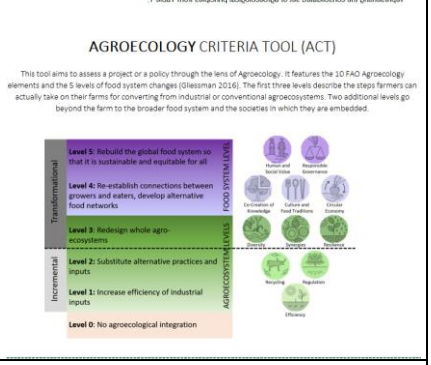
	farmers and all collective production or processing structures) 4. **Sustainability and adaptability** (of agricultural organizations stemming mainly from their inclusion in a network of farmers, consumers, technical advisors, and scientists) 5. **Diversity and exchange of knowledge** (traditional, empirical, and scientific knowledge is exchanged among the members of an organization) 6. **Social equity** (among all the stakeholders on all levels of the food system) 7. **Partnership between producers and consumers** (marked by the existence, whether formal or not, of a social contract between producers and consumers) 8. **Geographic proximity** (of the stakeholders in the various production, processing, and consumption phases) 9. **Rural development and preservation of the rural fabric** (a food system's projects participate in rural development and preserving the social fabric) 10. **Shared organization** (by the farmers and/or actors of the processing steps in common) 11. **Limited profit distribution** (profits are used to reach a social goal and not just to maximize the return on the capital invested) 12. **Democratic governance** (power of an organization's members is not based on their capital; decisions are made democratically) 13. **Joint implementation of the various principles in actual practice** (principles that an organization defends must be implemented together rather than separately)	
UN Food and Agriculture Organization (FAO) (2018). *The 10 Elements of Agroecology: Guiding the Transition to*	Characteristics of Agroecological Systems, Foundational Practices and Innovation Approaches	"The 10 Elements are a guide for policymakers, practitioners and stakeholders in planning, managing and evaluating agroecological transitions."

Sustainable Food and Agricultural Systems. http://www.fao.org/agroecology/knowledge/10-elements/en/	1. Diversity: diversification is key to agroecological transitions to ensure food security and nutrition while conserving, protecting and enhancing natural resources 2. **Synergies**: building synergies enhances key functions across food systems, supporting production and multiple ecosystem service 3. **Efficiency**: innovative agroecological practices produce more using fewer external resources 4. **Resilience:** enhanced resilience of people, communities and ecosystems is key to sustainable food and agricultural systems 5. **Recycling**: more recycling means agricultural production with lower economic and environmental costs 6. Co-creation and sharing of knowledge: agricultural innovations respond better to local challenges when they are co-created through participatory processes **CONTEXT FEATURES:** 7. **Human and social values**: protecting and improving rural livelihoods, equity and social well-being is essential for sustainable food and agricultural systems 8. **Culture and food traditions**: by supporting healthy, diversified and culturally appropriate diets, agroecology contributes to food security and nutrition while maintaining the health of ecosystems **ENABLING ENVIRONMENT** 9. **Responsible governance:** sustainable food and agriculture requires responsible and effective governance mechanisms at different scales – from local to national to global 10. **Circular and solidarity economy**: reconnect producers and consumers, provide innovative solutions for living within our planetary boundaries while ensuring the social foundation for inclusive and sustainable development	FAO uses 'elements' to express "the simplest principles of a subject of study", also "one of the factors determining the outcome of a process." FAO represents its Elements graphically:  FAO also shows Interactions between the Elements: 
FAO (2014). *Building a common vision for sustainable food and*	1. Improving efficiency in the use of resources is crucial to sustainable agriculture	These principles are not specifically referred to as agroecological but are

agriculture: principles and approaches. Working paper. http://www.fao.org/cofi/46037-0799fded181eabdcf681755783a3601b.pdf and http://www.fao.org/family-farming/detail/en/c/415026/	**2.** Sustainability requires direct action to conserve, protect and enhance natural resources **3.** Agriculture that fails to protect and improve rural livelihoods, equity and social well-being is unsustainable **4.** Enhanced resilience of people, communities and ecosystems is key to sustainable agriculture **5.** Sustainable food and agriculture requires responsible and effective governance mechanisms	agroecological in their expression and related to FAOs 10 elements.
FAO (2014) *Agroecology: A global movement for food security and sovereignty*. Proceedings, International Symposium on Agroecology for Food Security and Nutrition, Rome. http://www.fao.org/3/a-i4729e.pdf	**1.** Shift from through-flow nutrient management to a nutrient recycling model, with increased dependence on natural processes such as biological nitrogen fixation and mycorrhizal relationships; **2.** Use renewable sources of energy instead of non-renewable sources; **3.** Eliminate the use of non-renewable, off-farm human inputs that have the potential to harm; the environment or the health of farmers, farm workers, or consumers; **4.** When materials must be added to the system, use naturally occurring materials instead of synthetic, manufactured inputs; **5**. Manage pests, diseases and weeds instead of 'controlling' them; **6.** Re-establish the biological relationships that can occur naturally on the farm instead of reducing and simplifying them; **7**. Make more appropriate matches between cropping patterns and the productive potential and physical limitations of the farm landscape; **8**. Use a strategy of adapting the biological and genetic potential of agricultural plant and animal species to the ecological conditions of the farm rather than modifying the farm to meet the needs of the crops and animals; **9**. Value most highly the overall health of the agro-ecosystem rather than the outcome of a particular crop system or season;	Focus on the principles from a farm transition perspective -- per Gliessman, S.R. (2014). *Agroecology: The ecology of sustainable food systems, 3rd Edition*. Boca Raton, FL: CRC Press - Taylor and Francis. Overarching principles of agroecology and sustainability (Patton, 2018; Gliessman, 2014, 2015) 1. Use renewable resources 2. Minimize toxics 3. Conserve resources 4. Conserve soil 5. Conserve water 6. Conserve energy 7. Conserve genetic resources 8. Conserve capital 9. Manage ecological dimensions 10. Adjust to local environments 11. Diversify landscapes 12. Diversity biota (e.g., intercrops) 13. Diversify economics 14. Empower people 15. Manage whole systems 16. Maximize long-term benefits 17. Value health

	10. Emphasize conservation of soil, water, energy and biological resources; **11**. Respect local knowledge and experience in agro-ecosystem design and management; **12.** Incorporate the idea of long-term sustainability into overall agro-ecosystem design and management.	
FAO - High-Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security (HLPE) (2019). *Agroecological and other innovative approaches for sustainable agriculture and food systems that enhance food security and nutrition*. (Table 1, P.41). Rome. http://www.fao.org/cfs/cfs-hlpe/news-archive/detail/en/c/1202477/	**1. IMPROVE RESOURCE EFFICIENCY** Recycling: Preferentially use local renewable resources and close as far as possible resource cycles of nutrients and biomass. Input reduction: Reduce or eliminate dependency on purchased inputs and increase self-sufficiency. **2. STRENGTHEN RESILIENCE** Soil health: Secure and enhance soil health and functioning for improved plant growth, particularly by managing organic matter and enhancing soil biological activity. Animal health: Ensure animal health and welfare. Biodiversity: Maintain and enhance diversity of species, functional diversity and genetic resources and thereby maintain overall agroecosystem biodiversity in time and space at field, farm and landscape scales. Synergy: Enhance positive ecological interaction, synergy, integration and complementarity among the elements of agroecosystems (animals, crops, trees, soil and water). Economic diversification: Diversify on-farm incomes by ensuring that small-scale farmers have greater financial independence and value addition opportunities while enabling them to respond to demand from consumers. **3. SECURE SOCIAL EQUITY/ RESPONSIBILITY** Co-creation of knowledge: Enhance co-creation and horizontal sharing of knowledge including local and scientific innovation, especially through farmer-to-farmer exchange. Social values and diets: Build food systems based on the culture, identity, tradition, social and gender equity of local	Each principle is connected to FAO's 10 Elements; scale of application of each principle: field (F1), farm or agroecosystem (FA), and food system (FO) provided. HLPE's sources: Nicholls et al., 2016; CIDSE, 2018; FAO, 2018c One principle promotes animal welfare/justice. The Agroecology Info Pool https://www.agroecology-pool.org/methodology/ uses and adapts for its Agroecology Criteria Tool these principles by HLPE with Gliessman's five transitions levels: 1. INCREASE EFFICIENCY Efficiency: resource-use efficiency, produce more using less external resources, reduce dependency on external inputs. 2. ALTERNATIVE PRACTICES Recycling: Support biological process that drive the recycling of nutrients, biomass and water within production systems. Close cycles and reuse waste. Balance: Optimize the biophysical mechanisms and interactions at play within farming systems so as to boost natural regulation processes. 3. REDESIGN THE AGROECOSYSTEM Synergies: Optimize biological synergies that enhance key functions across food systems by a careful design of diversified system and integration of elements in the system.

	communities that provide healthy, diversified, seasonally and culturally appropriate diets. Fairness: Support dignified and robust livelihoods for all actors engaged in food systems, especially small-scale food producers, based on fair trade, fair employment and fair treatment of intellectual property rights. Connectivity: Ensure proximity and confidence between producers and consumers through promotion of fair and short distribution networks and by re-embedding food systems into local economies. Land and natural resource governance: Strengthen institutional arrangements to improve, including the recognition and support of family farmers, smallholders and peasant food producers as sustainable managers of natural and genetic resources. Participation: Encourage social organization and greater participation in decision-making by food producers and consumers to support decentralized governance and local adaptive management of agricultural and food systems.	Synchronize activities at landscape level. Resilience: Increase capacity to recover from disturbances, maintain a functional balance, enhance ecological and socio-economic resilience. Diversification: Optimize, manage and conserve the diversity of species and genetic resources, local breed, income and markets, diets and consumption, including vertical, temporal, spatial on-farm diversity 4. PRODUCER-CONSUMER LINK Circular and solidarity economy: Reconnect producers and consumers, prioritize local markets and short food circuit, support local economic development. Culture and food traditions: Support healthy, diversified and culturally appropriate diets, re-balance tradition and modern food habits, support the right to adequate food. Co-creating and sharing knowledge: Promote innovation co-created through participatory processes and context-specific, blended knowledge and bottom-up technology transfer. Promote formal and non-formal education. 5. NEW GLOBAL FOOD SYSTEM Social values: Protect and improve rural livelihoods, equity and social well-being, build autonomy and adaptive capacities, empower people and communities to overcome poverty, hunger and malnutrition, while promoting human rights, address gender and rural youth inequalities. Responsible governance: Promote responsible, effective, transparent, accountable and inclusive governance mechanisms, improve land and natural resources governance

		(equitable access to land and natural resources; protection of soil, biodiversity and ecosystems services), provide incentives for long-term investments in sustainable practice.   
INKOTA (2019) Strengthening agroecology. For a fundamental transformation of agri-food systems. Position paper directed at the German Federal Government. https://webshop.inkota.de/node/1565	**1.** More diversity above and below ground **2.** Greater resilience and adaptation to the climate crisis **3.** Strengthening the agroecosystem's capacity for self-regulation **4.** More control over livelihoods **5.** Strengthening family farms **6.** Healthy nutrition and producing food locally **7.** Less dependence, more autonomy **8.** Equal rights for women and men **9.** Greater participation and voice in decision-making **10.** Policies and participatory research	INKOTA is a German NGO's position paper for the German Federal Government.

Declaration of the International forum for Agroecology, Nyéléni, Mali (2015) February 27. Developments 58, 163-168. DOI/10/1057/s41301-016-0014-4 **International Forum on Agroecology** (2015, 27 February). *Our common pillars and principles of agroecology***.** Declaration of the International Forum for Agroecology, Nyéléni, Mali. http://www.fao.org/agroecology/database/detail/en/c/454188/	Pillars and Principles 1. **Agroecology is a way of life and the language of Nature**, that we learn as her children. It is not a mere set of technologies or production practices. It cannot be implemented the same way in all territories. Rather it is based on principles that, while they may be similar across the diversity of our territories, can and are practiced in many different ways, with each sector contributing their own colors of their local reality and culture, while always respecting Mother Earth and our common, shared values. 2. The **production practices of agroecology** (such as intercropping, traditional fishing and mobile pastoralism, integrating crops, trees, livestock and fish, manuring, compost, local seeds and animal breeds, etc.) are based on ecological principles like a) building life in the soil, b) recycling nutrients, c) the dynamic management of biodiversity, d) energy conservation at all scales, e) agroecology drastically reduces our use of externally-purchased inputs that must be bought from industry. There is no use of agrotoxics, artificial hormones, GMOs or other dangerous new technologies in agroecology. 3. **Territories are a fundamental pillar of agroecology.** Peoples and communities have the right to maintain their own spiritual and material relationships to their lands. They are entitled to secure, develop, control, and reconstruct their customary social structures and to administer their lands and territories, including fishing grounds, both politically and socially. This implies the full recognition of their laws, traditions, customs, tenure systems, and institutions, and constitutes the recognition of the self-determination and autonomy of peoples. 4. **Collective rights and access to the commons are fundamental pillars of agroecology**. We share access to	Strategies are proposed under the following topics: 1. Promotion of agroecological production through different polices 2. Knowledge sharing 3. Recognition of the central role of women 4. Build local economies 5. Further develop and disseminate our vision of agroecology 6. Build alliances 7. Protect biodiversity and genetic sources 8. Cool the planet and adapt to climate change 9. Denounce and fight corporate and institutional capture of agroecology. Has a stronger and clearer sociopolitical stance than other proposals.

	territories that are the home to many different peer groups, and we have sophisticated customary systems for regulating access and avoiding conflicts that we want to preserve and to strengthen. 5. **The diverse knowledges and ways of knowing of our peoples are fundamental to agroecology**. We develop our ways of knowing through dialogue among them (*diálogo de saberes*). Our learning processes are horizontal and peer-to-peer, based on popular education. They take place in our own training centers and territories (farmers teach farmers, fishers teach fishers, etc.), and are also intergenerational, with exchange of knowledge between youth and elders. Agroecology is developed through our own innovation, research, and crop and livestock selection and breeding. 6. **The core of our cosmovision is the necessary equilibrium between nature, the cosmos and human beings**. We recognize that as humans we are but a part of nature and the cosmos. We share a spiritual connection with our lands and with the web of life. We love our lands and our peoples, and without that, we cannot defend our agroecology, fight for our rights, or feed the world. We reject the commodification of all forms of life. 7. **Families, communities, collectives, organizations and movements are the fertile soil in which agroecology flourishes**. Collective self-organization and action are what make it possible to scale-up agroecology, build local food systems, and challenge corporate control of our food system. Solidarity between peoples, between rural and urban populations, is a critical ingredient. 8. **The autonomy of agroecology displaces the control of global markets and generates self-governance by communities**. It means we minimize the use of purchased inputs that come from outside. It requires the re-shaping of markets so that they are based on the principles of solidarity economy and the	

	ethics of responsible production and consumption. It promotes direct and fair short distribution chains. It implies a transparent relationship between producers and consumers and is based on the solidarity of shared risks and benefits. 9. **Agroecology is political; it requires us to challenge and transform structures of power in society**. We need to put the control of seeds, biodiversity, land and territories, waters, knowledge, culture and the commons in the hands of the peoples who feed the world. 10. **Women and their knowledge, values, vision and leadership are critical for moving forward**. Migration and globalization mean that women's work is increasing, yet women have far less access to resources than men. All too often, their work is neither recognized nor valued. For agroecology to achieve its full potential, there must be equal distribution of power, tasks, decision-making and remuneration. 11. Youth, together with women, provide one of the two principle social bases for the evolution of agroecology. **Agroecology can provide a radical space for young people to contribute to the social and ecological transformation that is underway in many of our societies**. Youth bear the responsibility to carry forward the collective knowledge learned from their parents, elders and ancestors into the future. They are the stewards of agroecology for future generations. Agroecology must create a territorial and social dynamic that creates opportunities for rural youth and values women's leadership.	
Kapgen, D. & Roudart, L. (2020). Proposal of a principle cum scale analytical framework for analyzing agroecological development projects. *Agroecology and Sustainable Food*	Ecological Principles 1. Nurture soil conditions for optimal plant growth, particularly by managing organic matter and enhancing soil life. 2. Recycle biomass for optimizing both energy flows and nutrient cycling and availability.	Principles are focused on helping agroecological development projects. Authors add methodological principles to use for agroecological development projects.

Systems. p.15. DOI: 10.1080/21683565.2020 .1724582	**3.** Minimize losses of energy, nutrients, soil and water through microclimate management, water management and erosion control in space and time. **4.** Diversify flora and fauna of the agroecosystem and natural habitats in time and space. **5.** Manage ecological relationships by re-establishing natural ecological relationships and allowing for beneficial interactions and biological synergies between components of agrobiodiversity. **6.** Adjust lo local environments by adapting biota and matching cropping and livestock systems to the productive potential and physical limitations of the farm landscape. **SOCIOECONOMIC PRINCIPLES** **7.** Build social equity among all stakeholders, both at the same hierarchical level and between levels. **8.** Ensure market access and autonomy (avoid dependence from single crops or products, use alternative markets, favor local producer-consumer cycles). **9.** Strengthen communities and local networks. **10.** Build financial independence by avoiding dependence from external subsidies and controlling. **11.** Use and enhance local human, social and physical resources. **POLITICAL PRINCIPLES** **12.** Support collective agroecological action at local scales. **13.** Promote institutional change for agroecology enabling public policies at all levels. **14.** Adopt a politically engaged position. **METHODOLOGICAL PRINCIPLES** **15.** Use a transdisciplinary approach. **16.** Use farmer participation and explain how **17.** Empower people so that they can control their development process **18.** Use bottom-up approaches, explain how, and enhance scale interaction **19.** Use action-oriented approaches and how **20.** Use long-term flexible development strategies	

	21. Use a multi-directional transfer of knowledge	
Patton, M.Q. (2018). *Principles-focused evaluation: the guide.* New York: The Guilford Press, pp. 276-285.	**1.** Enhancing recycling of biomass, optimizing nutrient availability, and balancing nutrient flow. **2.** Securing favorable soil conditions for plant growth, particularly by managing organic matter and enhancing soil biotic activity. **3.** Minimizing losses due to flows of solar radiation, air, and water by way of microclimate management; water harvesting and soil management through increased soil cover. **4.** Species and genetic diversification of the agroecosystem in time and space. **5.** Enhance beneficial biological interactions and synergisms among agrobiodiversity components, resulting in the promotion of key ecological processes and services.	Synthesized by Patton (2018: 278), Also presented in: Altieri, M. A., & Toledo, V. M. (2005). Natural resource management among small scale farmers in semi-arid lands: Building on traditional knowledge and agroecology. *Annals of Arid Zone, 44*, 365–385. Gliessman, S. R. (1992). Agroecology in the tropics: Achieving a balance between land use and preservation. *Environmental Management, 16,6*, 681–689. Gliessman, S. R., & Muramoto, J. (2010). The conversion of strawberry production. In S. R. Gliessman & M. E. Rosemeyer (Eds.), *Converting to sustainable agroecosystems: Principles, processes, and practices* (pp. 117–131). Boca Raton: CRC Press. Méndez, V. E. (2015). *A global performance assessment of agroecology for smallholder farmers*. Grant proposal developed by the Agroecology and Rural Livelihoods Group (ARLG), University of Vermont, Burlington, VT. Méndez, V. E., Bacon, C. M., & Cohen, R. (2016) Agroecology as a transdisciplinary, participatory, and action-oriented approach. *In* V. E. Méndez, C. M. Bacon, R. Cohen, & S. Gliessman (Eds.), *Agroecology: A transdisciplinary, participatory, and action-oriented approach*. (pp. 1-21). New York: CRC Press.
Petersen, P., Silveira, L. Bianconi Fernandes, G., and Gomes de Almeida,	Systemic Attributes **1. AUTONOMY** Mercantile productive resources:	SNAM stands for social nucleus of agroecosystem management

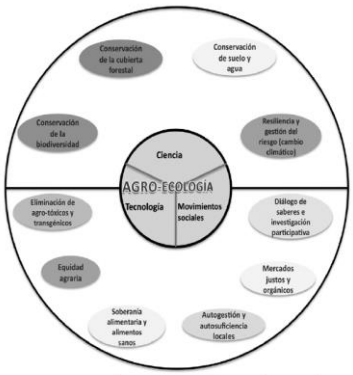
S. (2020). *Lume: a method for the economic-ecological analysis of agroecosystems.* Centre for Agroecology, Water and Resilience (CAWR) at Coventry University.	Autonomy in relation to: a) third party land (land use under renting, leasing, and other payment schemes for the right to use the land); b) seeds, seedlings, propagative material, offspring (acquisition of genetic resources); c) water (acquisition of water for different consumptions in the agroecosystem); d) fertilizers (market-sourced inputs for soil fertility regeneration); e) fodder/animal feed (market-sourced animal feed sources); f) third party work (Hiring of third-party services to perform activities related to agroecosystem management); Self controlled resources based: Autonomy in relation to: a) food self-sufficiency (SNAM food supply level -- in quantity, quality and diversity -- from production generated in the agroecosystem itself and or production donated by community members through reciprocal relationships); b) equipment/infrastructure (agroecosystem fixed capital, i.e., level of structuring of agroecosystem); c) workforce (quantitative and qualitative availability of the SNAM workforce effectively allocated to agroecosystem management); d) forage/ animal feed availability (forage biomass produced in the agroecosystem or freely appropriated on communal lands); e) soil fertility (chemical, physical and biological qualities of soils worked by SNAM); f) water (water availability to meet different consumption demands in the agroecosystem); g) biodiversity (both planned biodiversity –diversity of plant and animal managed species, considering both intraspecific variability and interspecific diversity--, as well as associated biodiversity for spontaneous/wild species diversity; h) land availability (territorial extension of the agroecosystem, that is, the environmental space in which the SNAM appropriates ecological goods to convert them into economic goods). **2. RESPONSIVENESS** in relation to resilience and adaptability: a) biodiversity (planned or associated, diversity, adaptability and ecological	Attributes seem to be considered principles. Petersen et al. (2020) calls them systemic attributes. Each systemic attribute has parameter and criteria. Strong sociopolitical domain.

	functions of plant and animal genetic resources maintained in the agroecosystem); b) diversity of accessed markets (variety of commercial circuits used to flow the agroecosystem production), c) income diversity. (agricultural and non-agricultural); d) input stocks (productive resources stored in the agroecosystem to be used in subsequent production cycles); e) living stock ("standing stocks" present in the agroecosystem). **3. SNAM'S SOCIAL INTEGRATION** a) participation in political organizational spaces (level of interaction of one or more SNAM members in political-organizational spaces); b) access to public policies (degree of access to resources redistributed by the state through public policies); c) participation in socio-technical learning networks (interaction of one or more SNAM members in learning processes directly related to the qualification of the work done in agroecosystem management); d) participation in community spaces dedicated to the common goods (governance Interaction of one or more SNAM members in collective actions aimed at the governance of common goods at community or territorial level). **4. GENDER EQUITY/WOMEN'S EMPOWERMENT** a) sexual division of housework and care (adults) (level of symmetry in the division of domestic and care tasks between adult men and women in the SNAM); b) sexual division of housework and care (youth) (level of symmetry in the division of domestic and care tasks between young men and women in the SNAM); c) participation in agroecosystem management decisions (level of symmetry between men and women in decision-making power related to agroecosystem structuring and management strategies, as well as marketing activities); d) participation in socio-organizational spaces (level of symmetry between men and women in the participation in organizations -- formal and informal--social networks	

	and movements); e) appropriation of wealth generated in agroecosystem (degree of equity between men and women related to the appropriation of the income generated by the work of the SNAM); f) access to public policies. (equality between men and women in autonomous access and /or decision-making power over redistributed resources through public policies). **5. YOUNG PEOPLE'S EMPOWERMENT** a) participation in learning spaces (degree of involvement of SNAM youth in spaces--formal and/or informal-- of education and professional training); b) participation in agroecosystem management decisions (degree of involvement of SNAM youth in strategic decisions related to the structuring and management of agroecosystem and production marketing processes); c) participation in socio-organizational spaces (degree of involvement of SNAM youth in organizations --formal and informal--, networks and social movements); d) access to public policies (level of autonomous access and/or participation in decision-making on the use of resources redistributed by the state through public policies by SNAM youth); e) financial autonomy (autonomy degree of SNAM youth in the management of productive activities, as well as the level of appropriation of the monetary income generated by their work).	
Scarborough, G., Méndez, V. E., & Bisson, A. (2014). *Agroecological risk and resilience screening tool: Guidance for considering agroecological.* p.3. https://www.uvm.edu/agroecology/publication/agroecological-risk-and-resilience-screening-tool-guidance-for-considering-agroecological-impact-	**1.** Preservation and enhancement of agroecosystem diversity. **2.** Conservation and enhancement of soil health and nutrient cycling. **3.** Supporting ecological pest and disease regulating mechanisms. **4.** Maximizing renewable energy potential. **5.** Supporting and diversifying livelihoods to manage and mitigate risk exposure. **6.** Prioritizing and enhancing local food production and food security. **7.** Reducing dependence on external synthetic inputs. **8.** Optimizing water use— preserving and regenerating water resources.	Stated in Patton (2018: 279)

of-agriculture-interventions-and-identifying-opportunities-to-build-resilience-in-food-systems/	**9.** Integrating local and scientific knowledge. **10.** Strengthening local organizations	
Stassart, P.M., Baret, P., Grégoire, J.C., Hance, T., Mormont, M., Reheul, D., Vanloqueren, G. & Visser, M. (2012). L'agroécologie: Trajectoire et potentiel: Pour une transition vers des systèmes alimentaires durables. *In* D. Van Dam, M., Streith, J., Nizet & P.M. Stassart, eds. *Agroécologie. Entre pratiques et sciences sociales*, pp. 25-51. Paris : Educagri Éditions. https://www.cairn.info/agroecologie--9782844448767-page-25.htm This list is copied from: Kapgen, D. & Roudart, L. (2020). Proposal of a principle cum scale analytical framework for analyzing agroecological development projects, *Agroecology and Sustainable Food Systems*. DOI:10.1080/21683565.2020.1724582	**HISTORICAL PRINCIPLES OF AGROECOLOGY** from Reijntjes, Haverkort, and Waters-Bayer (1992) in Altieri (1995) **1.** Recycle biomass as much as possible, so as to optimize both energy flows and nutrient cycling and availability. **2.** Nurture soil conditions for optimal plant growth, with a keen eye on organic matter and soil life management. Because of the antagonisms with oil-based external inputs and because fossil fuel is going to be out phased anytime soon, this nurturing should be conceived minimizing the use of petrochemicals (fertilizer, pesticides, fossil fuels). **3**. Minimize resource losses (e.g., energy, nutrients, water and soil) through microclimate management, water harvesting techniques in drylands, increasing soil cover in space and time and the interplay of territorial specificities, especially through mixed farming systems. **4.** Favor genetic diversification of agroecosystems, both within and between species, in space and in time. **5.** Allow for beneficial interactions and biological synergies between components of agrobiodiversity so as to strengthen the above-mentioned key processes and services. **6.** Value agrobiodiversity as an entry point for the redesign of food systems that ensure peasant autonomy and food sovereignty **METHODOLOGICAL PRINCIPLES** from Science in Action Department (SAD), INRA (from Tichit and Bellon et al. 2010) **7.** Develop multi-criteria guidance of agroecosystems within a long-term transition perspective, considering trade-offs between long term and short-term benefits, and giving due	Socio-economic principles underlying agroecology described in D'Annolfo, Graeub and Gemmill-Herren (2015): 1. Agroecology is about social organization generating collective knowledge and adaptability through networks involving producers (e.g., grassroots organization and community seed banks); 2. Knowledge plays an essential role in agroecology recognizing the diversity of skills and knowledge (e.g., Indigenous knowledge); 3. Agroecology is about fostering autonomy allowing farmers to become less dependent from the fluctuation of the market (e.g., crop diversification); 4. Agroecology seeks to improve social equity in food systems through mechanisms of solidarity (e.g., pricing systems along the food chain and farmer multinational cooperatives); 5. Agroecology aims to improve/strengthen democracy at several levels: member's power within an organization is not based on their assets and decisions are taken through a democratic process.

	importance to properties that increase resilience and adaptability. **8.** Value spatial-temporal resource variation: exploit local resources when and where they are available rather than trying to get rid of intrinsic variation. **9.** Stimulate the exploration of agroecosystems far removed from the already known local optima of today e.g., "extreme" systems with very low levels of external inputs both in animal and plant production **METHODOLOGICAL PRINCIPLES** (from GIRAF) **10.** Favor the construction of participatory research frameworks, which allow for action-oriented research while guaranteeing its scientific validity, Designing sustainable food systems is indeed complex because it requires researchers to consider stakeholder interdependencies and ambiguities as well as the socio-economic uncertainties of technical innovations **SOCIO-ECONOMIC PRINCIPLES** (from GIRAF) **11.** Create knowledge and a collective capacity to adapt, through networks comprising producers, citizen consumers, researchers, and state-funded technical advisers. These networks promote decision-making fora, public debate, and the diffusion of knowledge **12.** Foster opportunities for peasants to evolve toward greater autonomy with regard to dominant (world) market forces. This fostering happens through the creation of enabling environments for public goods and the development of practices and socio-economic models that strengthen the democratic governance of food issues. Systems would then be (re)localized and co-managed by both producers and citizen-consumers **13.** Value the diversity of forms of knowledge: local know-how or Indigenous Technology and Knowledge or empirical knowledge both while constructing problems and the	

	audiences these problems address as during problem solving research.	
Tittonell, P. (2015). Food security and ecosystem services in a changing world: it is time for agroecology. *In* FAO, *Agroecology for Food Security and Nutrition: Proceedings of the FAO International Symposium* 16-35 September 2014, Rome, FAO.	**1.** recycling **2.** efficiency **3.** diversity **4.** regulation **5.** synergies	Very broad ecology-focused principles extracted from Altieri, M.A. (2002). Agroecology: the science of natural resource management for poor farmers in marginal environments. *Agriculture, Ecosystems and Environment*, 93: 1-24. Gliessman, S.R. (2007). *Agroecology: The Ecology of Sustainable Food Systems*. Boca Raton: Taylor & Francis
Toledo, V. M. (2012). La agroecología en Latinoamérica: Tres revoluciones, una misma transformación. *Agroecología*, 6, 37-46. https://revistas.um.es/agroecologia/article/view/160651	**CIENCIA** **1.** Conservación de la biodiversidad **2.** Conservación de la cubierta forestal **3.** Conservación de suelo y agua **4.** Resiliencia y gestión del riesgo (cambio climático) **TECNOLOGÍA** **5.** Eliminación de agrotóxicos y transgénicos **6.** Equidad agraria **7.** Soberanía alimentaria y alimentos sanos **MOVIMIENTOS SOCIALES** **8.** Diálogo de saberes e investigación participativa **9.** Mercados justos y orgânicos **10.** Autogestión y autosuficiencia local	Does not talk about "principles" but Figure 4 present 10 social and ecological "*demandas*" that can be translated into principles  **Figura 4**. La agroecología, en su triple significación, logra responder a 10 demandas sociales y ecológicas para superar un número similar de problemas provocados por la crisis de la modernidad.
Shiva, V. (2016). *Who really feeds the world? The failures of agrobusiness and the promises of agroecology*. Berkeley: North Atlantic Books. p. 12	**1.** It recognizes interconnections in nature and is based on the application of ecological science to food and agricultural systems, instead of a reductionist, mechanistic, and militarized approach. **2.** It promotes the health of soils, plants, animals, and human beings. **3.** It enhancers the ecological integrity of food production through the Law of Return.	Labeled "paradigm of agroecological knowledge" for food and agriculture. Very political and feminist.

	4. It conserves biodiversity and intensifies biodiversity services such as pollinators, rendering agrochemicals inputs such as pesticides redundant. **5.** It maximizes "health per acre" and "nutrition per acre" instead of "yield per acre". **6.** It is based on seed freedom, where the control of seeds lies with farmers, instead of a system that views seeds as corporate intellectual property. **7.** It creates the socioeconomic, political, and cultural context for the exercise of food freedom and food sovereignty. **8.** It is centered on women's knowledge of biodiversity, ecosystems, health, and nutrition, instead of corporate-controlled and manipulated knowledge based on monocultures. **9.** It is based on a sense of place and gives priority to the local, instead of the unfair privilege given to global corporations.	
Wezel, A. Herren, B. G. Kerr, R. B. et al. (2020) Agroecological principles and elements and their implications for transitioning to sustainable food systems: A review. *Agronomy for Sustainable Development,* 40, 40. https://doi.org/10.1007/s13593-020-00646-z	**1.** Recycling. Preferentially use local renewable resources and close as far as possible resource cycles of nutrients and biomass. **2.** Input reduction. Reduce or eliminate dependency on purchased inputs and increase self-sufficiency. **3.** Soil health. Secure and enhance soil health and functioning for improved plant growth, particularly by managing organic matter and enhancing soil biological activity. **4.** Animal health. Ensure animal health and welfare **5.** Biodiversity. Maintain and enhance diversity of species, functional diversity and genetic resources and thereby maintain overall agroecosystem biodiversity in time and space at field, farm, and landscape scales. **6.** Synergy. Enhance positive ecological interaction, synergy, integration, and complementarity amongst the elements of agroecosystems (animals, crops, trees, soil and water). **7.** Economic diversification. Diversify on-farm incomes by ensuring that small-	Synthesized version of the principles based on some of the above sources

	scale farmers have greater financial independence and value addition opportunities while enabling them to respond to demand from consumers. **8.** Co-creation of knowledge. Enhance co-creation and horizontal sharing of knowledge including local and scientific innovation, especially through farmer-to-farmer exchange. **9.** Social values and diets. Build food systems based on the culture, identity, tradition, social and gender equity of local communities that provide healthy, diversified, seasonally and culturally appropriate diets **10.** Fairness. Support dignified and robust livelihoods for all actors engaged in food systems, especially small-scale food producers, based on fair trade, fair employment, and fair treatment of intellectual property rights. **11**. Connectivity. Ensure proximity and confidence between producers and consumers through promotion of fair and short distribution networks and by re-embedding food systems into local economies. **12**. Land and natural resource governance. Strengthen institutional arrangements to improve, including the recognition and support of family farmers, smallholders, and peasant food producers as sustainable managers of natural and genetic resources. **13.** Participation. Encourage social organisation and greater participation in decision-making by food producers and consumers to support decentralised governance and local adaptive management of agricultural and food systems.	

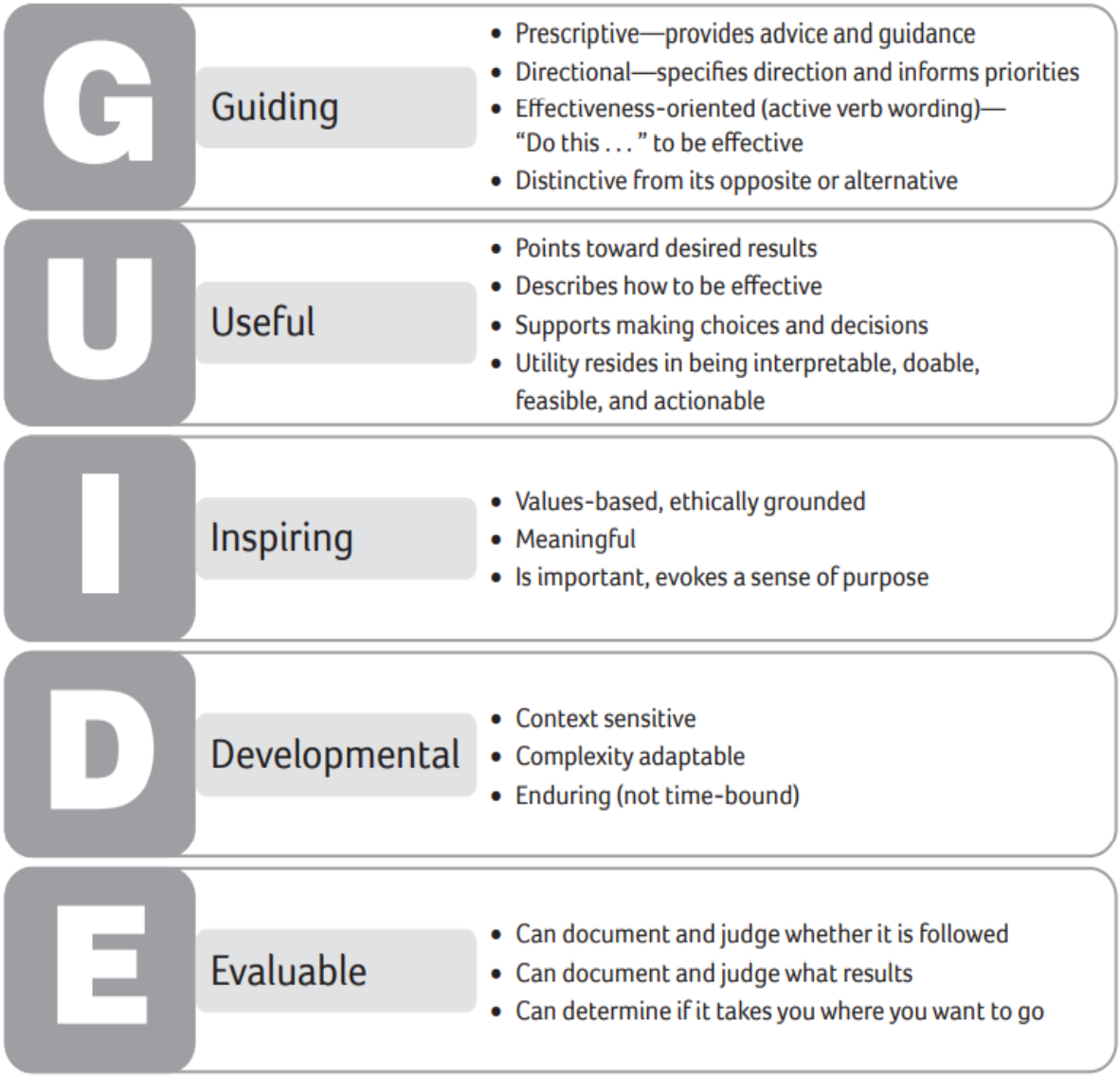
APPENDIX 4

BRIEF EXPLANATION OF CIDSE PRINCIPLES OF AGROECOLOGY (CIDSE, 2018)

1. Principles in the environmental dimensions	
1.1	Enhances positive interaction, synergy, integration, and complementarities between the elements of agroecosystems (plants, animals, trees, soil, water, etc.) and food systems (water, renewable energy, and the connections of re-localised food chains).
1.2	Builds and conserves life in the soil to provide favourable conditions for plant growth
1.3	Optimises and closes resource loops (nutrients, biomass) by recycling existing nutrients and biomass in farming and food systems.
1.4	Optimises and maintains biodiversity above and below ground (a wide range of species and varieties, genetic resources, locally-adapted varieties/breeds, etc.) over time and space (at plot, farm and landscape level).
1.5	Eliminates the use of and dependency on external synthetic inputs by enabling farmers to control pests, weeds and improve fertility through ecological management.
1.6	Supports climate adaptation and resilience while contributing to greenhouse gas emission mitigation (reduction and sequestration) through lower use of fossil fuels and higher carbon sequestration in soils.
2. Principles in the sociocultural dimensions	
2.1	Is rooted in the culture, identity, tradition, innovation, and knowledge of local communities
2.2	Contributes to healthy, diversified, seasonally- and culturally-appropriate diet
2.3	Is knowledge-intensive and promotes horizontal (farmer-to-farmer) contacts for sharing of knowledge, skills, and innovations, together with alliances giving equal weight to farmer and researcher.
2.4	Creates opportunities for and promotion of solidarity and discussion between and among culturally diverse peoples (e.g., different ethnic groups that share the same values yet have different practices) and between rural and urban populations.
2.5	Respects diversity between people in terms of gender, race, sexual orientation, and religion, creates opportunities for young people and women and encourages women's leadership and gender equality.
2.6	Does not necessarily require expensive external certification as it often relies on producer-consumer relations and transactions based on trust, promoting alternatives to certification such as PGS (Participatory Guarantee System) and CSA (Community-Supported Agriculture).
2.7	Supports peoples and communities in maintaining their spiritual and material relationship with their land and environment.
3. Principles in the economic dimensions	
3.1	Promotes fair, short distribution networks rather than linear distribution chains and builds a transparent network of relationships (often invisible in formal economy) between producers and consumers.

3.2	Primarily helps provide livelihoods for peasant families and contributes to making local markets, economies, and employment more robust.
3.3	Is built on a vision of a social and solidarity economy.
3.4	Promotes diversification of on-farm incomes giving farmers greater financial independence, increases resilience by multiplying sources of production and livelihood, promoting independence from external inputs, and reducing crop failure through its diversified system.
3.5	Harnesses the power of local markets by enabling food producers to sell their produce at fair prices and respond actively to local market demand.
3.6	Reduces dependence on aid and increases community autonomy by encouraging sustainable livelihoods and dignity.
4. Principles in the political dimensions	
4.1	Prioritises the needs and interests of small-scale food producers who supply the majority of the world's food and it de-emphasizes the interests of large industrial food and agricultural systems.
4.2	Puts control of seed, biodiversity, land and territories, water, knowledge, and the commons into the hands of the people who are part of the food system and so achieves better-integrated resource management.
4.3	Can change power relationships by encouraging greater participation of food producers and consumers in decision-making on food systems and offers new governance structures.
4.4	Requires a set of supportive, complementary public policies, supportive policymakers and institutions, and public investment to achieve its full potential.
4.5	Encourages forms of social organisation needed for decentralised governance and local adaptive management of food and agricultural systems. It also incentivizes the self-organisation and collective management of groups and networks at different levels, from local to global (farmers organisations, consumers, research organisations, academic institutions, etc.).

APPENDIX 5
PATTON'S GUIDE FOR PRINCIPLES



Source: Patton, 2018: 38.