ABSTRACT

Title of Thesis: DESIGNING AN ACCESSIBLE AGRICULTURAL GARDEN: CONNECTING SOLIDARITY & AGROECOLOGY

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This thesis explores the potential of agroecology as a transformative framework for guiding the transition of Bergamo's agricultural landscape toward sustainability, resilience, and community well-being. Grounded in the evolution of agroecology from farm-scale design to regional planning, the research investigates how this approach can integrate ecological methodologies and participatory action research in design to implement sustainable farming practices, rehabilitate landscapes, and cultivate solidarity-driven producer-consumer relationships. By emphasizing the interconnectedness of ecology, economy, and society, the study addresses whether agroecology can shape a district into a resilient landscape that enhances people's lives and promotes health and well-being.

Through an interdisciplinary lens, the thesis also delves into the broader concept of landscape, highlighting its role in social well-being and advocating for the protection and responsible management of landscapes as a fundamental human right. It explores the principles of landscape democracy and solidarity, aiming to empower communities to reconnect with their environments and promote ecological restoration through collective action and ethical practices. Ultimately, the research strives to contribute to the discourse on agroecology and landscape planning, offering proposals and strategies for actionable change in regenerative and organic agricultural systems that prioritize the needs and values of local communities.

DESIGNING AN ACCESSIBLE AGRICULTURAL GARDEN: CONNECTING SOLIDARITY & AGROECOLOGY

by

Patrick Robert Boyle

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University of Maryland, College Park, in partial fulfillment
of the requirements for the degree of

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Advisory Committee:

Dr. Deni Ruggeri, Chair
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DEDICATION

To the members of Consorzio Fa, the residents of Villaggio Solidale and Corte dei Massari, and all the people who taught me about the landscape, may your values and spirit be expressed in these pages.

To my daughter, for you have changed my life. All this hard work is for you.

And to my wife and parents for all your support, love,

ACKNOWLEDGMENTS

Dr. Deni Ruggeri, thank you. Meeting you changed my whole experience at the University of Maryland. I am so thankful for your dedication to making me a better researcher and designer. You gave me the chance to make a mark.

To Dr. Christopher Ellis, thank you for introducing me to regional planning. I found where my passions and expertise can be expressed. The Serpentine Barrens will always be a highlight of my formative years.

To Dr. David Myers, thank you for your willingness to guide me through the ecological design process. Your aptitude for diagramming processes taught me a great deal about graphical execution. Your guidance throughout these three years does not go without saying. You made a real impact on my success as a student.

To Marco and Chicco, thank you for welcoming me as part of your community. Thank you for always supporting us as we supported you all. This is solidarity.

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LIST OF ABBREVIATIONS

AMP: Adaptive Multi-paddock Grazing

CSA: Community Supported Agriculture

DUSAF: Destination of Use of Agricultural and Forestry Lands

FAO: Food and Agriculture Organization (of the United Nations)

FIEB: Fondazione Instituti Educativi Bergamo

GIS: Geographic Information System

PAR: Participatory Action Research

SOC: Soil Organic Carbon

UNSDG: United Nations Sustainable Development Goals

SECTION 1: INTRODUCTION

1.1 The Research Question

How can Agroecology serve as a Framework for
transitioning Bergamo's Agricultural Landscape
towards Sustainability, Resilience, and Community Well-Being?

This research question explores how agroecology serves as a framework for planning. Agroecology emerged in the 1980s for farm-scale design, promoting organic-certified production as an alternative to industrial farming methods. By the 1990s, it expanded to encompass the entire food system, integrating communities and ecological considerations. Agroecology developed into a means of building equitable, just, and accessible relationship-based market systems (Gliessman, 2018). In the mid-2000s, it adopted a political focus, aiming to dismantle the power dynamics that impede agricultural system reforms.

This thesis now takes the evolution of this approach to the regional scale for master planning rural districts using ecological methodologies and solidarity-driven participatory design. It looks to create a model for farm-level transitions, landscape-scale rehabilitation, producer/consumer relationships, and accessible pathways where communities can share culture and knowledge. These determinants aim to answer whether this framework can shape a district into a sustainable, resilient landscape that enriches people's lives and improves their health and well-being.

1.2 Principles

The following is a synthesis of the theoretical thinking in this body of work. It culminates the knowledge and experiences the author actively engaged in during his graduate studies, particularly through the Le: Notre Erasmus programs on landscape democracy, founded in part by the chair of this thesis. It also involves the nature of the college that the Department of Landscape of Architecture is under at the University of Maryland: Agriculture and Natural

Resources. It divulges the advancement of agricultural systems, ecological design, and structural interventions in the landscape.

Landscape

Some can misconstrue the definition of landscape. The landscape is viewed by many as a picturesque vision of nature or even someone's yard. Landscape architecture does not constrain itself to such a simplistic idea of the landscape. It involves a holistic, multidisciplinary approach to what landscape is and how it makes transformative changes to it. The Council of Europe Landscape Convention defines landscape as an area perceived by people whose character results from the action and interaction of natural and human factors (Déjeant-Pons, 2006). It is a key element in the social well-being of its inhabitants, and it intends for the people to protect and manage the landscape responsibly.

This thesis intends to promote this definition of landscape and what the author believes the work of a landscape architect entails. It includes the cultural roots of communities, highlighted by their structures and practices and their wants and needs for fresh air and open areas to connect with nature and one another.

The Right to Landscape

The Right to Landscape is a declaration that exemplifies the crossover of natural and human factors of the landscape with fundamental human rights (Figure 1). The landscape makes up the tangible pieces of the landscape: buildings, roads, forests, animals, humans, and the meaning that people give to them, as well as the intangible pieces, including the rituals and daily practices of people. Then, human rights, including justice and dignity, support life, liberty, and the pursuit of happiness. The crossover reveals the landscape as one of these fundamental human rights. All people have the right to access the landscape, free of privatization, and receive all its health, meaning, and community benefits. It introduces alternative ways to plan and construct the landscape, reducing conflict and generating diverse ideas (Egoz et al., 2018).

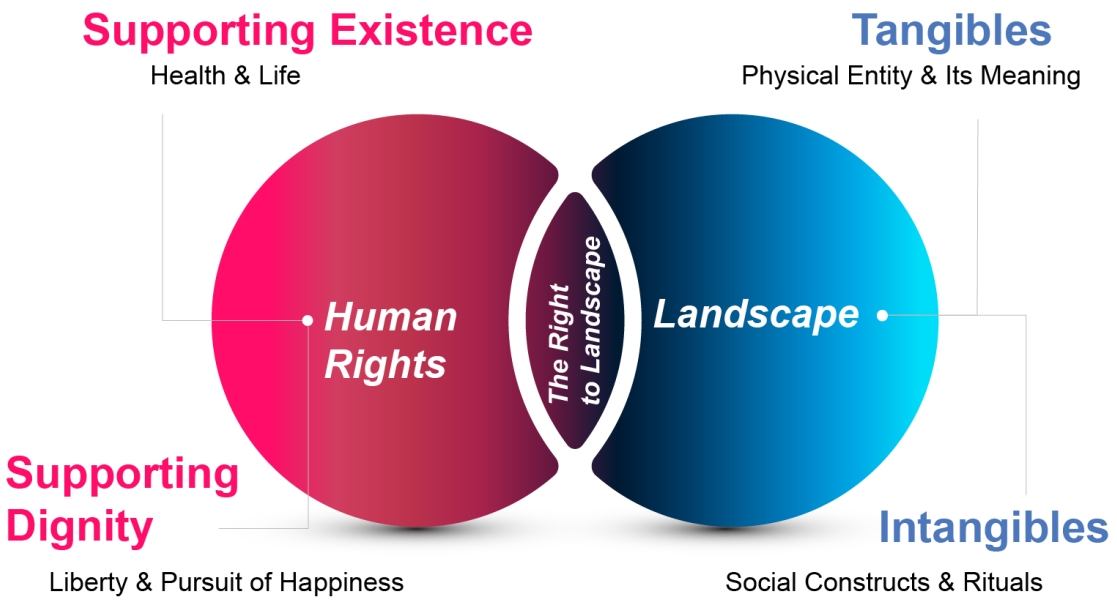

Figure 1: Diagram explaining the relationship between landscape and justice in the culmination of the right to landscape declaration. Image by author

Landscape Democracy

Urban development in an ever-changing landscape has severed the link between people and landscape, causing them to lose their symbiotic relationship (Egoz et al., 2018). Landscape democracy attempts to resolve the loss of the 'Right to Landscape' by empowering communities, enabling them to make place-specific goals, and participating in stewardship and activation of their community landscapes. By doing so, they can reconnect that lost link to the landscape and promote ecological restoration. This is done through collective action, participation, and ethical practices.

Solidarity

Solidarity, in this context, targets vulnerable populations and promotes inclusiveness within society. It strives to build the most substantial ties to universal welfare within its context. This type of solidarity goes beyond schemes of charity. It includes a notion of reciprocity in terms of

empathy toward neighbors and a shared responsibility to act as one political community with civic associations that promote trust and mutual support (Lahusen, 2018, p. 20-21). Italians frequently support people who participate in solidarity activities when they have social connections, are religious, or are considered worthy of help. Target groups in Italy benefit from ties, social capital, and solidarity. Political relationships elevate the importance of trust and civic engagement in the target group. Solidarity has increased in interest with higher migration rates of refugees into the country, economic crises have staggered over the last decade, contributing to budget cuts affecting disabled communities and others on welfare, and even more recently, the devastation of the COVID-19 pandemic (Lahusen, 2018, p. 127-167).

Agroecology

Participatory Action Research led to uncovering agroecology to develop the thesis (Cornish, 2023). As a student of academia, the chosen framework, agroecology, incorporates research and education. The sharing of knowledge is essential for the sustainability of change. Landscape Architecture is a multidisciplinary field, and because of all the systems it seeks to affect, agroecology fits the mission in its transdisciplinary approach. It confronts the challenges of industrialized agriculture and global economies and seeks alternatives such as solidarity-driven economies of reciprocity.

Moreover, for this economy to work, it must focus on a food system of local and sustainable products. A local food system must be diverse and resilient, and ecology must play a part. Ecology integrates soil health, nutrient density, and the microbiomes of fungi, building a holistic system that supports plants, animals, and humans while recycling organic waste at every step.

1.3 Making the Transition

Industrial Agriculture is responsible for 11-15% of greenhouse gas emissions, and transportation emissions contribute another 15-20% to the distribution of food on a global scale (Fair World Project, 2022). Agroecology models small-scale farming that feeds most of the world's population, creates resilience against intensifying weather events, and sequesters carbon, turning the tides on the effects of climate change. It favors this transition by supporting local food systems in rural communities and diversifying the landscapes that support healthy diets,

environments, and lifestyles for these communities. It brings light to the empowerment of the people and away from world powers.

Food Sovereignty

Agroecology intends to approach some of the world's biggest challenges. Food sovereignty is one of the issues discussed by many of its supporters. The Nyeleni Declaration, which originated in 2007 in Mali, defines Food Sovereignty as the right to healthy and culturally appropriate food produced through ecologically sound and sustainable methods and rural communities to define their own food and agriculture systems (Rosset, 2013). It puts the aspirations and needs of those who produce, distribute, and consume food rather than the demands of markets and corporations at the heart of food systems and policies. It prioritizes local over national markets and empowers family farmer-driven agriculture. It promotes transparent trade that guarantees just incomes to all people, ensures that the rights to use and manage lands are in the hands of those who produce food, and implies new social relations free of oppression and inequality (Figure 2).

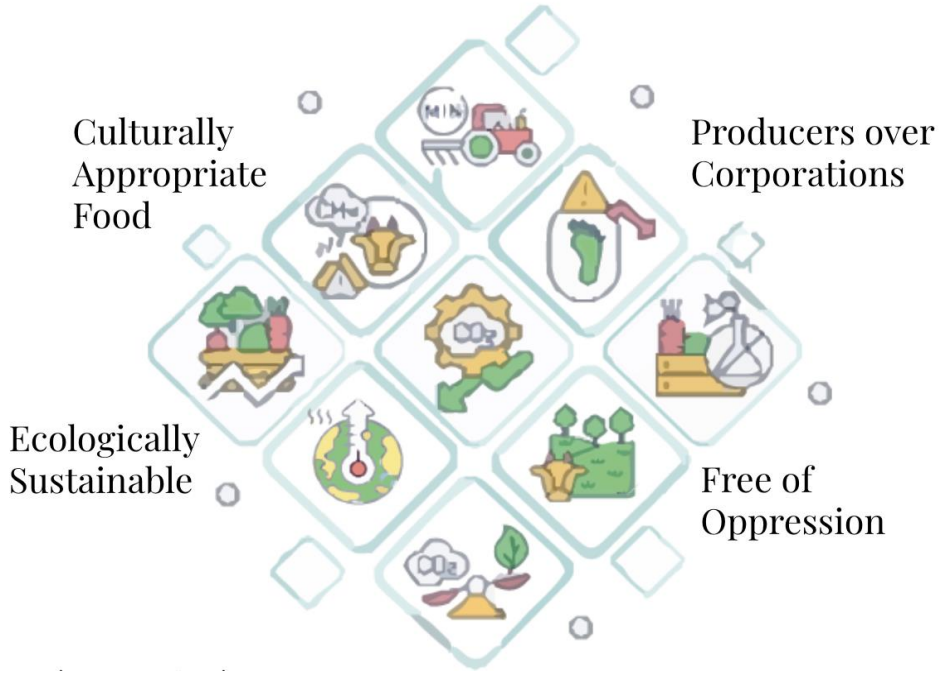

Figure 2: Diagram explaining food sovereignty: the intent of agroecology. Icons illustrate minimal tillage, neutralizing methane emissions, decreasing industrial impact, a balanced diet, carbon sequestration, no chemical use, climate mitigation, land rights, and carbon offset. Image by author

The Ten Elements of Agroecology

The redesign of this system is inherently complex, and so is the intended method of transitioning. It looks to simultaneously optimize social, economic, and ecological systems beginning with diversity (Barrios et al., 2020). Diversity means biodiversity: species of animals, plants, crops, agricultural practices, and land uses, as well as diversity in terms of players working toward the mission. Sharing of knowledge and responsible governance come next (Figure 3). To secure the transition, a government body must oversee the change, spread the word to others, and show them how to implement it. Community values, food traditions, and solidarity economies are next in line. They make up the bulk of what agroecology stands for, the people it seeks to support. And finally, efficiency, synergy, recycling, and resilience. These comprise the practices of regenerative agriculture that support ecological health and ecosystem services. The literature explains three ways to incorporate agroecology into a system: an ecological one, a market-driven one, and an educational one (Figure 4).

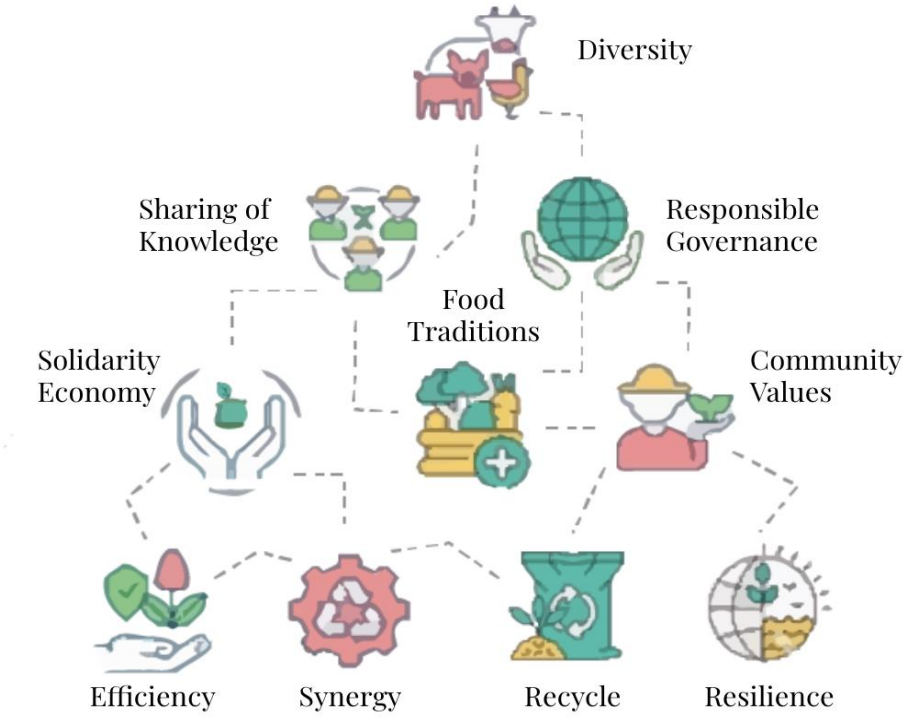

Figure 3: This diagram shows the interconnected nature of agroecology. Each icon represents one of the ten elements of agroecology developed by the Food and Agriculture Organization as a framework for optimizing food system redesign. Image by author

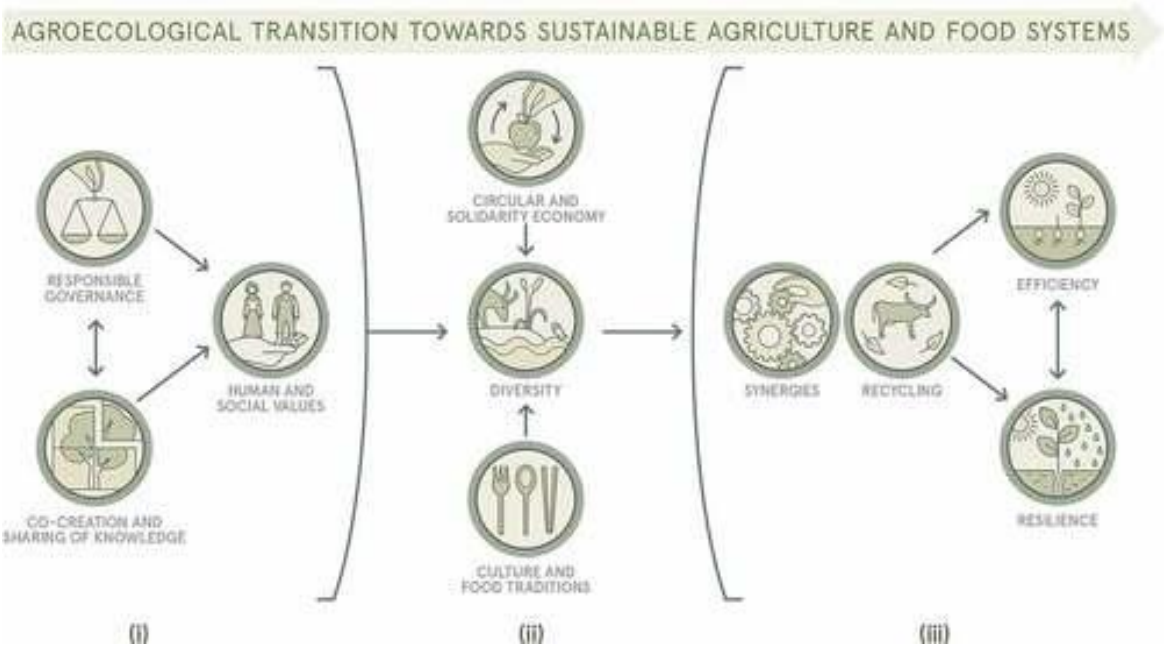

Figure 4: Dissecting a plausible theory of transformative change and agroecological transition in the education–governance–youth employment nexus through visual narratives based on the ten Elements of Agroecology. Source: Barrios, E. et al. (2020).

SECTION 2: PARTICIPATORY ACTION RESEARCH

2.1 The Community We Worked With

The Po Valley

The Po River valley is a natural depression framed by the Alps to the north and the Apennines to the south (Figure 5). In the southern part of the plain flows the Po River, the longest in Italy. To the north is a rich land in the lower plain named La Bassa, where the Region of Lombardia is located. This lower part of the plain is rich in water and is home to a band of springs called fontanili that arise from a high water table (Gomarasca, 2012). For centuries, this geographic phenomenon has made water here easily accessible to agriculture, making it fertile and abundant.

The State of the Region

Lombardia ranks highest nationwide in economic importance due to its agriculture and technology industries. It contributes 2.61% of the European GDP and 21% of the national GDP (Regione Lombardia, 2015). Famous for its production of wine, cheese, and dried meats, Lombardia is the source of Italy's many food traditions that residents proudly continue to follow.

The third most prosperous province in Lombardia is Bergamo, located just east of Milano (Figure 5). Many small farmers and factory workers here contribute to the production of goods. These rural towns help support the booming industries that make this region wealthy and attract migrants looking for a better life. To support them, many non-profits have emerged to serve their needs, house them, and help them find work.

These organizations help not only migrants but also all vulnerable communities affected by difficult situations. Bergamo has a rich network of organizations that partner to integrate immigrants and fragile individuals into the rich culture that has established itself here. The Kilometro Rosso Innovation District of Bergamo is significantly impacting the region, creating jobs and manufacturing opportunities throughout the region. On the other hand, the organic Bio-district of Social Agriculture also does innovative work, employing vulnerable populations to grow the organic agriculture industry that feeds and sustains this region. These efforts represent the tension between industry, agriculture, and social services in the region and how they are beginning to overlap.

Figure 5: Maps of Italy and the Po Valley locating the focus region and the study site in the Lombardia region and the Bergamo province. Source: edited by author

Consorzio Fa

The organization's mission is to support fragile and disadvantaged families, individuals, and children in pursuing autonomy through socio-occupational reintegration (Consorzio Fa). They protect them in two cohousing communities: Villaggio Solidale and Corte dei Massari. This graduate research project emerges from their mission to embed solidarity into their daily service work. These communities sit amidst the rural landscape in the towns of Lurano and Castel Cerreto in the southern portion of the province of Bergamo (Figure 6).

At Villaggio Solidale, they provide programming for differently-abled people, preparing them for self-sufficiency after their family members pass. They also have cooking and laundry services for residents to learn workplace skills and help them find jobs. Another area of focus is fostering children. Corte Dei Massari provides emergency housing for children and immigrants and a center for children and young adults on the autism spectrum. It also offers educational training for its residents and health and therapeutic services.

Consorzio Fa and its partners seek to establish bonds with the surrounding communities, building a culture of solidarity throughout the landscape and establishing trust and reciprocity between people. The locations of these communities are significant because within walking distance are forest preserves where residents of the surrounding towns recreate. One protects the fragile ecosystem of the fontanili, and another, a reestablished chestnut forest and a canal system that provides water to farmers in the region. In developing their occupational, educational, and health services, they seek to promote better access to these forests and other community resources throughout the landscape.

Figure 6: Context photos of the co-housing communities in Lurano and Castel Cerreto surrounded by agricultural land. Source: photographed by author

Partnerships

To achieve its mission, Consorzio Fa is acting in solidarity with several organizations. These organizations play a part in the governance needed to build civic engagement between the people they serve and the supporting community. Two of these organizations are already working towards agroecology and can be the entry point needed to begin the transition (Figure 7). Alchimia works in partnership to produce organic wine. They educate the public and employ underserved communities. FIEB has a history of socialized agriculture, teaching foster children how to farm in the early 1900s. Today, they have an Agricultural high school for young adults looking for an alternative educational experience.

These partnerships create opportunities to educate the public about agroecology, promote programs to activate it in the landscape, build careers out of it, and supply a local market with culturally appropriate food. Consorzio Fa is positioned to help create new opportunities for these organizations to expand their impact, incorporating the residents of their co-housing into like-minded programs to promote a sustainable agricultural system and enrich their lives.

Figure 7: Images of educational programs and agricultural training at La Porta del Parco (left) and Scuola per Lavorare nell'Agroalimentare (right). Source: Alchimia, ScuolaProf

2.2 The Approach

An Iterative Process

Participatory Action Research (PAR) focuses on change, promotes democracy, and challenges inequality. It is context-specific, often targeting the needs of a particular group. It requires openness to change and preparedness for iteration, action, and reflection, making it more sustainable. PAR seeks to give participants greater awareness of their situation and to take action into their own hands (Cornish, 2023). The PAR process organized by University of Maryland landscape architecture professor Dr. Ruggeri outlined a three-year project incorporating workshops, studios, and theses. The research for this thesis focused on summer 2023 and spring 2024 (Figure 8).

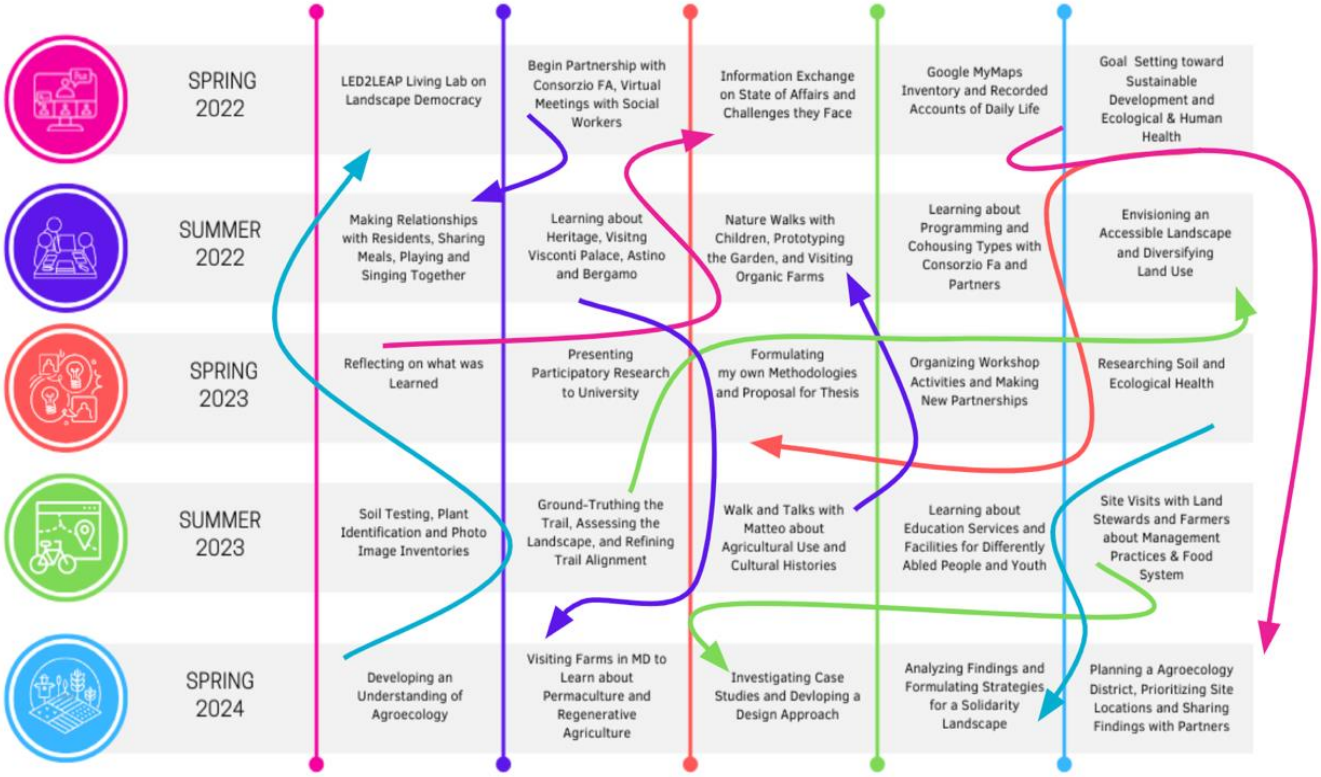

Figure 8: The methodologies used in developing this thesis evolved from a stepwise timeline of activities and processes. Arrows indicate the iterative process exemplifying the nonlinearity of PAR and how information influences the past and present.

The process began in 2022 with a listening phase with partners, followed by more personal communications and interviews in 2023 with local land stewards from the study area. These experiences then influenced the case study investigation of regenerative agriculture, learning ways to implement agroecology at the farm level and propose transitions. Following the PAR approach, the author continued the investigation by engaging with practitioners. Now informed of regenerative agroecology practices, he could see how they are being deployed in real life and learn firsthand from people who have already made the transition.

Triangulation of Research Methods

Figure 8 illustrates the project timeline, emphasizing the components tied to this thesis. Over three years, the author performed numerous tasks. To understand how they all transpired, the author used an illustration of the approach (Figure 9). The author deployed three methodologies to answer the research question. One is a landscape biography (Kolen, 2015), compiling a landscape history through a participatory lens. Site visits, community engagement, and fieldwork all contributed to telling this story. Community engagement involved co-creation activities and time spent with the residents of Villaggio Solidale and Corte dei Massari, which instilled values in the project and helped the author build empathy for the user groups. The second methodology is the overlay method described by Ian McHarg in *Design with Nature* (1969). The author performed a scientific analysis of the physical and biological processes occurring within the landscape. This process dynamically incorporates community values and histories, merging the first two methods. The author used GIS for mapping and conducted a suitability analysis of landscape typologies. These typologies come to life through the third methodology: a comparative analysis. The first two methods led the author to understand Italy's current situation and how it deploys organic agroecology practices. This comparison aims to reveal the complexity of how agroecology approaches similar challenges worldwide. It describes the methods and designs to employ agroecology and analyzes gaps in applying those methods to deliver on all ten elements of agroecology.

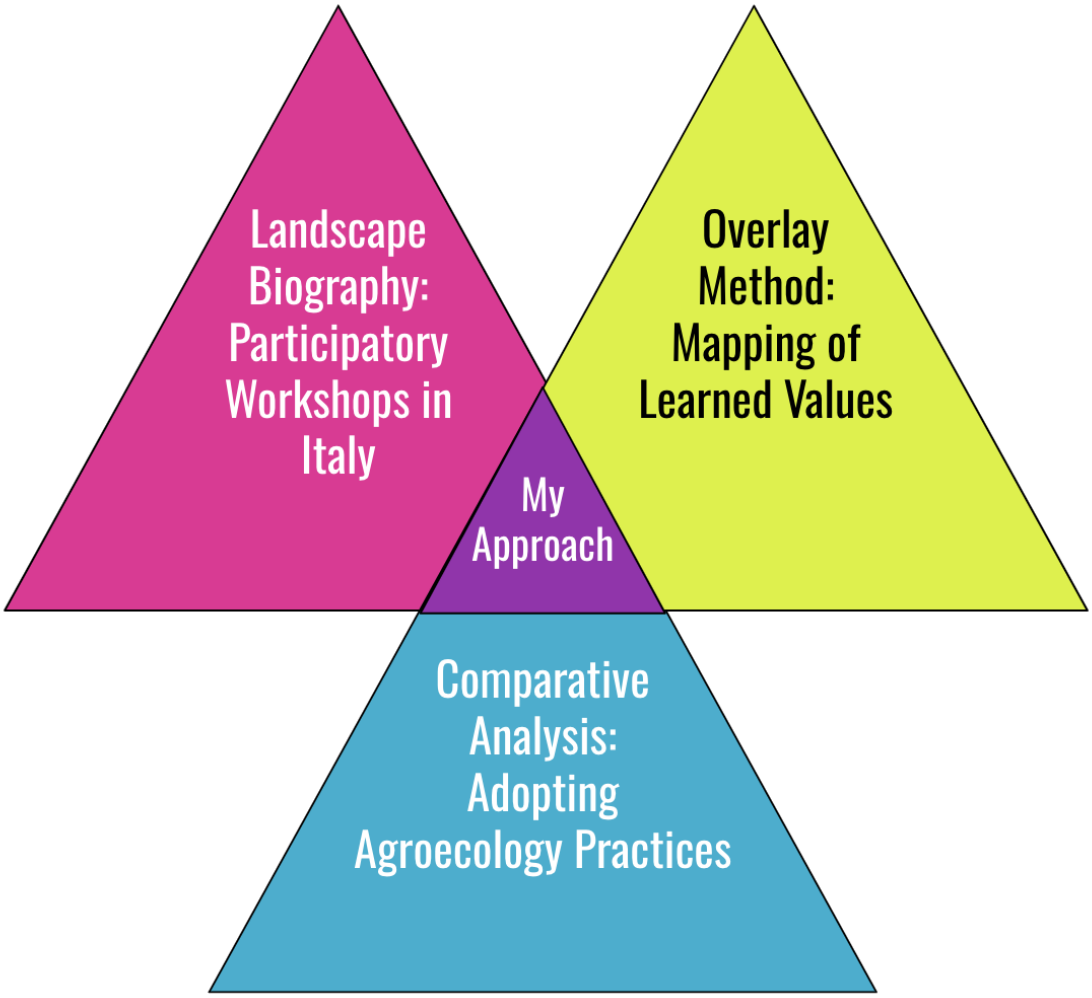

Figure 9: Diagram showing the intersection of each method used, implying a triangulation into a singular approach. Image by the author.

2.3 Drivers of Change

In every society, change is bound to happen (Figure 10). How it begins is the question. What drives people to act? A challenge facing society. Goals can be determined if a challenge or a need becomes apparent. In this context, social and environmental factors take the driver's seat in making change. Equity, diversity, and inclusion are strong determinants where solidarity has emerged in this region. This section uncovers some of the other drivers of change that emerged through the PAR research efforts. It also suggests a clear direction for the actions required to foster the transition introduced earlier in this document.

Figure 10: Graphic describing four types of societal change and the drivers that influence people to create that change. Source: Hitchens, R. (2022).

The Challenges: Climate Change and Anthropogenic Forces

In Italy's Po Valley and the province of Bergamo lies an agricultural district steeped in history and world-famous for its food production and cuisine. However, here, as in the rest of the developed world, people whose livelihoods rely on agriculture are left out because decisions and products are made for the benefit of global markets and trade. This undermines their decision-making power of what to grow and sell and creates a reliance that disempowers the people to feed themselves. By focusing on yield and efficiency, industrial farming produces monocultures that strip biodiversity from the landscape and deplete its resources faster than the landscape can regenerate.

Nevertheless, farmers and residents of Northern Italy have a resilient spirit that has endured centuries of socio-economic challenges. Today, they face a prolonged drought spanning more than twenty years. They are still recovering from one of the highest death tolls from the COVID-19 pandemic and quarantine measures that effectively dissimulated community bonds. This plan aims to support the region in overcoming these challenges.

Extreme Weather Events

Extreme weather events damage agricultural land, with high winds from tornadoes and hail storms that damage crops. The rainy season now comes in high-intensity storms instead of drawn-out periods of rain, making it hard to predict growing seasons. Since 2010, of the 236 extreme weather events recorded in Lombardia, almost 70% have occurred in just the past three years. These events will likely occur more frequently and with higher intensity in the years to come (Figure 11).

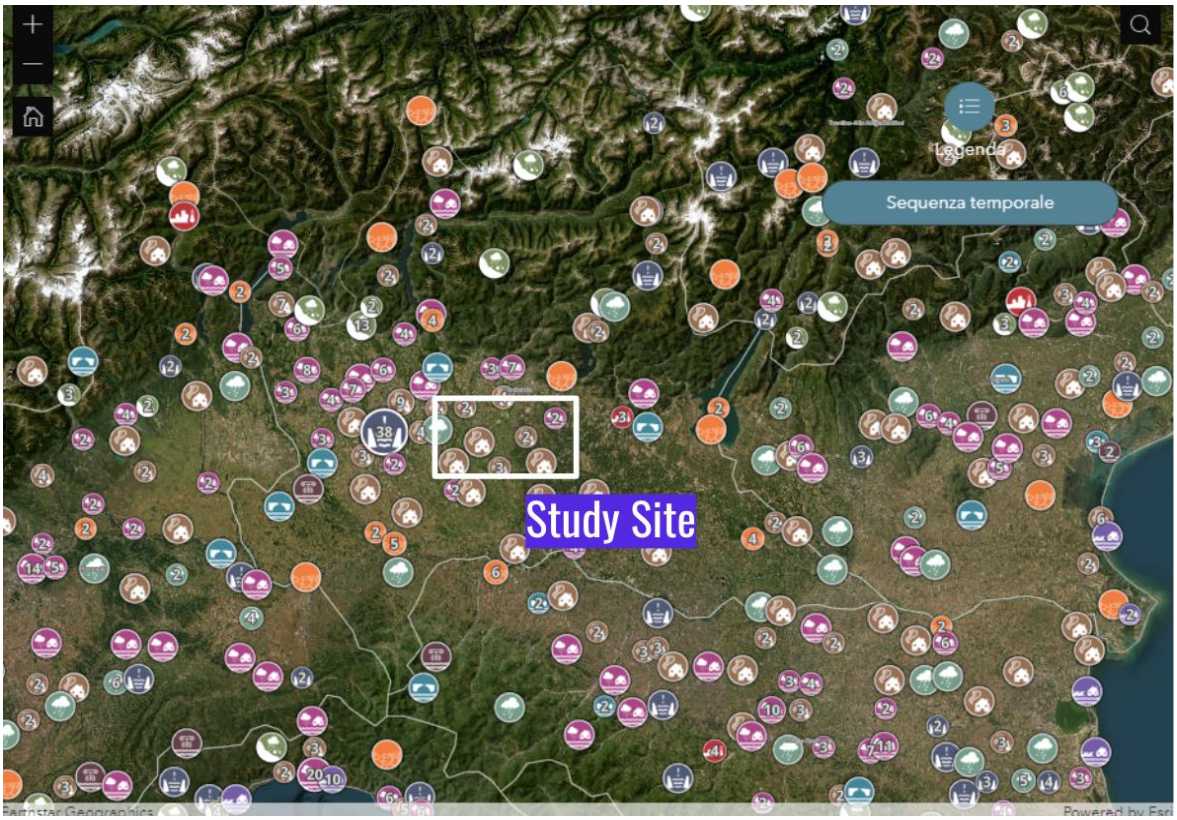

Figure 11: Map of the Po Valley with Lombardia at the center. The icons indicate all the extreme weather events between 2010 and 2023. Source: Osservatorio Nazionale

Prolonged Drought

In 2022, Italy experienced its worst drought in 70 years. The author experienced its effects firsthand during his first visit in the summer of 2022 on the occasion of the first Solidarity Landscape Workshop. Recent projections show that there will be a one-and-a-half-degree increase in average annual temperature through 2050. By 2070, there could be a three-and-a-half-degree increase, and by 2100, it could increase by six degrees (Municipality of Bergamo, 2021). The study region in the south of Bergamo is part of the region that will be impacted the worst.

After their growing season, the participants discovered that the fruit trees were producing unripe, dry fruit with flesh unrecognizable in color. Insufficient water and extreme heat were the

culprits. The Po River was dramatically affected as the lack of water narrowed its course, and the river became unnavigable (Figure 12). Aerial photos illustrate these changes, with agricultural land noticeably changing color from green to brown, reflecting how the ground was becoming harder and drier. This situation has significant implications for the landscape. For agriculture, it means a 50% loss in water supply available to food growers and a similar reduction in corn yields (Medri, 2013). Land value also declined and could continue to drop due to soil degradation.

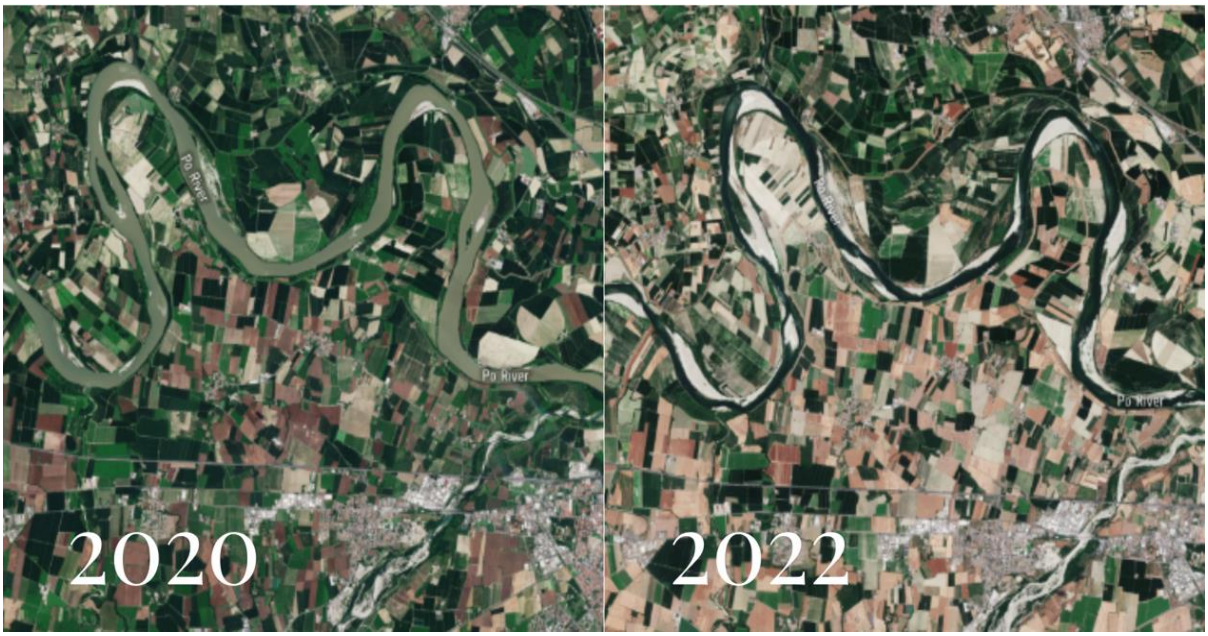

Figure 12: Before and after satellite images of the effects of the drought on the Po River and surrounding lands in 2022. Source: Askew, J. (2022).

Water Ecosystems

The Fontanili are a fragile ecosystem threatened by development and climate change. In 2021, Consorzio Fa purchased land to expand Villaggio Solidale and is in the planning phase for future development of the site, which is located adjacent to the Fontanili preserve. The fragility of this ecosystem has become far more apparent to the owners (Figure 13), and alternative designs are now being considered for this site.

Nature walks into the preserve with residents of Villaggio Solidale, who have provided observations of the current state of springs around Lurano. They are no longer filled with water. The changing frequency of rain events and decreasing snow accumulation in the Alps have lowered the water level in the aquifers. During one of the site visits, the author observed farmers pumping water from the fontanili, which further undermined their long-term resilience.

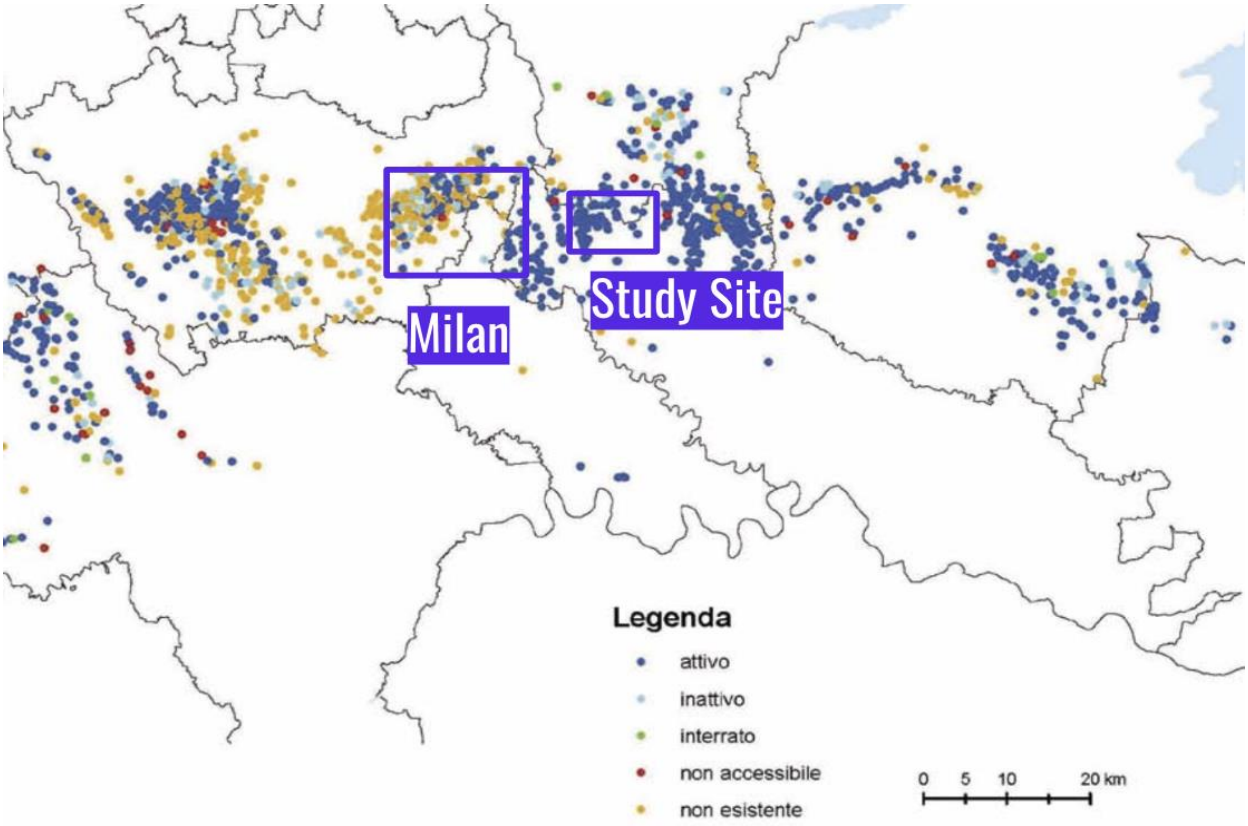

Figure 13: This map locates all fontanili across the Po Valley and their state of use in terms of water emerging at the surface. The box around Milan focuses on the dwindling number of active (blue) dots and the appearance of yellow (nonexistent) dots. The box around the study site shows a dense cluster of blue dots: active fontanili as of 2012. The Source: Gomarasca, S. (2012), edited by author

Air Quality

While researching the effects of the COVID-19 pandemic on the region, the author discovered why the people of northern Italy faced such severe impacts. He found that weakened respiratory systems caused by air pollution in the Po Valley led to worsened virus cases (Filippini, 2021). The air sometimes contains four times the safe amount of particulates (Figure 14). This is partly due to the inversion effect on the valley, which traps air between the mountain ranges. Additionally, the high emission rates from industries in the region, including agriculture, contribute to this issue.

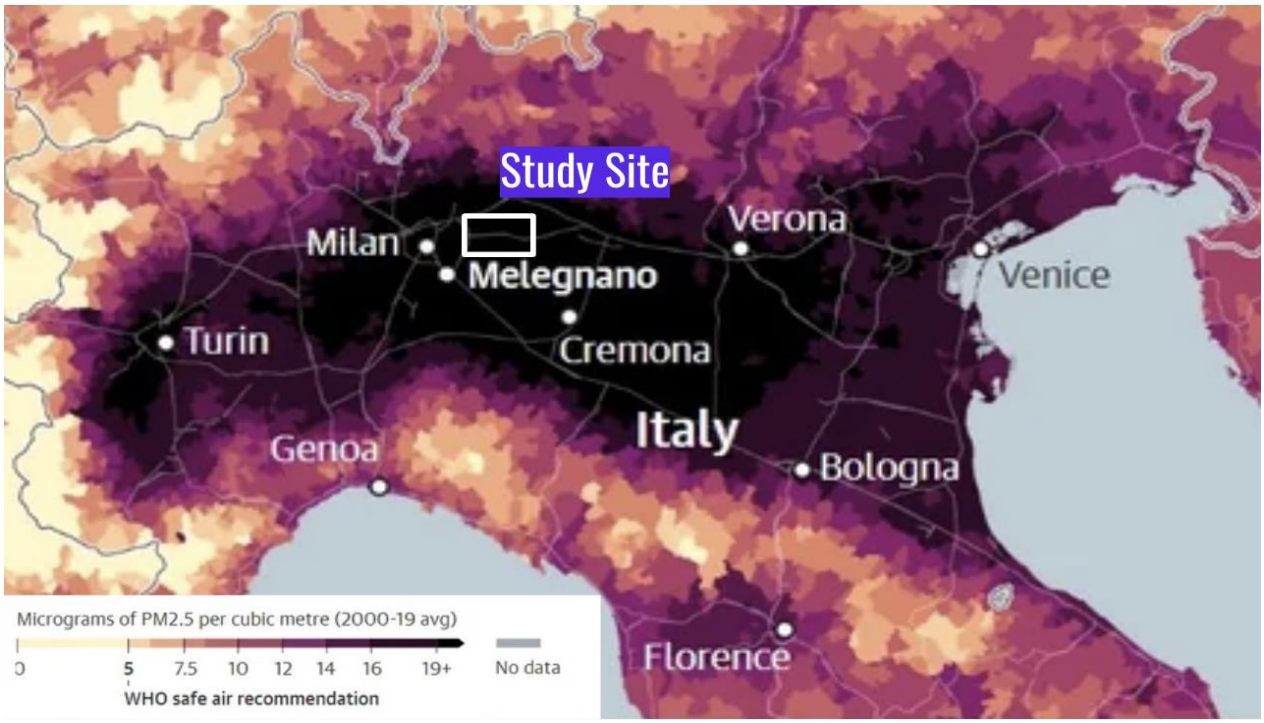

Figure 14: Map indicating levels of particulate matter in the air. The darker the area, the worse the air quality. The Po Valley represents the worst air quality in Europe. Source: Giuffrida, A. (2023), edited by author

Highway Proposal

To make matters worse, a new highway will be developed through the study area (Figure 15). This will impact air quality and emission rates, livelihoods, and land values. Another highway has just been implemented between Milan and Brescia and is showing its effects on the region. It has yet to reach its travel savings goal and has wasted valuable funding. The new highway will be funded with COVID-19 emergency funds and looks to damage lands in Castel Cerreto and bring more pollution to the region (Pagani, 2023).

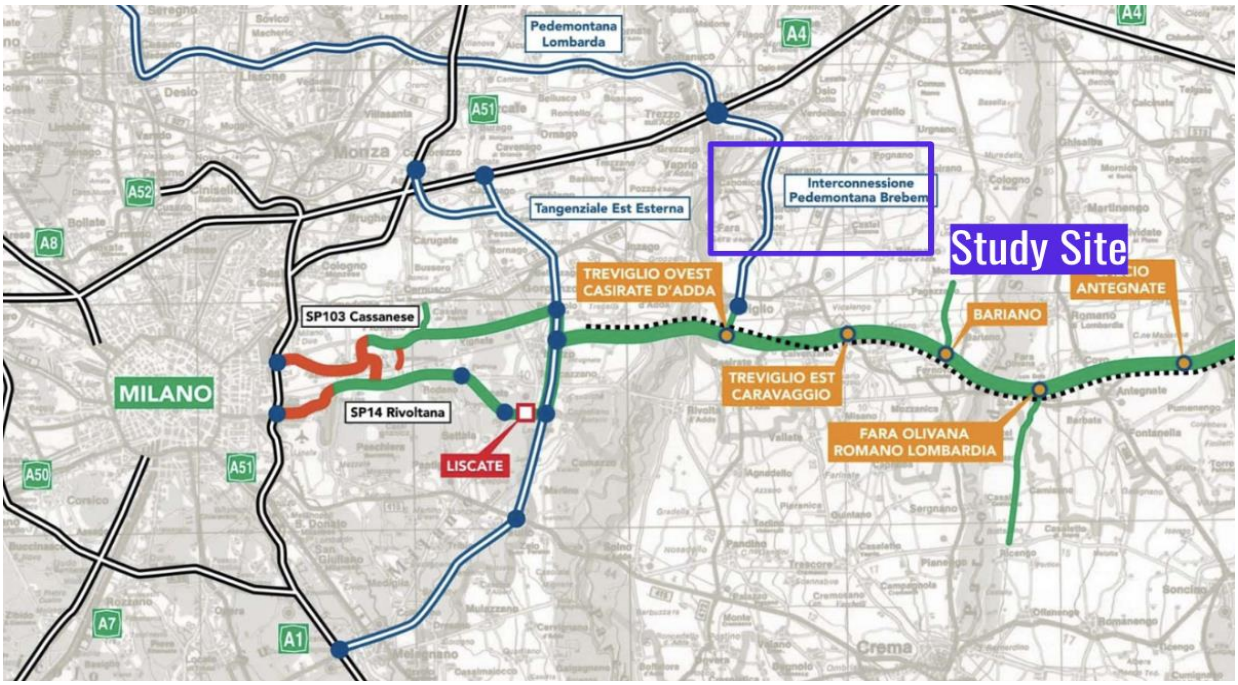

Figure 15: This map shows the new proposed highways surrounding Milan. White and blue indicate the highway that will cut through the study site, while green shows the one constructed to Brescia. Source: Piacentini Ingegneri. (2011), edited by the author.

Industrialized Agriculture

In Italy, as in other advanced societies, agriculture encounters significant challenges. The global economy prioritizes commodities and markets, focusing on industrial efficiency. Cheese and meat production are the primary agricultural activities, yet the animals are hidden from view (Lymbery, 2023). For decades, farmers have developed zero grazing to reduce labor costs, a practice where intensively reared livestock spend their entire lives indoors. Another tradition in the region is itinerant pastoralism, where sheep herds descend from the Alps in the winter to graze in the valley's dormant fields. This practice is now in decline (Genovese, 2022), with herds spending their time indoors. Fields primarily grow cereals, half of which serve as feed, while Italy continues to import millions of tons of soy for livestock.

In recent years, the European Green Deal policy (2020) has brought increased momentum to organic farming. Through the author's observations in the region surrounding Lurano, farmers have introduced an industrialized version of it (Figure 16). Row after row, greenhouses are covered and reflect immense amounts of solar radiation into the atmosphere, contributing further to rising temperatures. Afraid of the demise of the natural landscape, a strategy is needed to turn farmers to a different way of farming. A regenerative practice of organic farming that focuses on agroecology and the desire to create resilience in the landscape.

Figure 16: Pictures of agricultural fields in the study area. Left to Right: pasture grasses mowed, and chemical fertilizer being sprayed, intensive greenhouses, and a barren landscape of hay bales. Source: author

2.4 Goal Setting

As part of participatory action research, we conducted a goal-setting activity with our partners. By exchanging information, we gained a better understanding of the key issues throughout the landscape. These challenges informed our goal-setting to confront them, leading to actions to mitigate the problems. Using the United Nations sustainable development goals as a reference, we determined five project goals (United Nations, 2015). Goal 1: "Good Health and Well-being," translated into the project, aims to promote physical activity and balanced diets to improve public health. Goal 2: "Decent Work and Economic Growth," led to seeking support for local economies, creating job opportunities, and developing a food system that employs vulnerable communities. Goal 3: "Sustainable Cities and Communities," meant looking to establish affordable housing and sustainable transportation systems and to protect valuable land and fragile ecosystems by promoting a more conservative approach to urban growth. This would make land accessible to people and animals and provide housing for stewards of that land. Goal 4: "Life on Land," informed an approach that promoted climate adaptation and increased biodiversity to create a region resilient to extreme weather and a food supply that cannot be threatened so easily. Goal 5: "Partnerships." led to an emphasis on governance and implementation of these goals as the mutual responsibility of many parties (Figure 17).

Figure 17: Chart laying out the goals determined for the project. The UNSDGs are shown in boxes and numbered accordingly, as well as specific goals related to the challenges underneath Source: United Nations. (2015)., edited by author

2.5 Implementation

The “Green Deal” (The EU Green Deal) and “Farm to Fork Strategy” (European Union, 2022) (Figure 18) outline initiatives to reduce agricultural greenhouse gasses by 50%, increase organic farming by 25%, and reduce fertilizer use by 20% by 2030 across Europe. This strategy is behind the industrialized movement of organic farming in the region, making it more economically achievable on a large scale. However, it could also be leveraged to support more agroecology-minded people, including our project partners.

Figure 18: Diagram describing the goals for agricultural systems in achieving a greener continent of Europe. Source: European Union. (2022).

SECTION 3: THE LANDSCAPE BIOGRAPHY

The following describes the landscape biography method. It also includes concluding statements in italics that address the research question.

3.1 Landscape Inventory

This chapter discusses the process of learning about the landscape through inventory maps using data from the Regione Lombardia Geoportal (retrieved on June 5, 2023). The analysis of multiple layers and datasets helped to comprehend the physical complexities of the study area. Despite the challenges of inconsistent website access and language barriers, the team succeeded in finding datasets that provided relevant context for this specific area. The following maps offer insights into the geospatial understanding of the landscape, including its utilization and functionality.

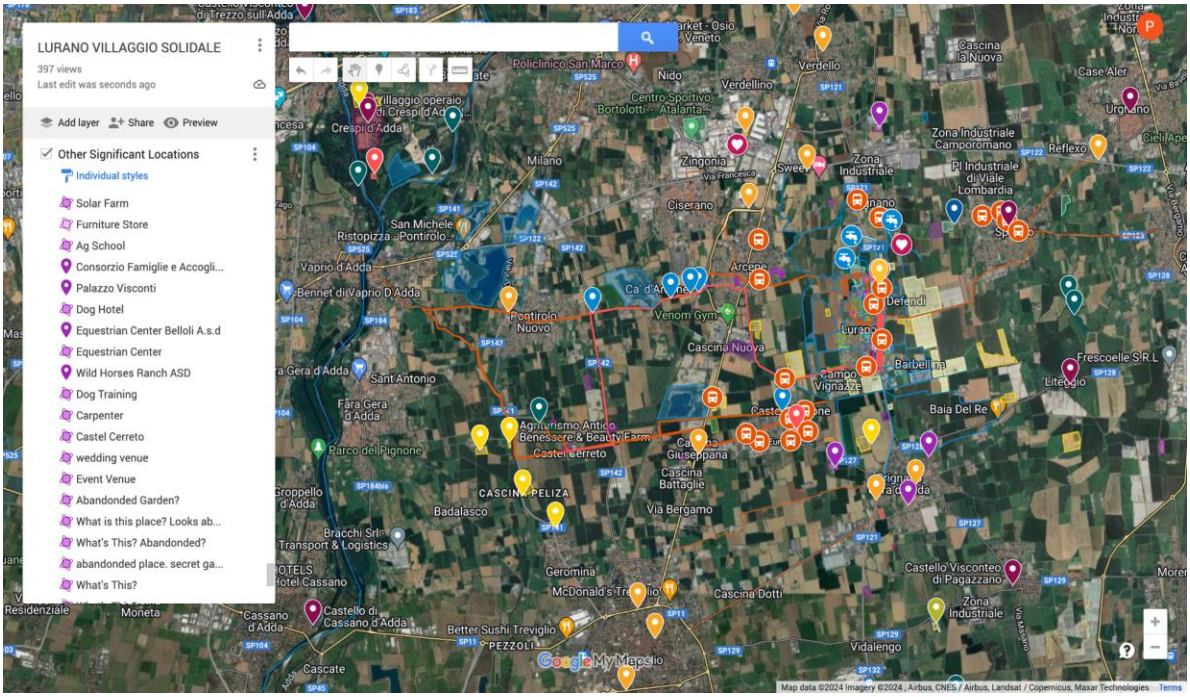

Figure 19: Preliminary mapping using Google MyMaps; examination of water linkages, bike routes, bus stops, agrotourism and food, heritage landmarks, and parks. Source: research team

Land Use

This data is part of the DUSAF project (Pagani, 2023) related to agricultural land use (Figure 20). It offered insights into the landscapes included in our investigation, providing an understanding of the agricultural uses in the region, such as horticultural uses, arable agriculture, and forestry types. Conservation areas consisted of meadows scattered across the landscape, making a patchwork integrated into the cereal cropping practiced in the arable zones. The meadows are permitted into perpetuity in a sustainable agriculture technique for cereal cropping to increase diversity. They are also mowed for hay to feed livestock. Our field research began with uncovering the locations of culturally significant farmsteads. It proceeded with additional research to determine their productivity and cover, ownership status, and participation in agrotourism or educational programs.

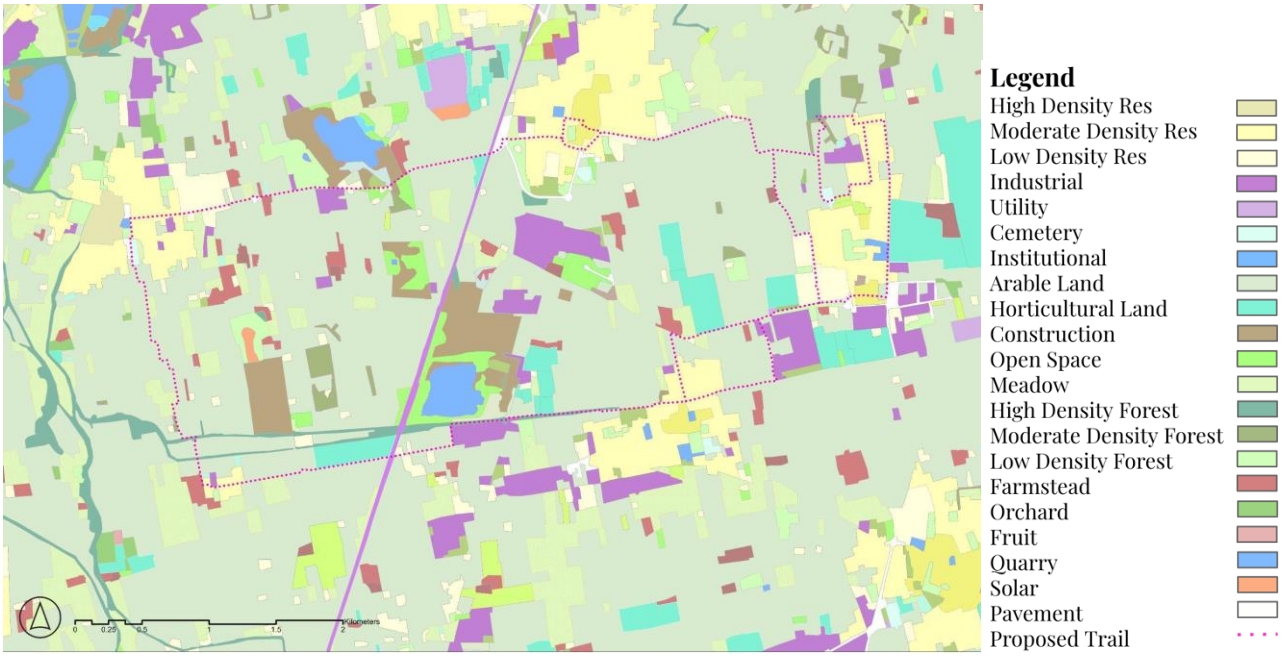

Figure 20: Land use map of the district: forest, agriculture, residential, industry, utility, water bodies, farmsteads, public institutions, and parks. Source: author

Built Environment

The author extracted data from the cadastral maps of Lombardia and compiled it to illustrate the structures that were built, shaping the landscape as it currently stands (Figure 21). This data highlights the size and shape of the townships using building and structural data sets and the entire landscape each township owns using community demarcation lines. It also shows the built corridors stretching across the landscape, such as roads, power lines, and canals, where roads divide the land and the extent of impervious areas.

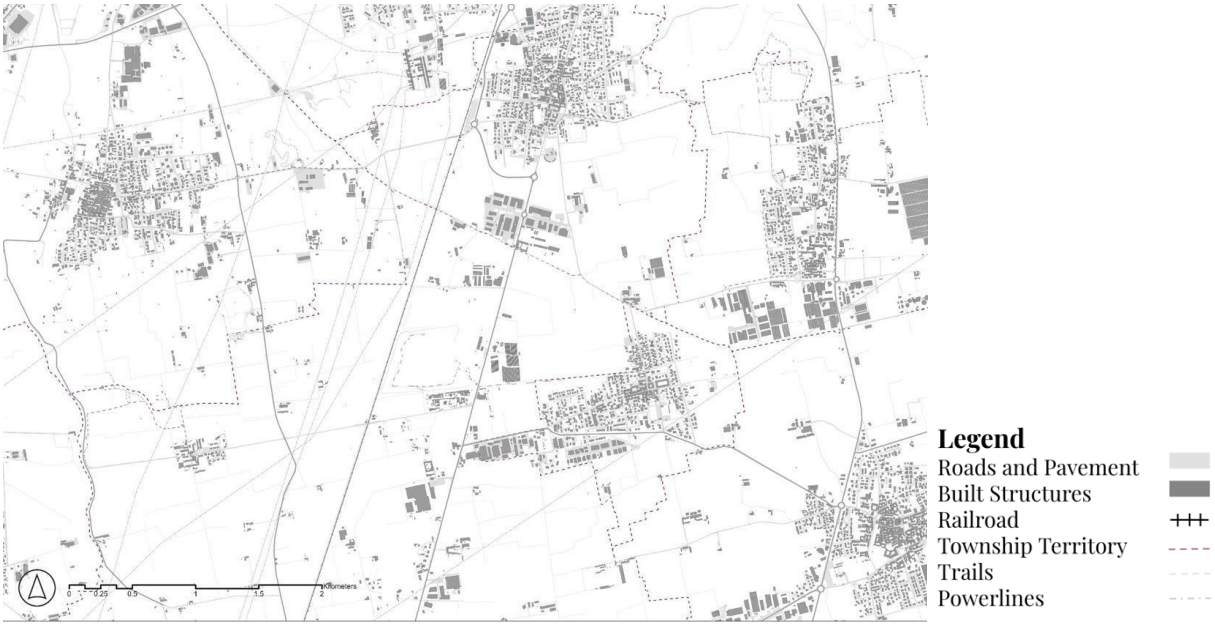

Figure 21: Map illustrating the built structures throughout the landscape: buildings, roads, pavement, greenhouses, railroads, power lines, and trails.

Industry & Growth

To illustrate growth patterns and permissible new construction areas, the author extracted data from the land use map, which singled out industrial, utility, and residential uses (Figure 22). He overlaid this data with roads from the cartography map and the proposed new highway alignment from “Infrastructure interventions planned in Lombardy” to observe how infrastructure aligns with accessibility and transportation routes. The presence of new warehouses and manufacturing buildings on the periphery of residential zones indicates urban sprawl. An emerging industrial corridor in the district center and power lines extending in various directions facilitate ecological connections and access throughout the landscape.

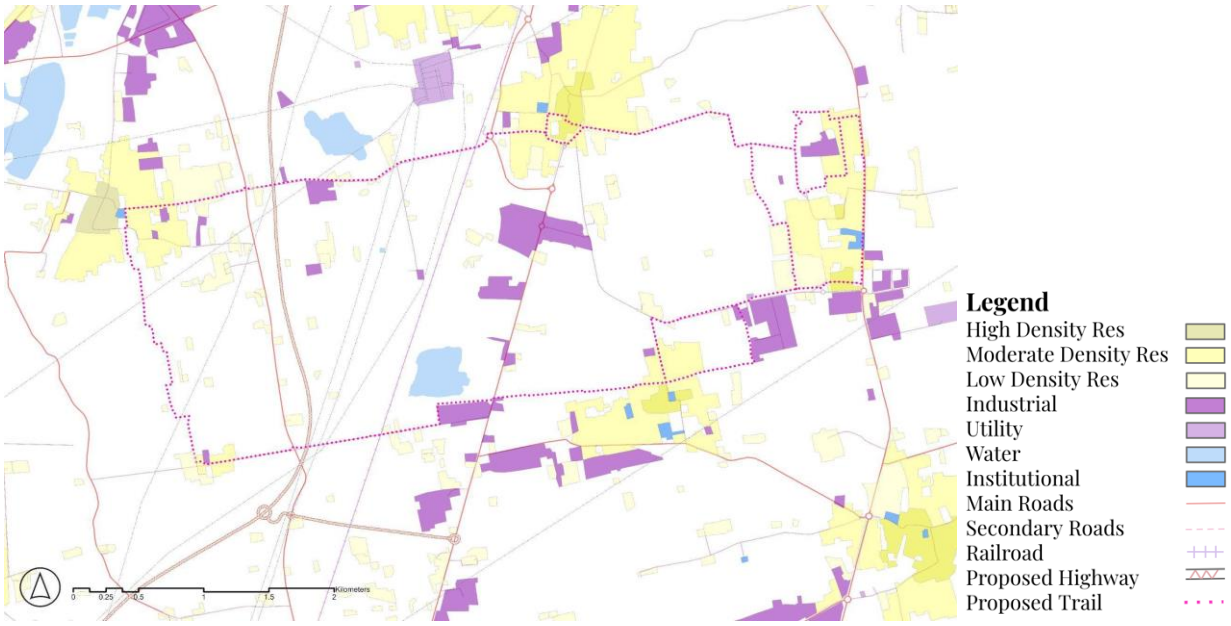

Figure 22: Map illustrating development patterns and the alignment of the proposed highway cutting through the district: industry, utility, main roads, and residential densities. Source: author

Patches & Corridors

An additional map of the existing conditions included data on parks and various types of forests highlighted, along with meadows designated for perpetual conservation, and individual tree plantings (Figure 23). The author updated the dataset by incorporating additional trees visible in recent satellite imagery, ensuring an accurate depiction of windrows and plantings along parcel edges and canals. The map illustrates patterns of large ecological patches within urban areas and others scattered across the landscape, with meadows predominantly adjacent to forested areas. Corridors appear as narrow strips, except for notable features such as the western riparian corridor and the east-west canal running alongside the trail.

Figure 23: Map illustrating the landscape ecology in the district, where concentrations of natural environments exist, and how they are connected or fragmented: the forests, parks, meadows, windrows, riparian corridors, and urban trees. Source: author

Hydrology

Topographical data is necessary for any landscape architect to understand how water moves across the landscape. The author derived this information for the landscape from Lurano to Castel Cerreto from spot elevations in a cartography dataset and used ArcGIS Pro to generate a topographic relief in the context of the study area (Figure 24). This map was later overlayed with maps of irrigation canals and waterways. The result was a depiction of the hydrological systems and the valleys, ridges, slopes, and plateaus across which water flows, moves, and eventually settles.

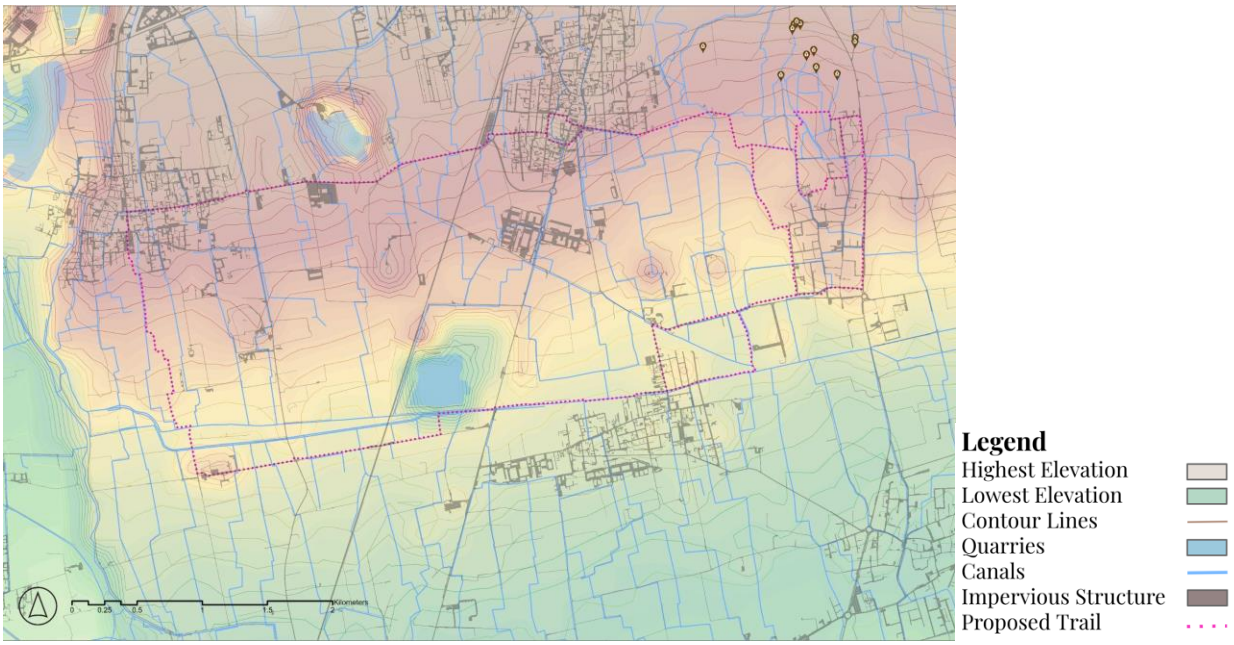

Figure 24: Map illustrating the typography across the district, the elevation change, and land formations that determine the flow of water and where it is captured: contour lines, irrigation canals, streams, roads, impervious surfaces, and bodies of water. Source: author

Geology

In agriculture, as in landscape architecture, understanding the soil composition is essential to determine suitable vegetation and crop growth. In this study, data from a soil survey was combined with contours to illustrate associated landforms (Figure 25), providing insights into hydrology and subsurface drainage capabilities. Dark blue areas indicate regions with high water tables and gravelly soil, while lighter shades of blue signify deeper soil profiles with better drainage. Clay soil, depicted in orange, has minimal drainage but retains water well. Yellow areas represent silty soils; lighter shades of yellow indicate higher sand content and improved drainage. Additionally, spotted swaths within these areas indicate high concentrations of calcium nutrients, enhancing soil fertility and suitability for cultivation.

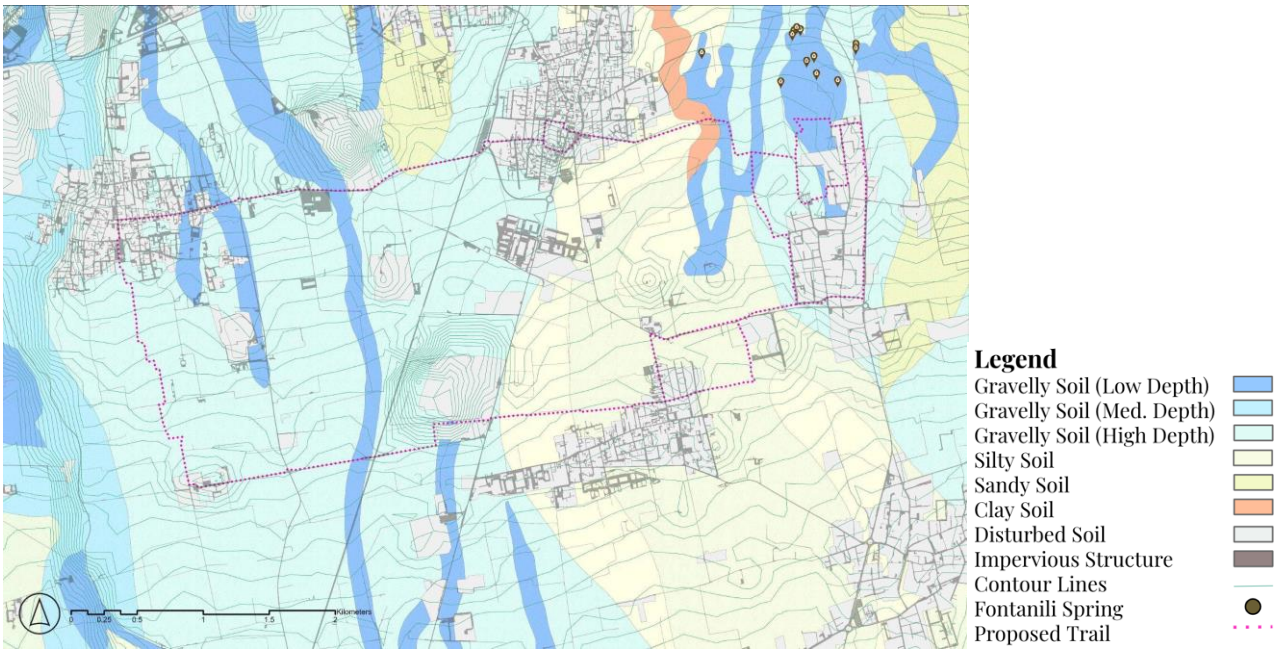

Figure 25: Map illustrating the soils in the district and the drainage capabilities of those soils in context with the typography: gravelly soils, sandy soils, silty soils, clay soils, contour lines, and disturbed urban areas. Source: author

3.2 Site Visits

As part of participatory action research, the research team participated in listening sessions with partner organizations and took guided walks. We purposefully chose each site visit to align with the project's goals. The learning objectives focused on solidarity, agriculture, conservation, and heritage. The twelve visits highlighted significant projects, initiatives, and public spaces where community members spend time cultivating the region's culture. It is important to note that these visits encompassed learning across overlapping themes. As such, the findings from each experience were analyzed holistically, leading to insights with regard to the local's unique understanding of solidarity, agriculture, conservation, and heritage-benefiting practices (Figure 26).

Solidarity

In this research, four site visits were especially insightful in learning about solidarity. At La Porta del Parco, the research team met with employees and volunteers of Alchimia. This social cooperative owns and operates a large open space featuring a children's park, picnic area, pizza kitchen, community garden, and vineyard. The space allows the community to gather, share culturally appropriate food, learn how it is made, and grow their own food. An interview with Marco Zanchi (2023, July 12) initiated a conversation about their partnerships with other non-profit organizations, such as Oikos, which employ disadvantaged people to grow and maintain vineyards. Marco talked about the first steps in establishing an organic vineyard: the rehabilitation of soils and their networking efforts with other culturally relevant, agroecology-minded sites in and around Bergamo.

Another insightful visit took the project team to Areté Social Cooperative, the initiator of a green district in Torre Boldone, on the eastern edge of Bergamo. The non-profit's mission seeks to reintegrate formerly incarcerated people into society as organic farmers. A tour of the property led by marketing and commercial manager Athos Mazzoleni (2022, August 21) provided the team with valuable information about sustainable irrigation methods, cropping rotations, and cover cropping practices. During the visit, we learned that the organization holds "volunteer days" with businesses and corporations seeking to contribute part of their time to advance social justice. A productive farm and workspace, Areté has a marketplace for fresh produce and local

Figure 26: Chart showcasing the twelve site visits conducted in the landscape biography. A color code indicates the learning objectives associated with each visit. Image by author

goods brought to market by a collective of organic producers promoting a local food system. The cooperative also runs an educational kitchen that teaches the public to work with uncommon produce, creating more balanced diets for the well-being of people throughout Bergamo's region.

In a meeting at Treviglio's "Carlo Cameroni" main library, the project team met the assistant mayor of the municipality, the research team, members of Consorzio Fa, and their partners. A discussion took place on the goals for the project and a preliminary vision for bike trails and linkages in the landscape. Treviglio's officials shared their concerns about funding such an ambitious vision. Still, they showed interest in its possibilities and suggested possible connections to their ongoing projects to establish an urban forest, a bikeway, and trails connecting Castel Cerreto to the city.

In the town of Pradalunga, north of Bergamo, we visited a nursing home operated by a branch of Consorzio Fa to learn about housing options and adaptive reuse possibilities for more affordable and diverse accommodations in the study area. Walking along the Serio River bikeway next to the nursing home also taught us about trail standards in the region, as well as the facilities for recreation and safety and accessibility linkages needed for soft mobility. Stopping points along the trail created meeting points for travelers and community members to interact, such as cafes and bars, calisthenics equipment, dog parks, skate parks, and BMX. The trail is within walking distance of the nursing home, making it easy for residents to engage with the river and the public spaces.

These visits led participants to enter into a continuous feedback loop with the research team, consistent with the nature of PAR projects. Many of the people we met have attended project year presentations year after year and are actively involved in supporting the vision we co-created. These visits have instilled the presence of Consorzio Fa in the community, constructing the necessary social capital for political and civic organizations to gain trust and for the project to gain traction. These visits informed the author about the importance of the need to create open spaces that produce food and ecology, while also engaging culture within walking of community centers and residential areas. Even more importantly, they taught the author the significance of making attachments to food, creating a landscape that supports agricultural crop diversity, is beautiful, and changes the attitude of people experiencing it.

Education can improve health, so incorporating knowledge and public access solidified our objective to create solidarity-driven landscapes.

Agriculture

The agricultural school, Scuola per lavorare nell'agroalimentare, in the town of Castel Cerreto, is a new endeavor funded by FIEB, the Foundation that owns and manages much of the surrounding ag land. The school started in 2009, but its new facilities opened in 2021. The school's principal, Clay Cassis (2023, July 13), organized a tour and presentation to teach the research team about their educational mission. He and other teachers presented the structure of the school, the students, and the curriculum to the workshop team. We discovered that students attend this school to pursue an alternative learning experience and that many of them struggle with traditional learning methods while excelling in hands-on tasks. The curriculum covers ecology, biology, and agronomy on an individual level, emphasizing holistic fieldwork practices. Students are responsible for maintaining the farm and school property and volunteer to upkeep other landscapes in the region. The students learn about current agricultural practices using machinery, technology, and traditional practices using hand tools. The school enrolls students in internships and study abroad programs and ensures job placement. We learned that some of their students are already partnering with nonprofits like Alchimia, where they tend to greenhouses over summer break and provide heritage grain species to a local bakery. Developing stronger ties between this project and the high school could help incorporate agroecology-informed growing practices into their education and show the validity of our vision.

In the summer of 2023, the author contacted and initiated a dialogue with the Castel Cerreto Social Cooperative, housed in Cascina Pelesa, a historic farm in the study area, to learn more about their operations. We met farm manager Fabio Proverbio on July 13 over lunch to learn about his vision, the farming operations, the challenges organic farmers face in the region, and their need for more knowledge and scientific insights. He addressed the threat of the proposed highway that will cross the Castel Cerreto landscape and his involvement in fighting it. He told stories about harvest festivals that united the community in a shared response to seasonal fresh produce. He explained how his farm and others create dishes highlighting the seasonal produce that each farm produces, creating a holistic view of the organic farming practice throughout the province. Fabio also told his career story, including how he went to university to be an

agronomist, how he ended up farming in Castel Cerreto, and the district's challenges in transitioning away from commodity farming. He explained why he started the self-picking farm with fruit trees and asparagus. He described the context of water availability on the farm, that he has a well on the property but also is forced by law to pay for water that flows in irrigation canals along the farm, and that during the drought, he had to cut back on production plots to save water and produce fruit where he could.

This meeting significantly enhanced our understanding of organic farming in the study area, including their specific practices and the broader context in which they operate. Fabio gave the team very important, detailed information on organic farming practices and the associated certification requirements. He emphasized the necessity of buffer zones to protect his farm from chemicals and external influences, surrounding his perennial plots with large patches of corn fields. Additionally, the social cooperative hosts visits from children's groups and participates in agricultural and cultural festivals across the province. We learned about existing connections Consorzio Fa partners have with the farm, bringing groups to engage with food, despite limitations in accessibility for many of the consorzio's clients. This farm serves as an exemplary model of agroecology in action, providing a community hub for learning about and promoting sustainable practices throughout the district.

These visits developed the possibility for agroecology to be spread throughout the district. They are the potential entry points, with the coordinated governance of Consorzio Fa, that the FAO outlined for successfully implementing the ten elements of agroecology. They introduce the inclusion of youth employment and education in agriculture to the project. Both partners encouraged the author to locate areas where more educational agriculture could be introduced, in closer proximity to community centers for people of all ages and abilities to access while also improving their physical health and relieving the reliance on vehicular transportation. The plan now prioritized making connections to agricultural heritage sites and other infrastructure projects, making linkages between Treviglio and Castel Cerreto more relevant.

Conservation

Additional site visits focused on two landscapes within biking distance of Lurano. Renova Park, managed by the World Wildlife Fund, is the site of a restored forest patch capping a landfill. Marcello Fattori cooperated by participating in an informal interview and tour of the park with the research team on July 13, 2023. During our visit, Marcello said in an informal interview and tour of the park with the research team. “Nature has its own rules. Understand nature as much as you can. You can guide nature, but its rules must be followed.” Ecological systems can only be forced to do so much. When industrialization is introduced into the landscape, it cannot function as a natural system; it must be propped up using fertilizers and other inputs that do not contribute to ecology. This type of approach brings much stress on the ecosystem and everything living in it. That stress affects their health and ability to adapt to changes in climate and physical use. Agroecology looks to work with the rules set by nature and coordinate with them. At Renova Park, they look to do the same. Bee hives provide pollination services to the growing forest and an opportunity to sell honey. Horses and donkeys promote therapeutic benefits from seeing and interacting with animals in the landscape and produce ecological benefits by recycling organic waste and managing grasses. Birds are usually the first macro-fauna to return to a restored ecosystem once smaller invertebrates return. At Renova Park, birdhouses seek to manage bird populations and bring back species diversity. The park has a whole trail system, conservation areas, determined picnic areas for events where larger disturbances are allowed. Marcello also showed the workshop team the beginnings of a small farm plot incorporating edible herbs and fruits into the park. He spoke about the ambitions of continuing this growth and establishing a profitable market share of e of production, but he needs assistance. Partnerships and support will be meaningful in continuing their transition toward agroecology.

A few kilometers from Lurano, in the municipality of Spirano, Parco di San Rocco celebrated a wealth of community assets. It is home to a fontanili preserve that is dry. In response, alterations have been made to pump water into a large fishpond in a natural depression. The park has a promenade of lined trees and open spaces, playgrounds, picnic tables, and art installations. There is also a chapel where community members come to pray, and weddings take place. This park is acting in conservation in a different way than Renova Park. The planting of

trees outside of the riparian area, where the fontanili used to be, protects and shades the area so other vegetation can thrive. Since the springs no longer produce water, the park functions in different capacities and the community unity is still active there. The park retains a cultural value and incorporates a diverse setting and reprieve.

Our findings from these visits reveal the challenges of conservation management, which requires more labor than is currently available or funded. Success demands greater involvement in managing the vulnerable natural landscapes of the region. They also demonstrate the ingenuity of parkland managers, who employ creative methods such as incorporating animals for land management, facilitating natural selection through competition and forest thinning, and adapting land use to current conditions by financing public work projects and integrating recreational activities. These approaches contribute to planning solidarity landscapes that expand existing natural areas, increasing forest canopy depth, patch size, and biodiversity.

Heritage

The researchers selected four sites for their cultural heritage to explore the region's history and its ties to religion, political history, folklore, and industrialization. Astino Valley is an organic district and heritage site in the city of Bergamo. It is home to the Astino Monastery, a historic complex being repurposed into a hub for local food production and education, complete with laboratories, restaurants, a wine bar, exhibition halls, a museum, and a botanical garden. We organized a tour with Stefano Zenoni (2023, July 16), a municipal official responsible for environmental policy and planning. He discussed the agricultural district's intent to become completely organic and diversely productive by enacting a commitment statement to contribute to the organic movement. To increase diversity, leases are agreed to following a plan for mixed-cropping contributing to the Slow Food movement. The valley comprises vineyards, orchards, flax, hops, small fruits, herbs, and corn (European Landscape Convention, 2021).

Stefano explained the practice of harvesting and growing flax to produce linen. The vineyards practice various growing habits, and tests are conducted on their effectiveness for grape yields in changing climatic conditions. The district is also part of a conservation park protecting the hills, and forest stands around the city from further development. A central feature in the district is a biodiversity garden with hundreds of heritage species and educational signage about their lineages and how they traveled to the region. The garden encourages visitors to take

seeds and plant their own gardens with them. It is a valuable example of how culture and agriculture can be intertwined to create a place where people can educate themselves and change their lifestyles and attitudes.

Not far from Consorzio Fa's headquarters, in the municipality of Brignano, The Visconti Palace was built in the 16th century by the ruling family of the Duchy of Milan as a summer residence. The canal surrounding the palace derives its water from the Brembo River, through a system of canals built in the 1300s across our study region. The Visconti crest illustrates a child in the mouth of a mythical dragon named Tarantasio, who lives on in folktales around the region. The palace is now used as a municipal office and community event center. It holds a gallery of masks and illustrations representing the people of life in the Duchy of Milan. The frescos on the walls tell the story of the family and their control over the landscape. The former garden—now used as a parking lot--features towers that were once aviaries full of birds to fly through the garden and be enjoyed by the family and its guests. This visit ties into the relevance of storytelling, the historical canals, and the importance of ecology throughout history.

The toponym *Città Alta* (Upper Town) refers to the oldest part of the hill town surrounded by walls and perched on a bluff overlooking the landscape below. It holds significant importance in Italian history, being one of the few walled cities in Europe. It features stunning Catholic cathedrals and religious artifacts. Numerous museums showcase histories spanning different eras, including discoveries of ancient Roman sites. The food culture in *Città Alta* is vibrant, featuring many Michelin-star restaurants that offer a taste of Italy's and Lombardia's culinary traditions. This area proudly exhibits Bergamo's culture on a grand scale, reflecting the city's rich heritage cherished by both locals and visitors.

Crespi d'Adda is a UNESCO heritage site along the Adda River. It is a historic village built to house and make comfortable living for manufacturing workers at the turn of the 19th century. The site is a stop along another bikeway in the region that reaches north to Lake Como. There are connectors to this trail from the city of Milan, accessible by road from the study area. The bikeway connects to historically relevant sites and follows the embankment of the Adda River. There is even a park in the floodplain with wood statues of native animals and Tarantasio, the dragon also visible in the seal of the Visconti family. Connecting physical activity to heritage creates an experience that people enjoy and want to participate in.

These visits provided insights into the significance of heritage in community and culture. They emphasized how heritage sites attract community engagement with their surroundings and highlighted the importance of infrastructure to safeguard these places. Without public access and the establishment of community gathering spaces and active trails, these sites face the risk of being overlooked and potentially replaced by residential developments or privatization. The visits aided in identifying meaningful places valued by the local community, guiding the alignment of the shared-use trail to showcase these sites and create enriching experiences along the route.

3.3 Building Empathy

Participatory Action Research (PAR) involved immersion in the lived experiences and perceptions of Villaggio Solidale residents, listening firsthand to their aspirations for the future. Establishing strong bonds with the community was pivotal, prompting our team to organize various participatory activities (Figure 27) aimed at engaging residents and understanding their concept of solidarity.

Together with a group of twenty-two children, we constructed a prototype garden during an annual ceremony, fostering trust and camaraderie through shared activities like games and meals. These interactions not only facilitated a cross-cultural exchange but also deepened our understanding of residents' food culture and preferences. Attending local celebrations such as clown shows, raffles, and music performances further enriched our insights into local customs and traditions. Occasionally, the research team was invited to visit the apartments of some of the residents and sleep at the village so they could experience first-hand their living conditions and special needs the housing supports. We visited the education centers, kitchen, and training facilities, where we spent time with the trainees to get to know them, hear about their desires, and see their motivation for change.

Through conversations with community members and observations, the author gained valuable insights into the livelihoods of the residents. They emphasized the need for accessible pathways and facilities to enhance mobility and independence for wheelchair users. Social workers stressed safe routes and secure play areas for children, while individuals with autism

and educators advocated for quiet, sensory-friendly spaces. There was a consensus on the importance of equitable infrastructure to ensure fair access to amenities across socioeconomic backgrounds. Residents also highlighted the therapeutic benefits of natural landscapes for mental and physical healing. Community feedback indicated a desire for extensive walking areas, active spaces, sensory-rich play areas, and engaging water features to promote health, social interaction, and joy among residents, including differently-abled individuals and trauma victims. The children expressed interest in outdoor recreational areas within walking distance from their homes, connecting them to nature to foster physical activity and strengthen social bonds. Additionally, the author learned that thoughtful design and programming connecting underserved communities with the broader community would promote inclusivity, friendship, and a shared sense of belonging, fostering solidarity. These insights underscored the profound benefits of empathy building in creating supportive, inclusive environments that address the diverse needs of the residents.

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Figure 27: Pictures relaying the author's PAR activities with the Consorzio Fa community and at Villaggio Solidale. Images by the research team

3.4 Field Work

Fieldwork expanded the landscape biography to include site-specific, on-the-ground perspectives. It allowed for an in-depth understanding of the landscape and experience at the human scale. The author used four different fieldwork methods (Figure 28): spontaneous nature walks with a foster father at Villaggio Solidale; ground-truthing of mapping performed using Google maps and aerial photography through bike rides; soil testing to gain knowledge of the conditions of the agricultural land and to compare the effects different land uses had on its quality; and a plant inventory to gather a list of species currently growing in the landscape.

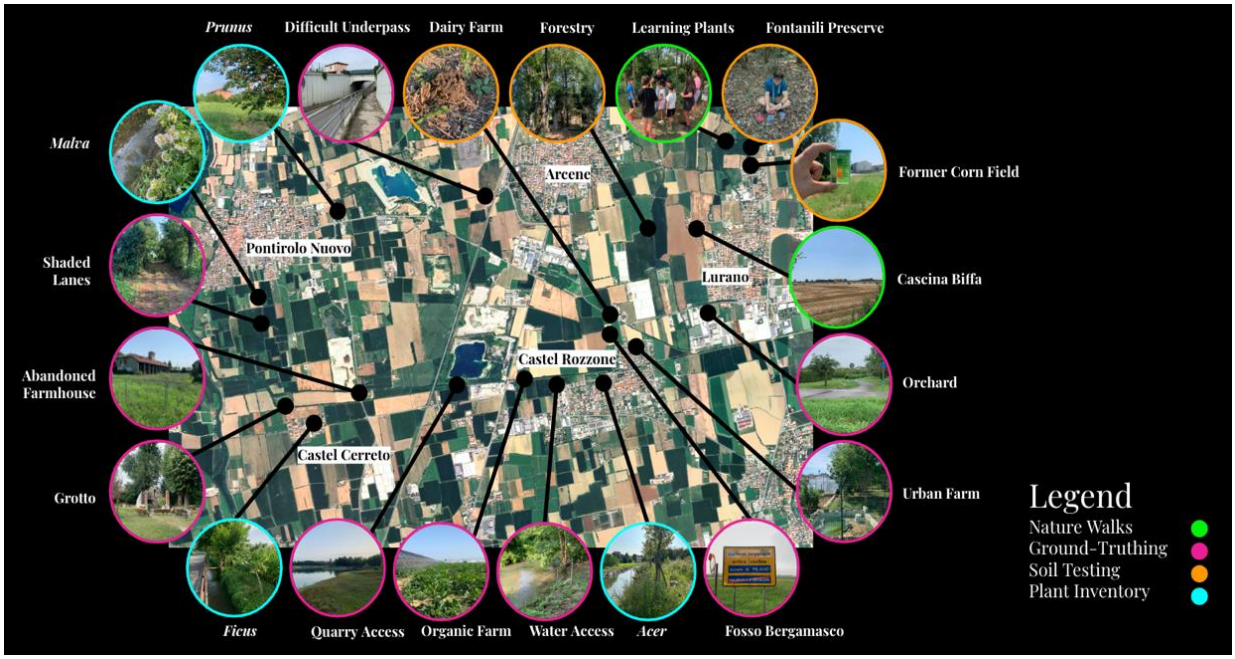


Figure 28: Illustration of the fieldwork performed in the study and where it took place. Image by author

Nature Walks

The author organized two activities with Matteo, a foster father living at Villaggio Solidale. He is one of the founders of the co-housing community and has lived in the area all his life. He is an expert on the culturally relevant landmarks around the region. He is an active bicyclist and has ridden trails and routes throughout the landscape, including trips north into the Alps. He

shared those experiences describing the presence of a historic lake that used to cover the region and the activity of water accessibility around rivers and wetlands. He provided insight into his community and what it is like to live there. His stories reveal a web of relationships he has established with people in Lurano and spoke about the town center, where they like to gather. It is a multi-functional open space where outdoor dining, sporting events, and concerts occur together, activating the civic landscape. In our discussions, Matteo spoke about how the village and the surrounding landscape have evolved over his lifetime, providing a long-term perspective on how farming has changed within the last several decades from a wet area with a lot of rain and fog to a dry area being sculpted to fight against drought.

During the summer of 2022, the author led a nature walk to the Fontanili preserves in Lurano. Matteo and other caregivers accompanied 16 children on a participatory nature walk and memorial activity (Figure 29). The idea came from dinner conversations with Matteo, where he asked for more participation in learning about the fontanili and agricultural landscapes in Lurano. The goal of the activity was to observe the children at play in nature, see what interested them, what they were afraid of, what kind of knowledge they had about the landscape, and understand the fate of the Fontanili Springs. The children collected objects found along the path that interested them and carried them to one of the spring heads, where they constructed a shrine in remembrance of the Fontanili Springs. They learned about the effects of climate change and became more aware of what was around them in nature. They voiced concerns about briar patches and stinging nettles while also noting the importance of avoiding prolonged exposure to the hot sun.

This experience provided the author with valuable insights into the design of the trail system. It enabled him to observe how locals navigate the landscape, following the edges of agricultural fields and seeking shade when possible. The author noted the presence of bridges across canals for tractors but observed a lack of pedestrian access bridges. Children also pointed out invasive species around the fontanili and noted a decline in park maintenance, evidenced by broken signage, encroaching vegetation, and eroded paths. During the visit, the author discovered fig trees scattered throughout the forest, although the fruit had not ripened due to insufficient water. Matteo showed him holes dug in riverbeds, revealing groundwater levels significantly lower than expected for the time of year. The author also observed large pumps installed to access deeper aquifers, resulting in reduced levels in natural spring systems.

Lastly, interacting with the children gave the author insights into their deep connection to nature, their hopes for an improved quality of life around the preserve, and their enthusiasm for environmental stewardship.

Figure 29: Pictures from the nature walk: the shrine the children created with evidence of edible plants, trails along the edges of fields, and a water pump for irrigation. Source: author

During the 2023 workshop, Matteo guided the author on another nature walk along the country roads bordering agricultural fields. During the walk, he identified various crops seen throughout the year, including remnants of winter wheat, alfalfa in the meadows, and sprouting corn in the fields. He discussed the seasonal emptiness of the fields and expressed concerns about the lack of government incentives for diversifying crops. Matteo also highlighted that much of the land around Lurano is owned by the Catholic Diocese and leased to farmers. As they approached Cascina Biffa, a nearby farmstead, Matteo spoke about the cows that lived there and explained that the surrounding crops were grown to feed them. Leading the way to the farmstead, Matteo showed the parking lot filled with cars of restaurant patrons. Behind the farmstead was a

small fenced-in paddock with chickens and goats where visitors could interact with the animals, though access to the cows was restricted. Matteo mentioned bringing children here to visit the animals, and later research by the author revealed they also host a summer camp focused on environmental stewardship.

The nature walks taught the author about the mechanics and seasonal change of the agricultural fields, which would have been difficult to understand from viewing land use maps and satellite images. They revealed information not readily available about the livestock practices in the region, leading to further research on pastoralism and the rise of intensive rearing. By walking the landscape, the author witnessed community members in the landscape, observing their use of country roads for physical activity and leisure walks. The author observed tractors, people with disabilities, bikes, and cars all utilizing the same routes, observations that were critical in experiencing the tension between accessibility and agricultural activity within the landscape.

Ground-truthing the Trail System

Starting in 2022, the author utilized Google MyMaps to analyze the landscape and its features based on satellite imagery and georeferenced data from Google users and businesses (Figure 19). This mapping initiative included identifying the locations of agrotourism sites, quarries, and Renova Park. Additionally, the author mapped the positions of bus stops, sparking discussions on the bus network's reliability. Much work was done to understand the functioning of the extensive network of irrigation canals and distinguish between natural water courses and artificial channels within the district. However, this initial effort provided only a foundational understanding. Therefore, fieldwork was essential to verify accessibility and clarify ambiguities in the satellite imagery. This approach allowed for direct observations of landscape users and significantly enhanced the understanding of the area's characteristics, usage patterns, and overall ambiance.

Using bikes to ride around and explore the landscape helped the author gather a feel for what it was like to see it from a human scale and experience the disconnections and gaps in the existing bike trails caused by inward-looking, uncoordinated planning. It revealed the need for safe crossings and greater collaboration across municipalities on infrastructure projects to increase connectivity for bike commuters and recreational users of soft mobility. The bike rides

identified two existing underpasses that are the only ways to cross the rail line, which cuts the district in half. There are pedestrian walkways elevated above the roadway, but they are steep and narrow, with tough-to-handle switchbacks that seem unnecessary. By riding bikes, the author could experience the landscape slowly and focus on the quality of that experience. It also allowed us to observe farming in residential private yards and the presence of small orchards along roads and questioned their 'publicness.' The shrines, chapels, and sanctuaries they came across are cherished waypoints for residents during their daily walks, emphasizing the importance of the trail alignment in connecting to the paths that lead to these destinations. Each township has a historic center with a bell tower, some even with castles from medieval times. Historic farmhouses are scattered across the landscape, exhibiting the common archetype in the region. These buildings are in various states of use, and some are in disrepair. The trail aims to showcase these buildings as assets to the communities and their culture as important places to restore and be utilized by the public.

Through the bike rides, the author learned about the locations of historical places, like the alignment of the *Fosso Bergamasco,* a medieval border separating the Duchy of Milan and the Venetian Republic, a feature included in the master plan that became the focus of multiple solidarity-driven land uses.

Observations of the agricultural fields now revealed the specific crops being cultivated and their respective locations. Corn dominates the landscape during the summer months, while the layout of horticultural areas provided clarity on the types of crops and their cultivation methods. These crops were exposed to direct sunlight with minimal or no windrows and planted in long rows similar to corn and other cereals, a technique less suitable for brassicas.

In some cases, the team discovered organic farms with greenhouses abutting the roads and blocking views across the landscape. The greenhouses also hinder passersby's from seeing the farmhouses and their crops, further dissociating them from their food system. Access points to the quarries were also essential to understand. Were the quarries abandoned? Did people go there? They discovered trails branching off the road and observed trampled fences, indicating use without any supporting infrastructure.

The beautiful views across the water and the sunrise and sunsets over the fields made this experience memorable and worth recording. The team assessed trails and country roads: some led nowhere, while others revealed hidden gems. They found potential entry points for children

to wade in the canals, art installations depicting wizards and mythology in the forests, and alleés of trees providing shade from the hot sun and embracing visitors with nature. These highlights became evident as perfect spots for the trail experience. The author recognized them as cornerstones of the landscape needing improved accessibility for all and greater visibility from the proposed trail.

Ground-truthing was an essential methodology in the research because the team primarily worked virtually from the United States. While virtual research using tools like Google Earth, Maps, and digital data, along with peer-reviewed literature on the Po Valley landscape, was valuable, exploring the landscape uncovered hidden places not marked on maps. It provided insights into traffic patterns and safety concerns at road crossings. Riding bikes allowed firsthand assessment of comfort and difficulty levels. The team discovered discrepancies between maps and actual conditions, noting significant new infrastructure developments such as concentric bike paths in townships and a restoration project along the canal in Castel Rozzone with newly planted trees and reinforced walls. These findings are significant as they highlight new community development interests and existing funding opportunities for project implementation. Ground-truthing also enabled the team to experience the region's response to extreme heat and observe local reactions firsthand.

Additionally, it revealed aspects not visible on maps, such as forest trails, which helped understand regional identity and areas of focus. Country roads and quiet alleys, ideal for the bike trail due to minimal traffic and proximity to agricultural landscapes, were identified. The summer workshops enriched our understanding of the region's character and informed strategies to enhance its accessibility and environmental health through existing infrastructure.

Soil Testing

The foundation of agroecology lies in soil health. To gain insights into soil health, the author utilized an assessment manual from Cornell University (Moebius-Clune, 2016). Subsequently, the author identified a soil quality test kit suitable for fieldwork, selecting it for its portability via bike and simplicity of testing. (Natural Resource Conservation Service, 1999). The author selected four tests from the manual to evaluate soil quality, adapting the kit to enhance affordability and accessibility. He employed a rapid test kit to measure pH, potassium,

nitrogen, and phosphorus levels and soil observations to assess topsoil depth, penetration resistance, soil structure, and textural class, alongside tests for soil density and water infiltration.

These tests provided the author insights into the presence and distribution of fertilizers, the contribution of natural fertilizers and decay to soil chemistry, the soil's texture (whether gravelly, sandy, or silty), compaction levels, erosion occurrence, and water retention capabilities. The four test plots included a former corn field owned by Consorzio Fa, the Fontanili preserve, a hornbeam agroforestry patch, and a field adjacent to a dairy farm and Fosso Bergamasco. This approach facilitated an understanding of soil dynamics and how different agricultural crops and uses may influence its composition. It aimed to illustrate the impacts of industrial farming on soil health and identify agricultural practices that promote soil regeneration.

Plant Inventory

Understanding plant identification provides insights into both native flora and intentionally cultivated species along the edges of parcels. This method led to the compiling of a regional plant inventory, documenting prevalent species. While trees dominated the landscape, our observations extended to perennial flowers, grasses, and edible plants bordering roads and canals. Although shrubs were less prevalent and thus excluded, it's worth noting their underutilization along the landscape's edges due to aggressive and undifferentiated landscape maintenance regimes by each farmer. Among frequently observed species were maples, hornbeams, cottonwoods, poplars, willows, and lindens. Moreover, we identified common edible fruit-bearing trees like chestnut, hazelnut, cherry, and fig trees. Mulberry, elderberry, and blackberries thrived along the canals. Common grasses included alfalfa, orchard grass, and sorghum, while flowers such as poppies, mallow, and clover adorned the landscape. These findings underscore the agricultural richness of this landscape, where plants have either been intentionally cultivated or dispersed from adjacent areas via canals or wind dispersal. All these species offer inherent benefits in a farming context and are viable crops.

The findings of the plant inventory confirmed that agroforestry is a viable approach for transitioning to agroecology in the landscape. The identified vegetation, some of which has been used in agriculture for centuries, is overlooked as a resource despite its prevalence due to industrial farming, which has decreased the reliability of locally grown food. These edible plants

illustrate the cultural and landscape character that has withstood the test of time. The existing vegetation typology not only demonstrates the feasibility of this transition but also simplifies its implementation. The author and research team aimed to emphasize the landscape's current assets. Implementing changes, adapting practices, and enhancing tree canopies are practical steps to increase landscape resilience and promote biodiversity and sustainable resource utilization.

3.5 Shared Use Trail

Finding the Alignment

Working collaboratively with local experts, the research team proposed a shared-use trail vision following their landscape biography investigation. This trail, representing the second iteration, exemplifies participatory action research principles. The approach drew inspiration from Dr. Guilio Senes and his planning of the Lambro River Greenway in Milan (Toccolini, 2006). The final trail alignment reflects the ground truthing findings (Figure 30), identifying segments designed as bike paths and sidewalks, highlighting safety concerns at traffic crossings, noting inaccessible country roads, and identifying areas lacking alternative transportation options besides cars. The trail's route forms a loop connecting five townships and physically linking the co-housing communities of Villaggio Solidale and Corte dei Massari.

Integrating Community

The trail's alignment considers the communities it traverses, prioritizing nodes of community activity linked to significant landscape features (Figure 31). Lurano and Castel Cerreto are focal points due to the presence of Consorzio Fa co-housing and social services, and their proximity to major forest parks. Castel Rozzone is recognized for its chapel commemorating the Plague and a canal connecting to the Visconti Palace, agriculture, and other historical sites. Arcene is selected for its train station, transportation access, historic central plaza, and connection to the Fosso Bergamasco. Pontirolo Nuovo features picturesque streets, a large cathedral, vibrant restaurants, and access to the Adda River. Lastly, the quarries and forests provide recreational and conservation opportunities, including Renova Park.

This trail aims to promote health and well-being for users, with a bikeable loop that can be completed leisurely in one hour and 20 minutes and that would help an average cyclist burn 450 calories. Beyond physical exercise, the loop fosters social interactions along the way and offers the therapeutic benefits of nature.

Gearing Toward Agroecology

Figure 32 shows the final layout, there are a few things to note. Firstly, a change occurred to the alignment in Pontirolo Nuovo for the trail to link to a community operated by Consorzio Fa. Similarly, a major connection to Cascina Biffa dairy farm resulted from one of the nature walks (see page 43). Secondly, an emphasis on places in the region that are achieving elements of agroecology. Thirdly, the trail sought to link farms in the region that are of interest to the project. All the farmsteads are shown in yellow, and the orange dots denote those of interest. While these farms may have different objectives from those of our project, they are key elements in today's agricultural landscape and users of our plan should familiarize themselves with their operations and seek to partner with them.

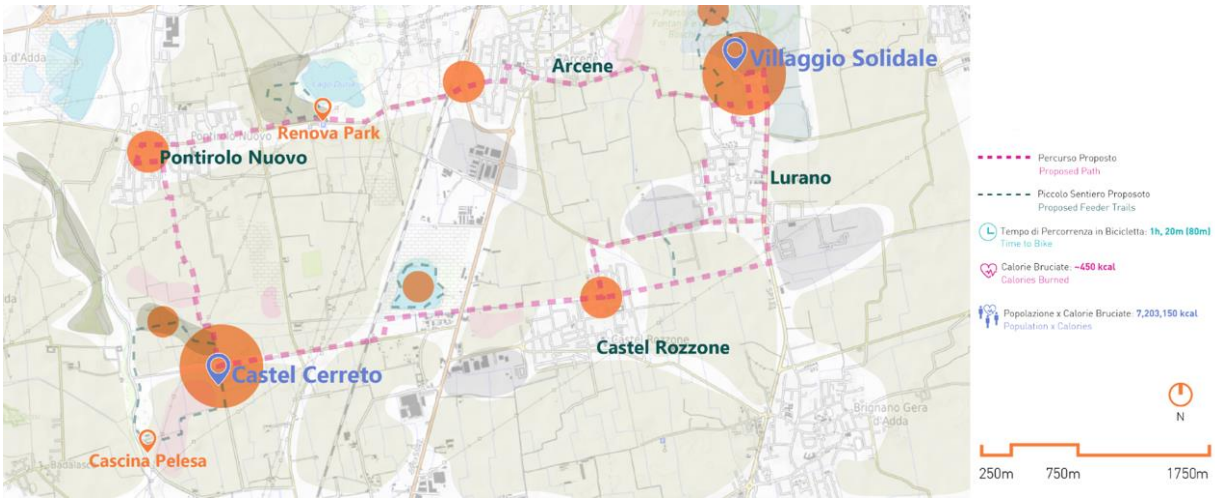


Figure 30: Map indicating the trail in totality and the community nodes indicated by orange circles; priority and intensity of involvement are indicated by size. Source: Erin Callahan, workshop team

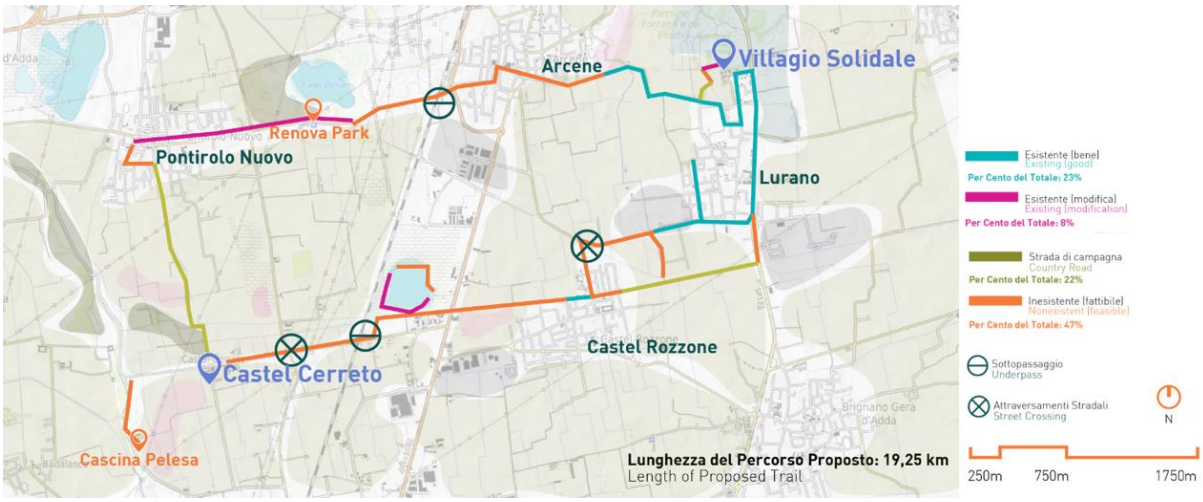


Figure 31: The second iteration of the proposed trail indicated where it existed and where gaps and alterations would be needed. Source: Erin Callahan, workshop team

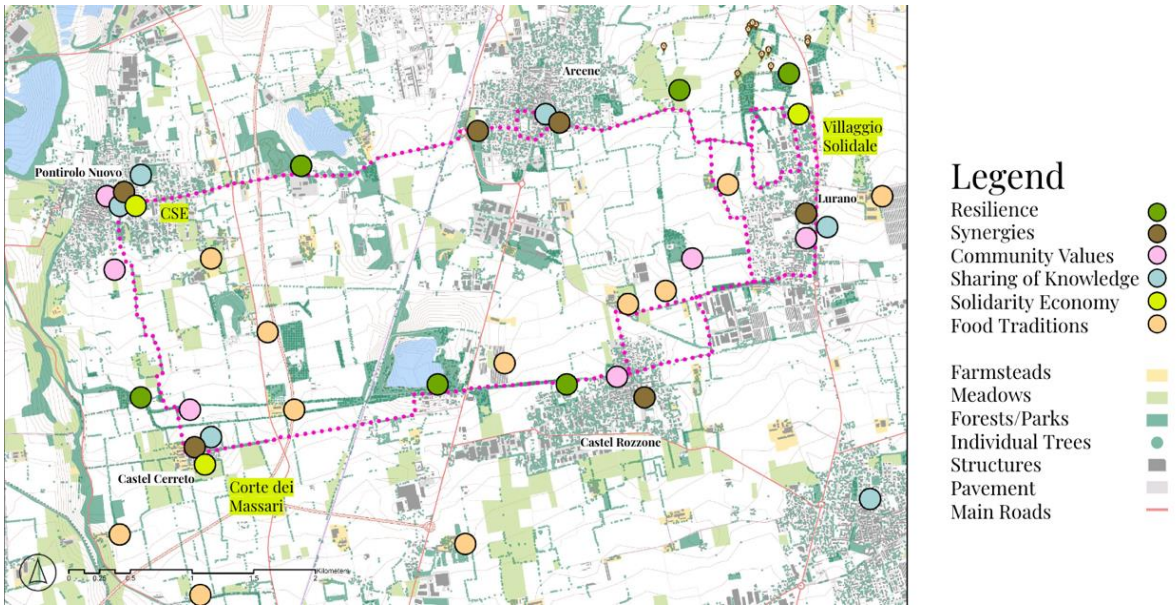


Figure 32: Map of the final plan for the shared use trail indicating relevant sites that embody the elements of agroecology. Image by author

SECTION 4: AGROECOLOGY PRACTICES

4.1 Case Study Investigation

The case studies are a compilation of organizations, initiatives, and farms practicing agroecology. They support governance, avenues for sharing knowledge, and related agricultural practices regarding organic or regenerative farming. They touch on various aspects of agroecology based on the challenges and site context discovered during participatory action research and landscape biography.

La Asociación de Trabajadores del Campo (ATC)

Agroecology was recently addressed in a seminar at the University of Maryland, where a representative from the Asociación de Trabajadores del Campo (ATC) discussed the organization's mission and contributions to justice and local food systems in Nicaragua (Takeo, 2023). The ATC, a union of workers and activists, supports labor improvements for rural communities. As a leading entity in the Agrarian Reform movement of the 1980s, the ATC provides essential services across various development levels to foster a new labor system. By collaborating with members, cooperatives, and government institutions, the organization promotes social programs designed to enhance the quality of life for rural families and achieve food sovereignty (The Association of Farm Workers, 2021).

La Via Campesina

Founded in 1993, La Via Campesina is an international movement comprising millions of peasants, landless workers, indigenous peoples, pastoralists, fishers, migrant farmworkers, and small and medium-sized farmers, including rural women and youth worldwide. The movement is built on a foundation of unity and solidarity, advocating for peasant agriculture as a means to achieve food sovereignty (La Vía Campesina, 2021).

Vi Agroforestry

Vi Agroforestry is an organization dedicated to combating poverty and climate change through holistic agricultural development projects executed in partnership with local entities (Vi

Agroforestry, 2021). The organization provides training and advisory services to farmers in sustainable agriculture, promoting practices such as planting trees alongside crops and integrating livestock. These measures enhance soil fertility, increase crop yields, and diversify agricultural outputs. Additionally, the planted trees contribute to biodiversity, carbon sequestration, and flood mitigation. The "Trees Sustain Life" project specifically targets poverty reduction in Tanzania, ecosystem restoration, and climate change mitigation.

Ridgedale Farm

Richard Perkins, a farmer and influential figure in the field, utilizes social media platforms like Instagram to disseminate knowledge on permaculture, agroforestry, and related management practices, emphasizing community integration and quality of life (Ridgedale Permaculture, 2014). Agroforestry at Ridgedale Farm incorporates a land-use system that combines agriculture and forestry to create an integrated, productive, profitable, and sustainable ecosystem beneficial to small-scale farming. The system relies on a tree canopy with at least 20% crown cover, which enhances soil conditions by maintaining organic matter, closing nutrient cycles, and integrating nitrogen-fixing trees to reduce dependence on external inputs and chemical fertilizers. Perkins also educates his followers on keyline design, using practical demonstrations and resources for farm system designs such as mobile or permanent livestock fencing and other essential tools and infrastructure.

New Forest Farm

The Regenerative Agroforestry Podcast introduced New Forest Farm, a Wisconsin-based farm in production for over 20 years, as a pioneering entity in the American regenerative agriculture movement (Tsitos, 2022). Operated by Mark Shepard, this family-owned farm has transformed from a depleted row crop farm into a 106-acre commercial perennial agricultural operation. It utilizes ecological models referencing oak savanna, successional brushland, and eastern woodlands to recreate a native biome. The farm integrates trees, shrubs, vines, canes, perennial plants, and fungi in a keyline-inspired water management pattern to produce food, fuel, medicines, and enhance beauty. Livestock grazes the grassy alleys between tree crops, contributing to soil building, water retention, carbon sequestration, habitat diversification, and overall ecological cultivation. The farm operates entirely on solar and wind power, and farm

equipment is designed to be powered by locally produced biofuels that do not compete with the human food chain (Sheppard, Redesigning Agriculture in Nature's Image).

Chinampas

Chinampas, a traditional agricultural system dating back to the Aztecs, consists of floating gardens built on reclaimed wetlands around Mexico City (Godoy, 2016). These gardens are created by braiding reeds with stakes to form underwater fences that accumulate soil and vegetation until they reach the surface. Canals are deepened to enhance accessibility and water retention. Trees are planted atop the accumulated soil, with their roots providing structural integrity (Vasiloudis, 2021). Managed cooperatively or independently, Chinampas are a drought-resistant system using less water than conventional irrigation methods, producing fish, vegetables, flowers, and medicinal herbs. They repel pests and are more productive than traditional agricultural systems, sustaining moisture and regulating microclimates.

Carbon Cowboys

Peter Byck, a professor at Arizona State University specializing in sustainability and journalism, created the film "Carbon Nation" and the YouTube documentary series "The Carbon Cowboys," where he explores Adaptive Multi-Paddock (AMP) grazing (Carbon Cowboys, 2023). His work includes interviews and community meeting videos, documenting his research team's engagement with AMP grazing across ten farms in North America. This research focuses on soil health, carbon storage, microbiomes, biodiversity, and water cycling, presenting AMP grazing as a viable practice for enhancing ecological and agricultural resilience.

SUGi Project

The SUGi Project, discovered through a fellow student and followed on Instagram (@sugiproject), supports forest makers in planting urban forests globally to connect communities with biodiversity and nature. Employing the Miyawaki Method, the project follows a seven-step process—soil survey, species survey, soil engineering, dense plantation, mulch application, maintenance, and reaching a climax forest within twenty years, equivalent to a century-old forest (SUGi Project, 2023).

4.2 Maryland Site Visits

In the context of this case study investigation, participatory action research was conducted to engage directly with farmers and acquire firsthand knowledge regarding the benefits of agroecology. Given the author's background in Maryland, studying local agricultural practices provided significant relevance and context. The author actively participated in disseminating critical knowledge in agroecology and landscape democracy to share available resources effectively.

Several methodologies were employed to identify the four farms visited during this phase of the study. Information about Forested was obtained through academic consultation with a university professor. Spring Meadows Farm was identified serendipitously during a road trip to the mountains of Pennsylvania in the final year of study. Hidden Water Farms and Next Step Produce were identified through systematic online searches for regenerative agricultural practices. Following these initial identifications, a series of email correspondences were conducted, which facilitated the establishment of mutual familiarity and led to scheduled meetings. These meetings involved detailed discussions of farming practices, comprehensive tours of the facilities, and examinations of the tools and techniques employed on the farms.

Forested

Lincoln, the owner of the permaculture food forest known as Forested, extended an invitation to the author to participate in a volunteer day (Smith, 2023, August 5). The day commenced with a thorough farm tour during which Lincoln elaborated on the operation of their specialized permaculture system. This system features sequentially planted circular plots with edible perennials, including trees, shrubs, and ground covers. Ducks form an integral part of the farm ecosystem, aiding in pest control and contributing to the recycling of organic matter.

Activities for the day included trimming grass along the farm’s pathways, harvesting ground cherries and squashes, and relocating inoculated timber logs from soaking tanks to drying racks. Volunteers also moved grass clippings into compost areas within the circular plots for decomposition.

Forested engages in diverse objectives and activities. These include grafting edible fruit varieties onto native trees grown from a seed bank revived following a transition away from corn cultivation. Forested also offers training programs in grafting and marketing indigenous foods,

hosts design workshops, provides permaculture certification courses, and experiments with polyculture agricultural methods.

Hidden Waters Farm

Hidden Waters Farm, founded on principles of regenerative agriculture, was identified through a search for regenerative AMP grazing practices in Maryland. Joe Schaffer, a co-owner of the farm, invited the author for a farm tour to demonstrate livestock rotation, grass cultivation, soil building, and water management techniques (Schaffer, 2024, January 16). The tour included a visit to a mobile chicken coop, a tractor-movable tented paddock where chickens graze year-round. The chickens are relocated daily and do not return to the same ground within the year. Cows are housed in an open-air barn and fed fermented farm grasses during the winter, while in other seasons, they graze on pastures and are moved every few days to prevent overgrazing. This rotation occurs monthly, allowing other farm areas to rest for up to three months. This method supports marketing approximately 23 cows on roughly 150 acres. Pigs are rotated in the forest to manage invasive species and seed the understory with grains and grasses. The author noted that the farm's practices align with those outlined by Gabe Brown in "Dirt to Soil."

The farm operates a CSA program, packaging meats for distribution on a monthly or weekly basis. It also maintains a market offering local products, including fresh bread from a nearby bakery. Portions of the farm are leased to an organic vegetable grower and beekeepers, enhancing biodiversity and benefiting the soil ecosystem. The farm actively participates in community events and farmers' markets, hosts barbecues, and has arrangements with the local Orthodox Jewish community for kosher inspections, ensuring meat quality for holiday meals.

Next Step Produce

Heinz Thomet, an immigrant to the United States and successful business owner, practices regenerative agriculture at Next Step Produce. Thomet cultivates a variety of cereals, including rice, wheat, oats, barley, corn, and millet, and maintains an orchard and vegetable plot.

During the visit, Thomet discussed his agricultural philosophies and the theoretical foundations of his farming practices at his dinner table (Thomet, 2024, January 14). He credited Dr. Christen Jones and her research on fungal energy pathways as inspirations for his methods. The author observed a wood-burning boiler used to heat Thomet's home and greenhouses, which

are utilized in early spring for crop seeding and winter house plant sales. The farm features a barn housing hulling machines, processing stations, storage rooms, and refrigeration facilities, indicating the comprehensive scope of Thomet's operations. Additionally, a large workshop is used for milling lumber for constructing barns on the property. Outside the barn, a compost-tea fermentation system using organic material from the surrounding forest exemplifies Thomet's resourcefulness and the integration of a working ecosystem into the agricultural system.

The farm tour included a walk through the orchard, showcasing a diverse array of tree species with a flock of chickens in proximity. A substantial compost pile enriched with stone dust, copper, and mineral supplements was demonstrated, illustrating its use in regenerating nutrient-deficient fields. Thomet explained the process of cover cropping, employing four species per cycle that change seasonally to enhance soil diversity and nutrient content. The machinery used for sowing, weeding, and harvesting minimizes soil disturbance while fulfilling essential functions. The farm features a large reservoir and four solar panels that power the entire operation. Thomet also highlighted his forest management efforts, including tree plantings around the reservoir and field edges, aimed at creating a sustainable ecosystem for future generations.

Spring Meadows Farm

Spring Meadows Farm was encountered serendipitously during a lunch stop on a drive back from Pennsylvania in the small town of Upperco. The activity and plume from the smoker on a Sunday afternoon captured the author's attention. Conversations with employees at the market vendors revealed the cooperative model employed by the nursery, which owns the venue and invites other vendors to create a vibrant community space. The vendors include a barbecue restaurant, brewery, and ice cream parlor. The farm hosts concerts during the summer and features a petting zoo and nature trail. This site exemplifies a space where community members can gather, participate in the consumer market, form partnerships, build friendships, connect with nature, and enjoy farm produce.

4.3 Comparative Analysis: Adopting Agroecology

After completing the investigation, the author created a chart to illuminate gaps within the context of agroecology as it relates to this thesis. The author examined twenty-two case studies and rated them based on their performance against the ten elements of agroecology. Drawing inspiration from TAPE, a tool for evaluating agroecological performance recommended by the author for further use (FAO, 2019). Once rated, the author organized the case studies based on their strength in 'diversity' (Figure 33), color coding each case study to emphasize where its focus lies in terms of the four learning objectives: solidarity, conservation, agriculture, and heritage.

This revealed some trends, notably a general trend of increased efficiency correlating with decreased diversity. Efficient systems do not prioritize diversity and, therefore, are prone to the hardship of changing climate. Secondly, some higher diversity systems focused on recycling organic matter in their agricultural system have developed networks in which they share knowledge of their practices with one another but need a responsible governance that backs their objectives, which means that these highly regenerative systems do not have a body of government that supports their mission. Lastly, the case studies focused on solidarity have developed local economies where social values and culture are fully achieved but lack practices supporting recycling and resilience. This means that these systems are focused more on people and economic sustainability than the ecological importance of soil health and regenerative practices vis-a-vis climate change. This analysis reports these trends to show the importance of multiple systems in achieving agroecology to its full potential. This is a reminder of the importance of partnerships in achieving sustainable development goals.

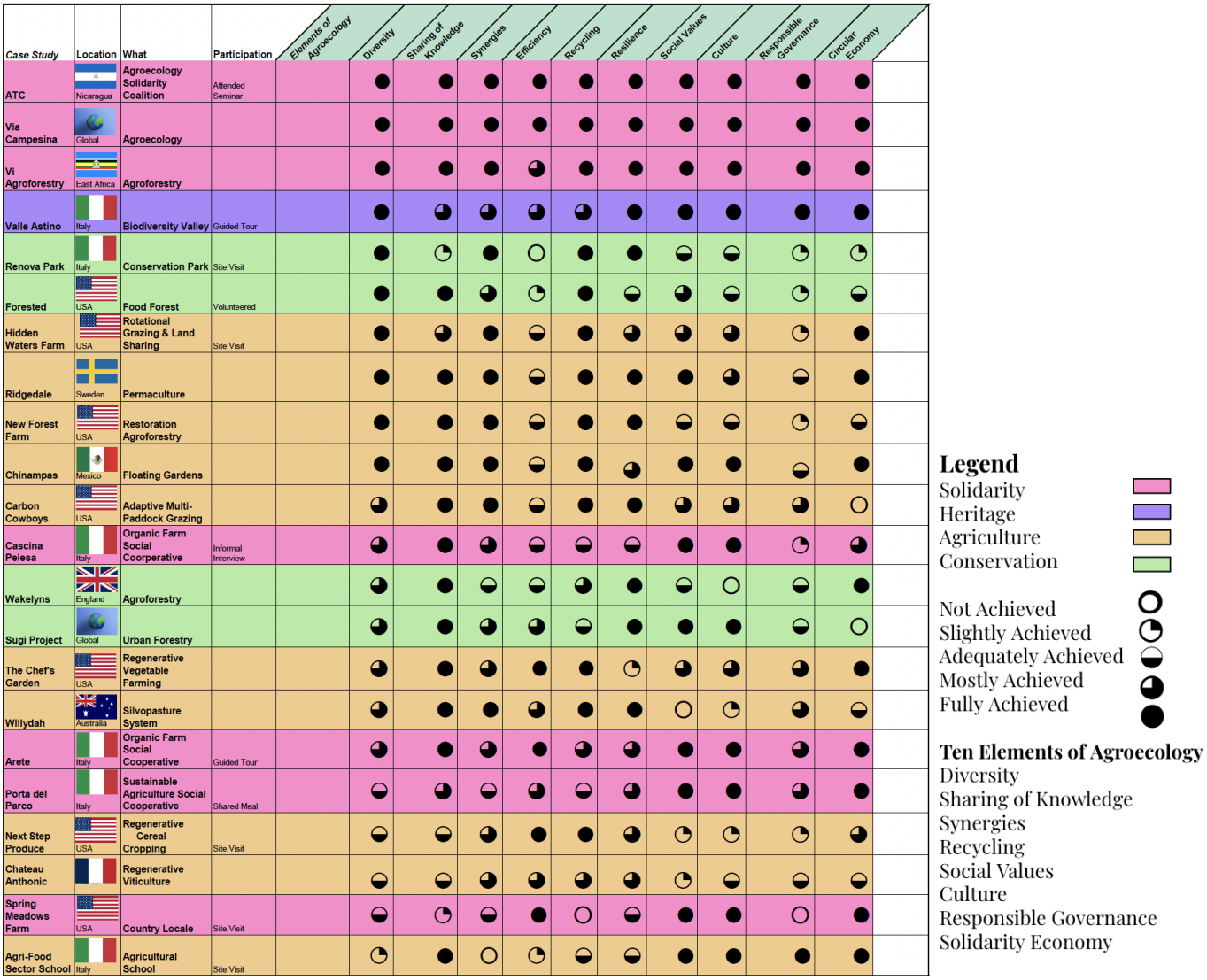


Figure 33: Chart representing the comparative analysis and the rating system developed to assess how well each case study addresses the ten elements of agroecology. Image by author

SECTION 5: VALUE-DRIVEN PLANNING

5.1 The Overlay Method

The work of landscape architect Ian McHarg (1920-2001) and his book “Design with Nature” (1969) illustrate the methods used in this study, following a process of overlaying maps and creating graphics that represent them from a different perspective. "The basic proposition employed is that any place is the sum of historical, physical, and biological processes, that these are dynamic, that they constitute social values, that each area has an intrinsic suitability for certain land uses, and finally, that certain areas lend themselves to multiple coexisting land uses" (p. 104). During the landscape inventory phase, the research team identified physical and biological processes at play in this landscape. They later supplemented them with social values and principles they gathered through fieldwork and empathy-building, participatory activities. Four land use types, solidarity, agriculture, conservation, and urban growth formed the basis of a suitability analysis that overlapped to create a composite zoning map that formed the master plan (Figure 34).

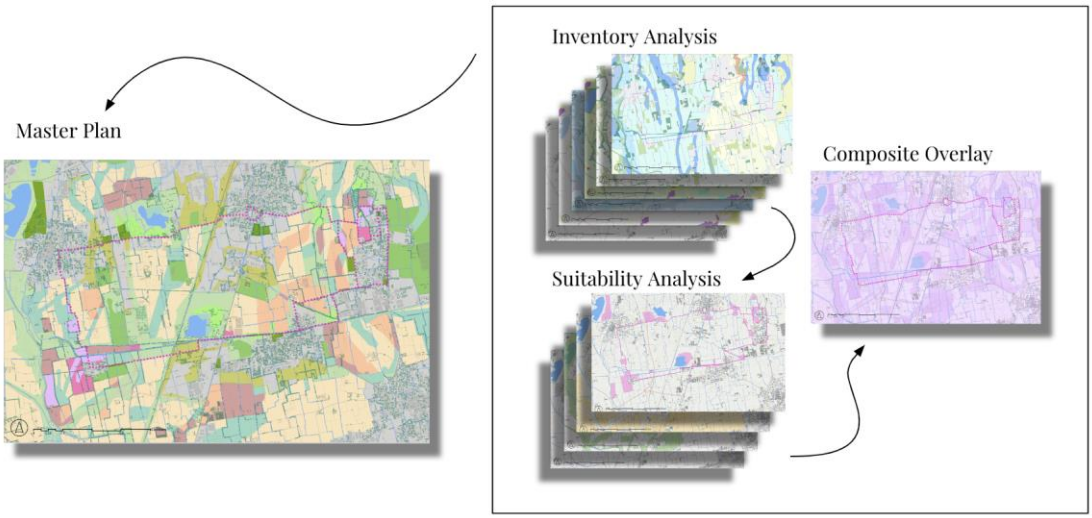


Figure 34: Diagram illustrating the stepwise approach to developing a master plan for the region using ArcGIS Pro to create maps. Image by author

5.2 Suitability Analysis: Preparing the Landscape for the Transition

Decision Making

The author employed a progression to assess the suitability of each land use type based on an analysis of the landscape inventory and the process used to create illustrative maps (Figure 35). He ensured that the urban growth would protect fragile habitats and designed the conservation area to include ridges and slopes with gravelly soils prone to erosion. The agricultural area prioritized soils with high calcium levels for nutrient-dense food. Lastly, solidarity-driven areas would be located within walking distance of existing or proposed social services and community centers.

Urban Growth Area	Conservation Area	Agricultural Area	Solidarity Driven Area
- Find patterns in growth - Industry generally shows where new growth is occurring, contain it - Identify other built structures such as roadways that can be delineation markers - Allow for growth and densification where major disturbances have already occurred - Only occupy open space where there is low canopy coverage and bound by the built areas - **Contain area so not to disturb fragile habitats and water resources**	- Protect riparian habitats - **Preserve ridges and slopes** - Preserve high water table areas with gravelly soil - Contain linear built structures such as powerlines, and roads introducing wide buffer areas - Conserve meadow and pasture in areas with existing tree cover and windrows, and in proximity to other conservation types - Conserve forestry cropping areas and forest patches - Conserve water courses, low elevation points, and clay soils	- Protect current agricultural identity and areas around historic farmhouses - Seek opportunities for farming in alternative areas, such as bodies of water and vacant lots - Determine areas of disturbance, separated spatially from urban communities that can be restored - Protect areas with established windrows and buffers - **Prioritize "valuable" land with nutrient rich soil** - Prioritize meadows and conserved areas	- **Identify places of ecological importance within walking distance to social services** - Identify culturally relevant or heritage driven areas - Determine activity centers and high traffic areas that residents use for wellness and bonding - Locate sites in proximity to the trail that have significant views or features in the landscape - Locate easily accessible areas in proximity to farmsteads for collaboration and partnership - Determine land most viable for immediate change, owned by partners, or exhibiting a transition already

Figure 35: The decision-making approach to determine land uses, set priorities, and make trade-offs for the design of the landscape. Source: author

Landscape Sections: The Importance of Soil

Sectional drawings for each land use were created to lend an understanding of the landscape types and soils present across the study area from east to west. They represent the central features of the landscape and its typography (Figures 36-39). As in McHarg's own precedents (1969), these sections show where in the landscape the land uses are best suited based on

knowledge from landscape ecology, regional planning, comprehensive planning, and landscape democracy.

Urban Growth Area: Controlling Sprawl

Urban growth is suitable for areas on plateaus at higher elevations and places where the topography is primarily flat. This land use aimed to contain development, densify existing urban areas and preserve agricultural land, a concept learned from studying master planning in Lancaster, PA (LIMC, 2006). The author determined the urban areas first in the suitability analysis to show where conservation agriculture would not be the priority, allowing for densification and a physical boundary to be established around the perimeter. The areas defined exist around locations of immense disturbance in manufacturing and construction of transportation routes and industrialized agricultural areas with many built structures and use of machinery (Figure 36).

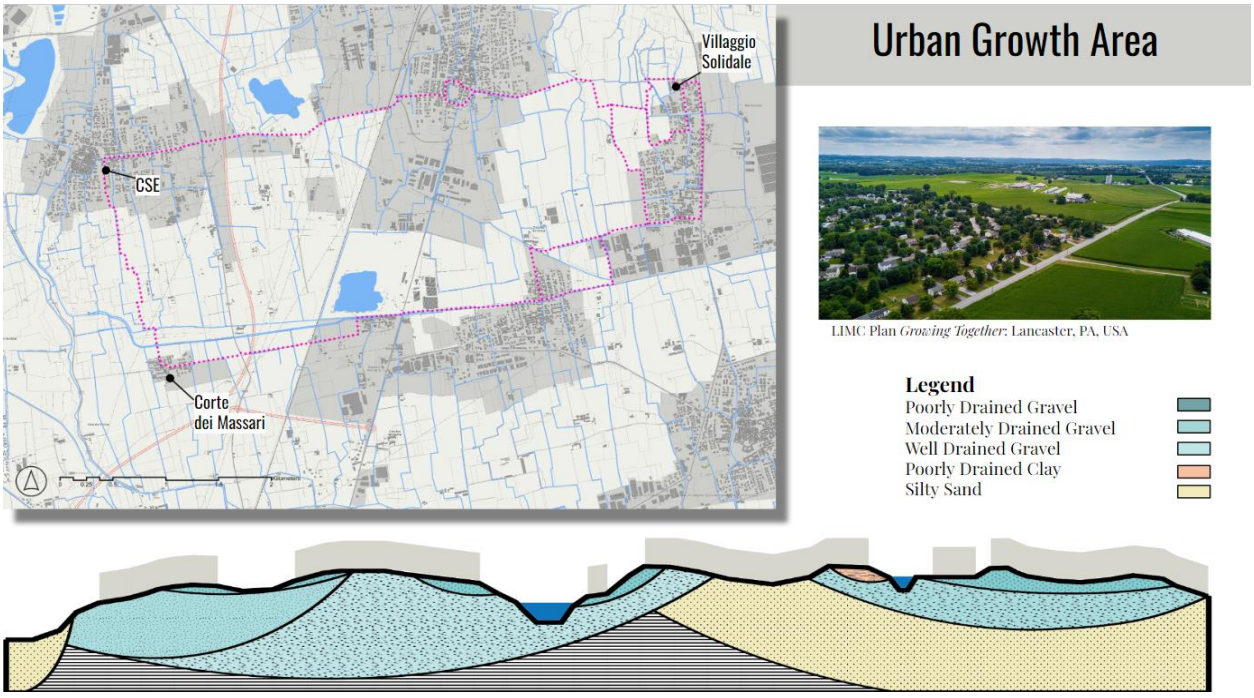


Figure 36: Summary map showing the urban growth area, where development is most suitable based on topography and geology, and the inspiration behind the concept. Image by author

Conservation Area: Expanding Vegetated Buffers

In the model, conservation areas follow man-made features like power lines, railroads, and highways, as well as streams and canals (Figure 37). The purpose is to establish corridors to connect existing forested areas, and landscapes that can help infiltrate water. Conservation areas expand existing ecological patches while also establishing new ones. This land use is particularly appropriate to buffer hazardous sites in urban growth areas and preserve important existing ecosystems.

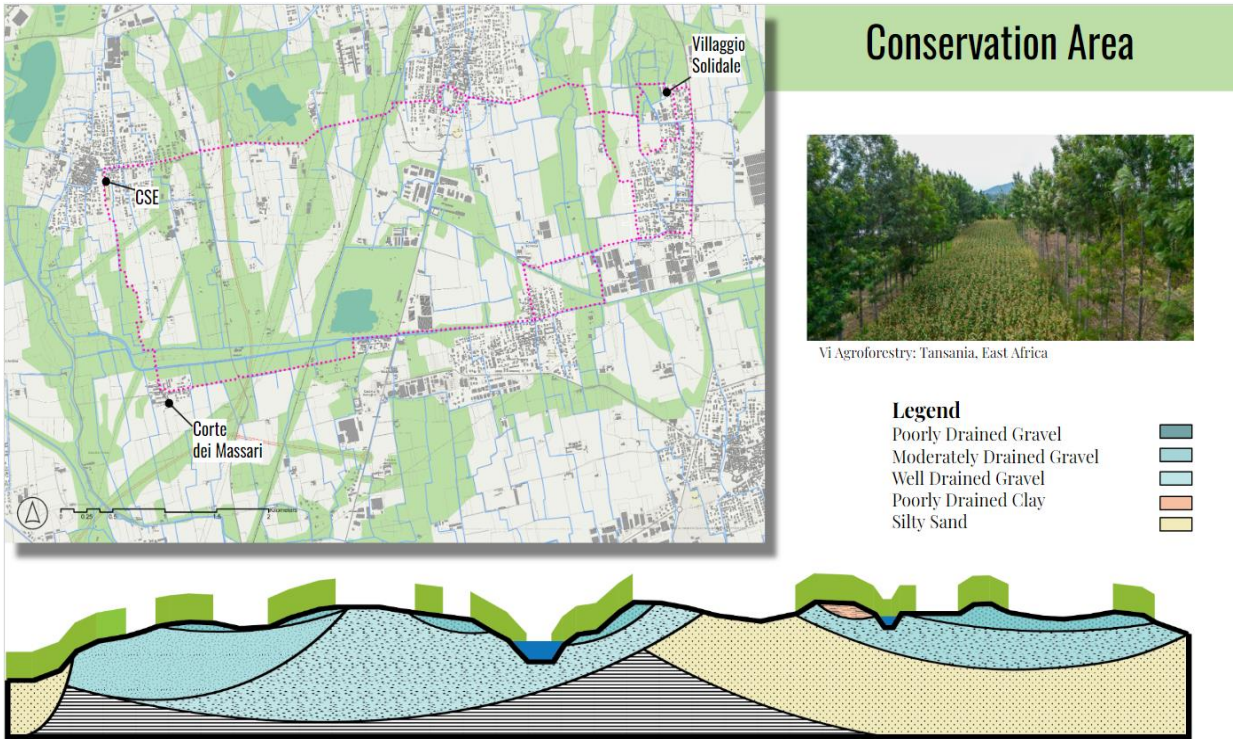


Figure 37: Summary of the Conservation area where woody plants are most suitable in terms of topography and geology and the inspiration behind the concept. Image by author

Agricultural Area: Prioritizing Soils for Organic Production

The proposed model prioritizes flat ground, calcium-rich soils, existing windrows, existing landscape buffers, organic farms, water bodies, and vacant lots and sets them aside for agricultural production to integrate existing ag-land that should be protected from urban growth (Figure 38).

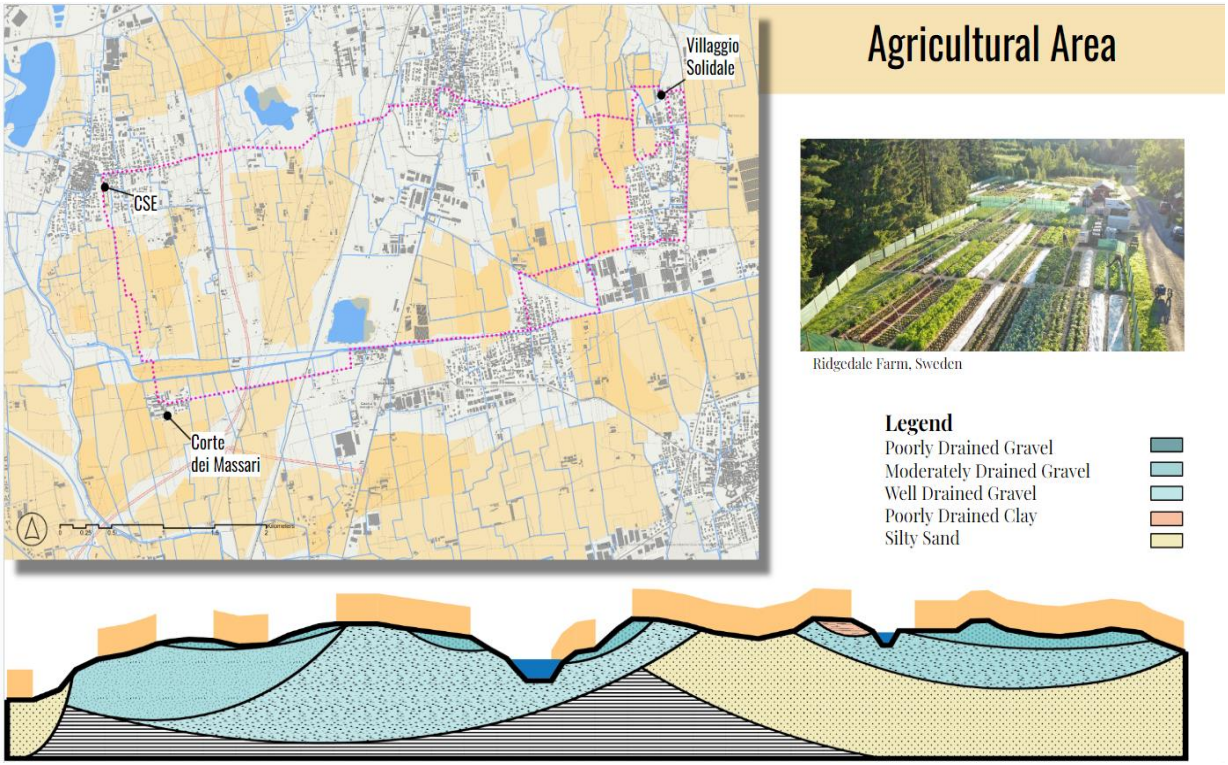


Figure 38: Summary of the Agricultural area where farming is most suitable in terms of topography and geology and the inspiration behind the concept. Image by author

Solidarity Driven Area: Creating Access and Community

Solidarity-driven areas consist of areas near or adjacent to the shared-use trail, and heritage sites, especially the religious sanctuaries and chapels (Figure 39). They are within walking distance (¼ mile or ½ Km) from town centers, social services, and the co-housing communities Consorzio Fa manages. Some make connections to water, lakes, canals, and confluences. Others connect to culturally significant farmhouses, such as Cascina Biffa, Cascina Pelesa, Cascina Giuseppina, and two abandoned ones in Castel Cerreto. Solidarity-driven land uses include Renova Park and some agricultural fields in the Fontanili preserve. They also refer to the Fosso Bergamasco and see an opportunity for those areas to educate on the region's history. There are also locations along roads that make farms more visible to all users, even those who prefer to use a car or have a necessity for one because of their physical ability.

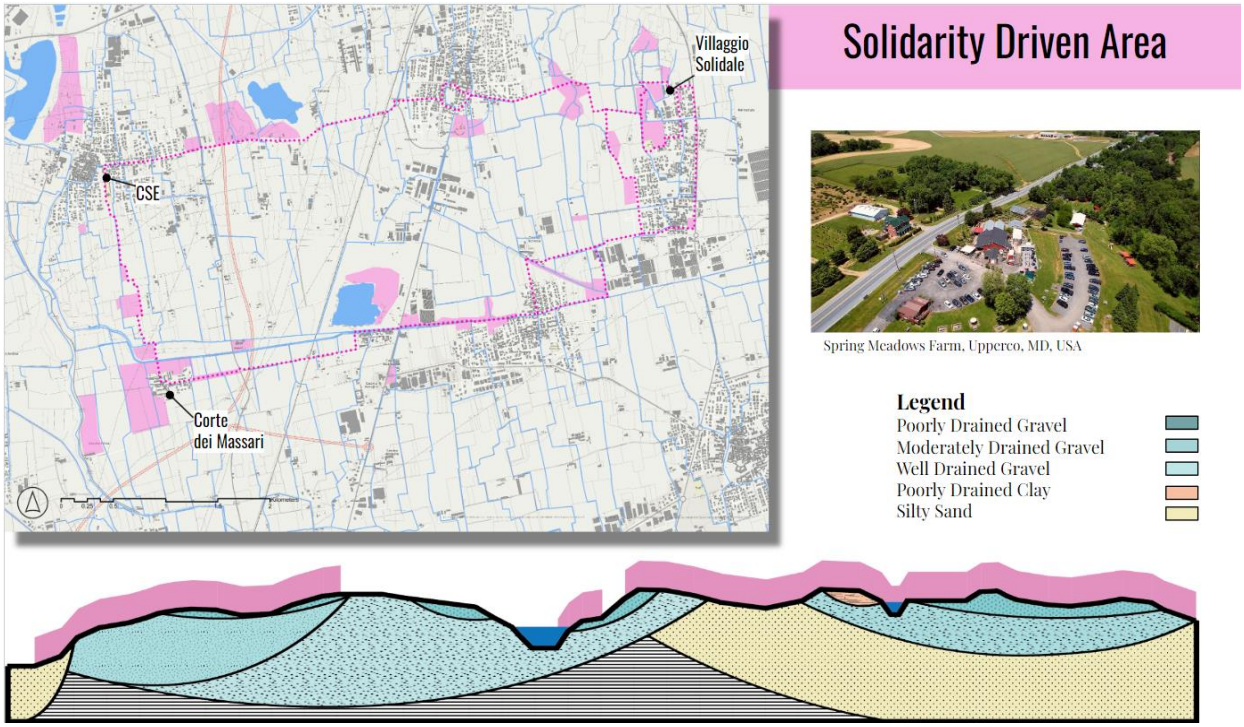


Figure 39: Summary of the Solidarity-driven area, where community spaces are most suitable regarding topography and geology, and the inspiration behind the concept. Image by author

5.3 Composite Overlay: Diversifying Land Use

The composite integrates all four land uses from the suitability analysis. Initially, the author visualized them using color codes associated with each land use type to illustrate their intersections. Many of these land uses overlap, fostering diverse functionality and experiences within the landscape (Figure 40). This visualization demonstrates how land use relationships contribute to the multifunctional nature of spaces throughout the area. Subsequently, each land use received identical color and opacity treatment to highlight areas with the highest diversity, prioritizing them for plan implementation (Figure 41). Darker shades indicate areas concentrated with multiple land uses, pinpointing key focus areas.

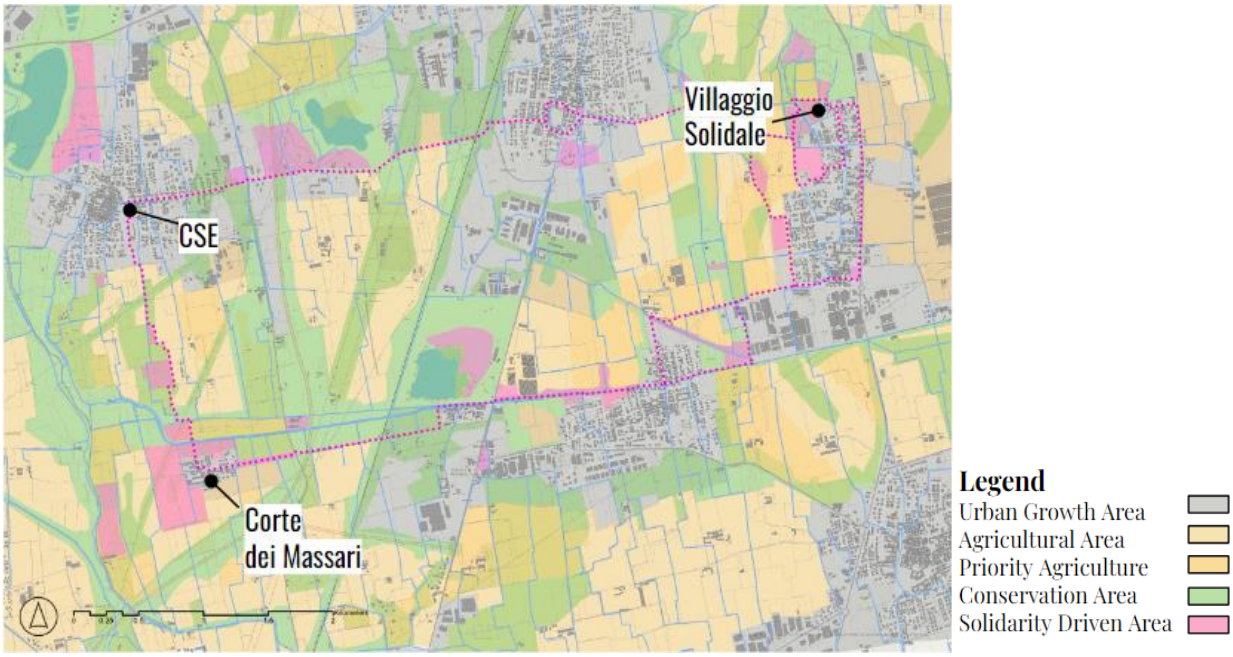


Figure 40: Overlay of all four land uses from the suitability analysis. Image by author

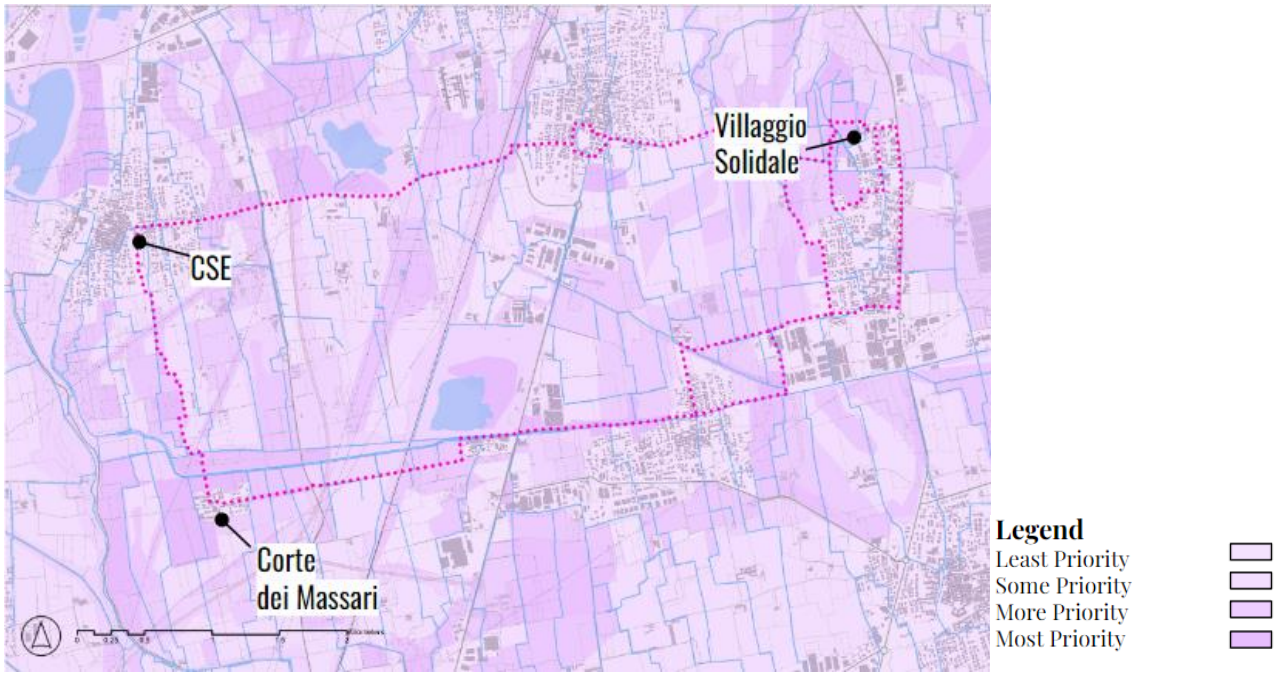
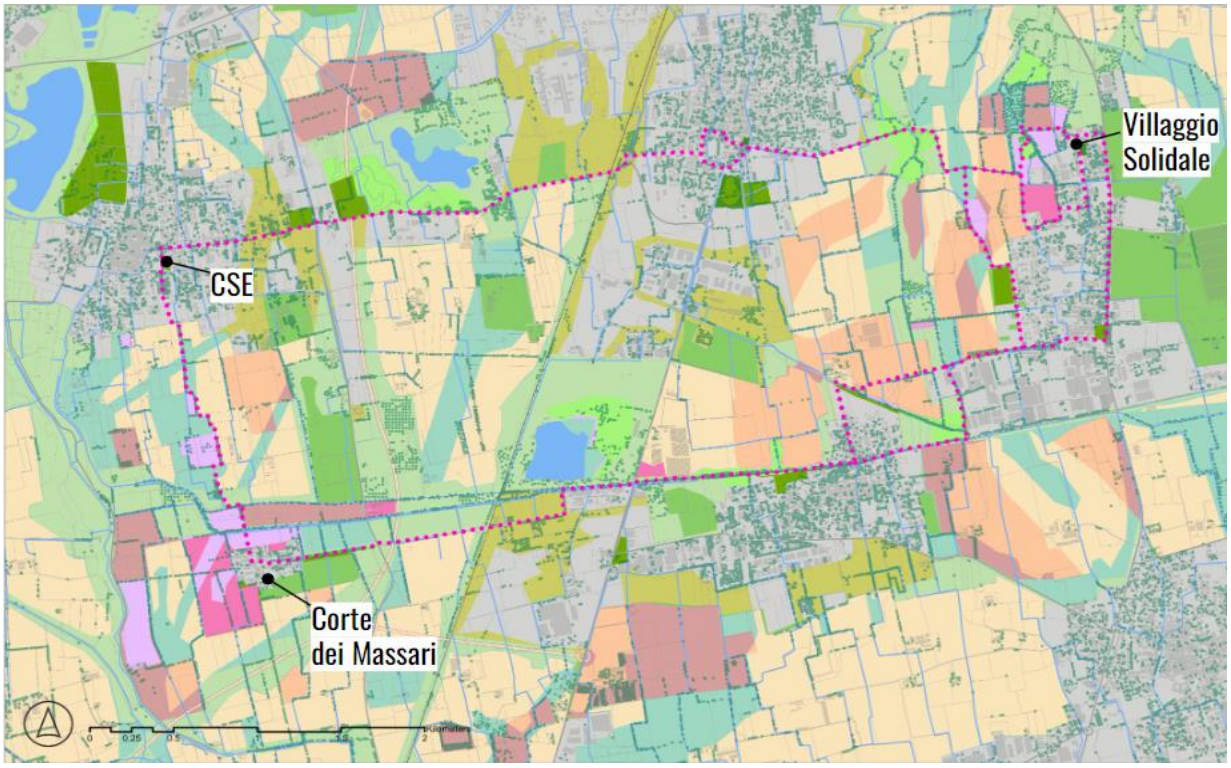


Figure 41: Composite of the four land uses shows certain areas' diversification. Image by author

5.4 Regional Master Plan: Zoning for Agroecology

The master plan is a product of the overlay method (Figure 42). Each zone depicted is a different scenario of the land uses that overlap. The composite led to the identification of these zones. Agroforestry, for instance, is the overlapping of land suitable for conservation and agriculture. Organic agriculture is a priority area that is suitable for agriculture. Undefined agriculture is an area that can continue practicing commodity farming or transition as seen fit. Open Space and Recreation are areas suitable for conservation and solidarity. Conservation buffers overlap the urban growth and conservation land use types. Conservation corridors are the remaining areas suitable for conservation. Green innovation is the overlap of urban growth and agricultural land uses. Regenerative agriculture is the overlap of conservation and priority agriculture. Green neighborhoods consist of land uses suitable for agriculture, urban growth, and solidarity. Commercial/residential areas are urban growth areas that do not intersect with other land types. Solidarity Park is conservation, agriculture, and solidarity, while Solidarity Lab overlaps all four land uses.



Legend

Solidarity Lab	
Solidarity Park	
Regenerative Agriculture	
Agroforestry	
Green Innovation	
Organic Agriculture	
Undefined Agriculture	
Open Space & Recreation	
Conservation Buffer	
Conservation Corridor	
Green Neighborhood	
Commercial/Residential	

Figure 42: The regional master plan showcasing all of the zones and where transitions are suitable depending on the characteristics of the landscape. Image by author

SECTION 6: DESIGNING THE AGRICULTURAL GARDEN

6.1 Agroecology Zoning Typologies

Solidarity

The solidarity zones in this plan comprise the solidarity lab, solidarity park, open space and recreation, and green neighborhood. All four are present in Lurano around Villaggio Solidale. The section shows the transition and integration of solidarity throughout the landscape (Figure 43). In this transition, Consorzio Fa will be a key player and there lies its cultural significance and place to share knowledge. The icons denoting this are brought back from the elements of agroecology and its intent. They point to features within the different zones, how they contribute to agroecology, and what their functions are in creating a resilient, sustainable landscape of well-being. 'Open space and recreation' allows greater access to people and animals. Using pigs and other animals to manage overgrowth and invasive species. Solidarity Park creates resilience to global markets by thinking culturally and focusing on walkable and accessible landscapes. Solidarity Park brings in all regenerative agriculture practices and creates a place to test their viability for the proposed transition. It promotes a place for people to come and learn, engage with their food, and take some home with them. It is a place for production, a place of culture, and a place of community.

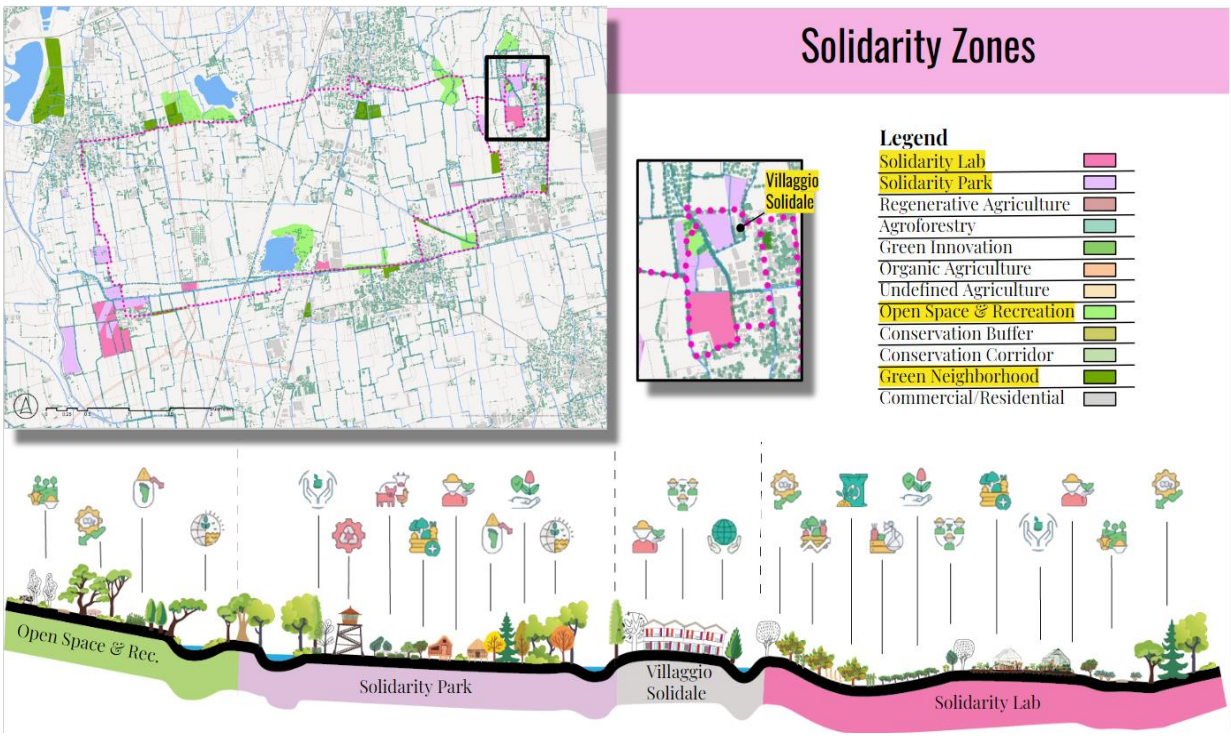


Figure 43: Graphic of the proposed trail illustrating a selection of zones related to solidarity-driven areas, a focus on the landscape surrounding Villaggio Solidale, a vision for the landscapes and practices that make up the zones, and how they achieve agroecology. Image by author

Heritage

Solidarity zones are also in terms of heritage. Within the focus area are a sanctuary, a chapel in remembrance of the plague, and the Fosso Bergamasco, the historic border between Milan and Venice (Figure 44). Both states fought over the territory for decades. The border is marked by stone pillars and canals throughout the landscape, which are used as delineation markers. The place where this meets with the Brembo Canal has been zoned as open space and recreation. A place to conserve and highlight in the landscape, making cultural references that people can connect with. The Solidarity parks relate to culturally significant farmhouses and social services, where the community is already active and can build trust over religion, thought, and beliefs. These zones can create relationships between community members, educate the public on historical significance, and work together to become landscape stewards.

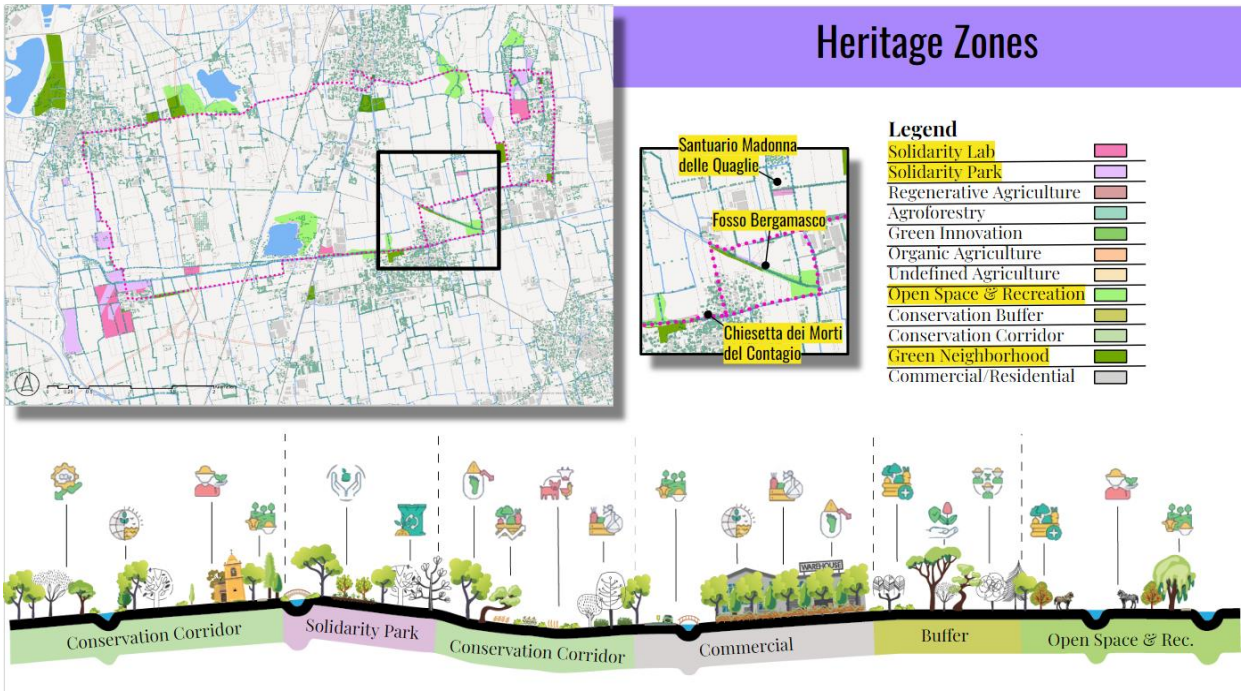


Figure 44: Graphic of the proposed trail illustrating a selection of zones related to solidarity-driven areas; a focus on heritage landscapes between Castel Rozzone and Lurano, a vision for the landscapes and practices that make up the zones, and how they achieve the agroecology. Image by author

Conservation Agriculture

These zones contribute to the transition to small-scale farming, regenerative commercial agriculture, and conservation zones. They are regenerative agriculture, agroforestry, green innovation, organic agriculture, conservation buffer, and conservation corridor. These zones tend to contain the growth area, restore fragile conditions in the soil and topography, and extend existing conservation areas.

The Green Innovation Zones enhance the technological practices within agriculture (Figure 45). These zones consist of areas affected by industrial activities, such as landfills, urban development, and large infrastructural elements integrated into the agricultural landscape. They aim to incorporate emerging technologies that are progressing in the region, with the goal of diversifying agricultural landscapes through the use of green energy, advanced pest control strategies, experimental hybridization of culturally significant crops capable of withstanding climate extremes, and cutting-edge indoor and vertical farming methods. These zones foster a movement towards integrating manufacturing and industry with solidarity economies and

regenerative agriculture, thereby strengthening the resilience of both the landscape and its inhabitants against formidable challenges.

Agroforestry represents ecological or conservation corridors that also exhibit agricultural practices. They exist on top of ridges, along the edges of roads, underneath power lines, and in areas with preexisting trees. These zones can function as buffers, accessible greenways, reestablishing ecotypes, diversifying crops, and places open to foraging and self-picking. The conservation corridors and buffers would create areas of succession and layering of vegetation in the landscape, increasing tree canopy, shrubs, and pollinating perennials.

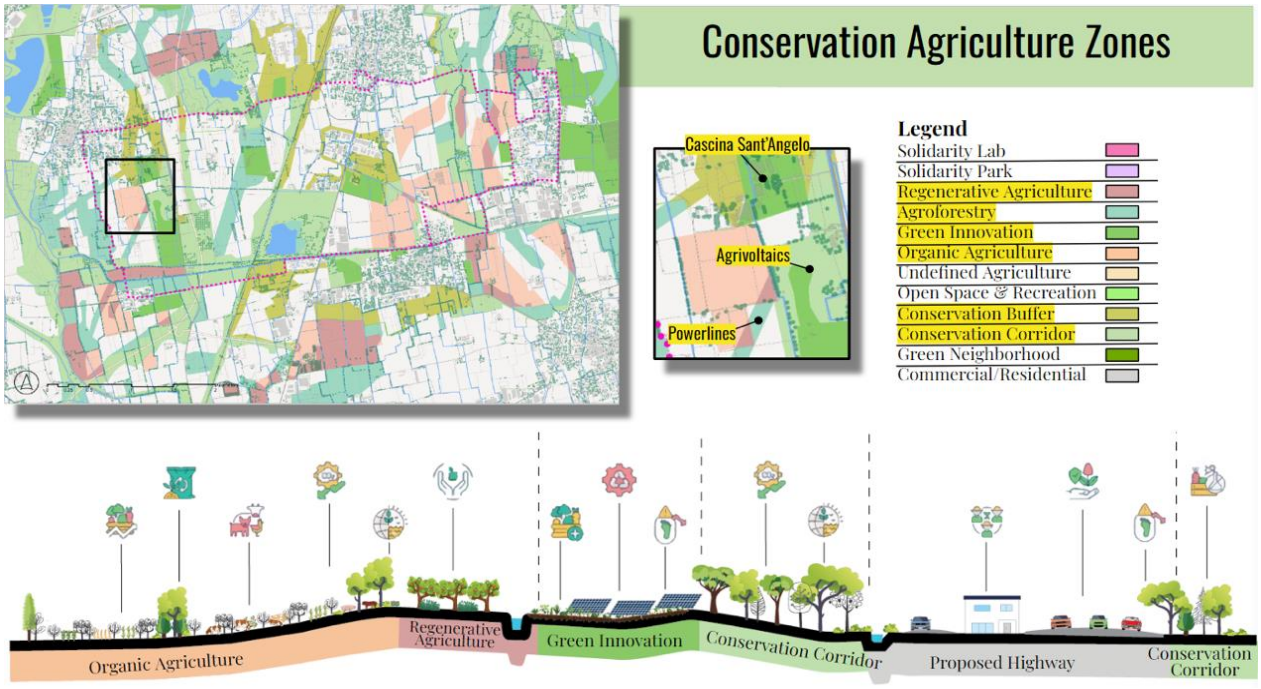


Figure 45: Graphic of the proposed trail illustrating a selection of zones related to conservation agriculture areas; a focus on the landscape along the country road between Castel Cerreto and Pontirolo Nuovo, a vision for the landscapes and practices that make up the zones, and how they achieve the agroecology. Image by author

6.2 Actional Practices Toward Agroecology

Each zone has various alternatives for what they could practice and perform. However, as a starting point, one practice illustrates a transition that could be easily implemented because of the extensive shared knowledge on the subject and 'how to' design strategies.

Permaculture, Miyawaki forests, stream restoration, and community farming are examples of practices in solidarity-driven zones (Figure 46). Miyawaki forests are densely planted forests that outcompete and grow quickly. They are super diverse, engage communities, and sequester carbon. It is most practical to begin with tree planting and growth, followed by allowing natural succession to take place. All that is needed are shovels, trees to plant, and hands to plant them. A volunteer event could begin this transition.

Conservation agriculture zones should establish diverse and robust edge conditions, particularly between commodity farms and regenerative or organic farms, as well as around urban growth areas. A critical component of this initiative involves planting and cultivating a variety of coniferous and broadleaf trees. These trees will serve as natural air filters between different land use types. Additionally, an understory of shrubs and smaller, fast-growing, or fruit-bearing trees should be incorporated, which can also be harvested for timber. In the context of sustainable agriculture, intensive livestock rearing is unsuitable. Instead, silvopasture systems provide a viable alternative, promoting increased biodiversity and a diverse range of marketable products. The design of these systems should accommodate tree planting in various configurations, such as rows, circles, or keyline designs, facilitating efficient livestock movement. Following the establishment of trees, livestock should be introduced into the fields, using movable electric fencing to manage grazing areas. This allows animals to graze on grasses and contribute organic matter to the fields through defecation. It is imperative to rotate animals at least every third day to new areas, ensuring resources remain within the farm. The land should be allowed to rest and regenerate between grazing periods, which fosters soil building, root system development, and the growth of a beneficial microbiome of bacteria and fungi. These principles form the foundation of adaptive multi-paddock grazing, where practices must be adaptable based on specific conditions. Such an approach not only enhances the health of ecosystems and livestock but also reduces the need for external inputs and physical labor, leading to a more cost-effective and sustainable business model.

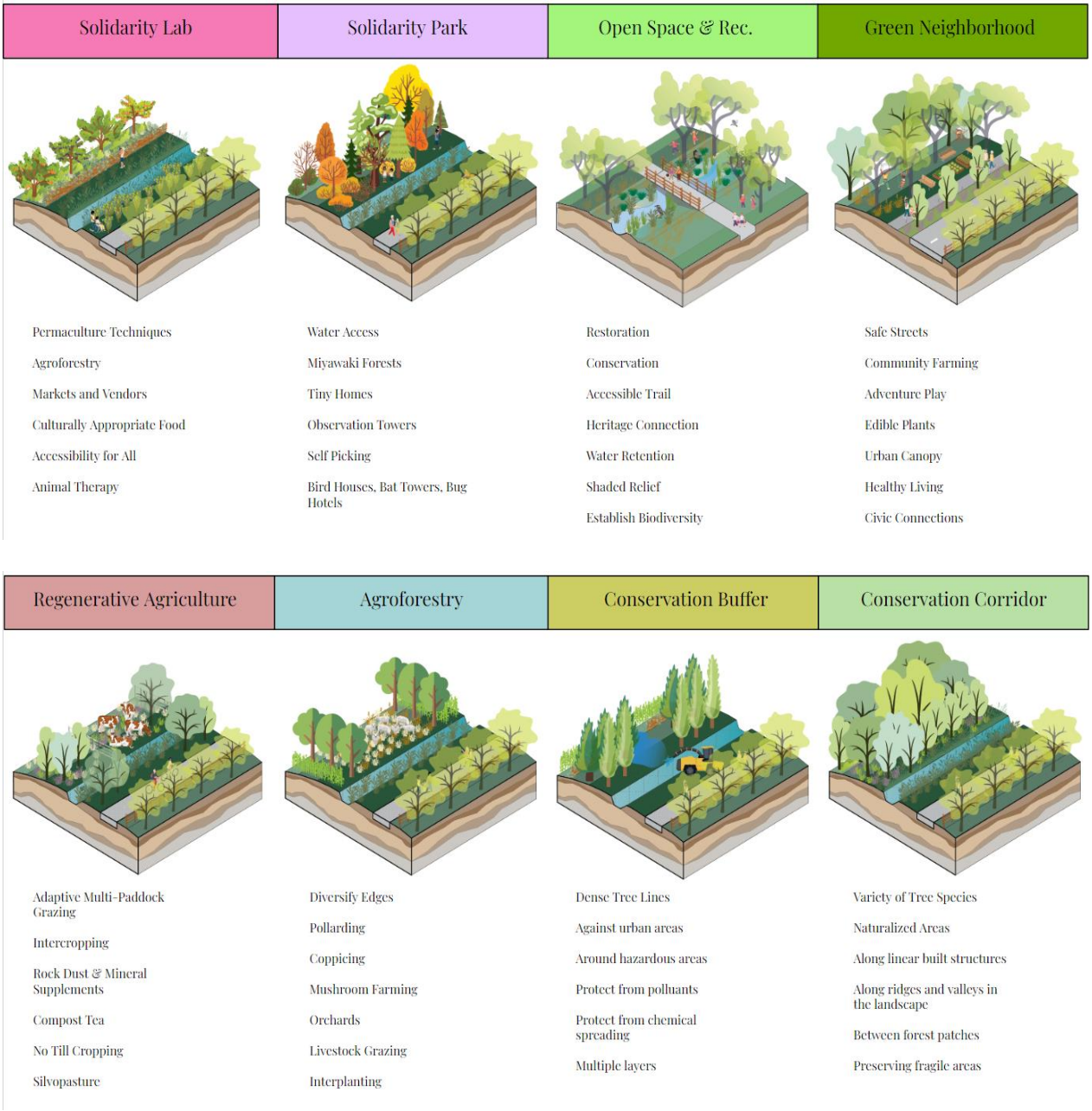


Figure 46: Actionable practices derived from the case study investigation to implement into the desired zones in the regional master plan. Images by author

6.3 Exemplifying the Transition

A look into the existing landscape gives perspective to the mapping performed in this thesis (Figure 47). The image portrays the context of the white space on the map and reveals how it exists today. Besides the area in the foreground with larger trees that exemplify a network of ecological areas, the landscape is barren within the fields. The picture depicts the agricultural landscape after harvest, but still, the vast fields of monocultures are visible, one after the other, with thin lines of trees scattered about following along. Cascina Biffa is central in the image, barely portrayed as a farmhouse with no crops or livestock around it. It gives a better understanding of just how large the district is. The image shows an immense landscape but is only about a tenth of the study area in the regional plan.

The proposed transition shows change on many levels (Figure 46). The implementation of the master plan illustrates the view of the agricultural landscape to the west of Lurano 40 years into the future. Agroforestry at the forefront of this plan illustrates an increase in tree canopy. The form of the landscape will change, with more small plots edged with trees and more diverse crops. Open meadows mowed for hay transformed into accessible spaces free of machinery, which hindered public safety and perceptions that the land was not for people. The shared-use trail brings people through ten landscape scenarios in this stretch alone: intercropping of cereal and nitrogen-fixing crops, keyline design permaculture, floodplain restoration, regenerative vegetable cropping, adaptive multi-paddock grazing, agrivoltaics or solar farms with under-cropping, parks, markets, restaurants, and more.

Figure 47: The existing landscape on the outskirts of Lurano. In the foreground is the southern end of the Fontanili preserve. The middle ground is Cascina Biffa. The background, intensive greenhouses, Castel Rozzone, the 'industrial corridor,' and Treviglio behind. Pictured to the side is a context map of the area this photo portrays. Images by author

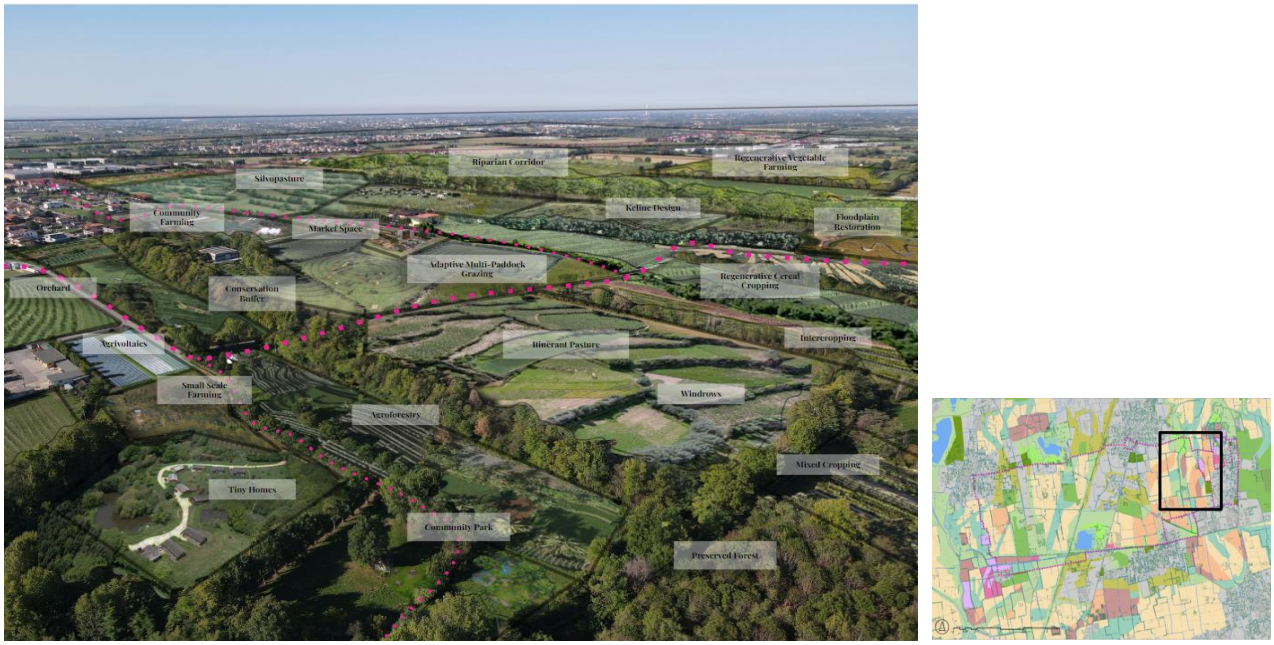


Figure 48: A picturesque view of the landscape surrounding Lurano after the plan's implementation, showcasing the diversity of practices used for zoning. Images by author

6.4 Ecological Performance Analysis

Not only is this plan creating wellness and community engagement, but it is also achieving resilience and sustainability by building soils and creating ecosystem services that benefit the landscape and contribute to the cost of maintaining it. Through research on agroforestry, AMP grazing, and PAR with farmers, the author determined the calculated benefits that these practices could yield:

"Each percent of organic matter in the soil can hold one inch of rainfall (Thomet, 2024, January 14)."

"10 years ago, there were 3 or 4 of them (quail)...this year we are hearing quail from daylight to dark, front to back and everywhere in between (@carboncowboys)."

Agroforestry systems have raised bird species from 3 or 4 to 60 in a 25-year span - Prof. Martin Wolfe (Ridgedale Permaculture, 2014).

White acacia (*Faidherbia albida*) agroforestry systems have shown a 41% increase in Soil Organic Carbon (SOC) compared to row cropping and grasslands - University of Illinois (Carbon Cowboys, 2023)

Adaptive Multi-paddock Grazing (AMG) increases SOC by 18% from that of business-as-usual grasslands (Carbon Cowboys, 2023)

Sustainable practices (sowing legumes, fertilization, irrigation) can increase Carbon Sequestration by 1.5 Mg C/ha/yr after ten years, while AMG sequesters carbon by more than double, 3.3 Mg C/ha/yr on average (Carbon Cowboys, 2023)

1.86 Gt C is lost yearly due to global erosion on farms (46% inputs, 54% wind/water/tillage). AMG and conservation cropping practices contribute to decreased erosion by 50% - Peter Byck (Carbon Cowboys, 2023)

The analysis used the above-mentioned statistics on the benefits of regenerative farming practices to assess the overall performance of the new plan. A 1" rain event (2.54 mL of rain/cm^2) drops about 65k gals (246k L) h20/ha: The regenerative agriculture zone proposed at Cascina Biffa is practicing adaptive multi-paddock grazing in the proposal. This 18-ha range could hold more than half the rain that falls during an event (37,012 gals or 140105 liters) because of AMGs' effectiveness in building soils and organic matter's ability to absorb and hold water (Figure 49). Now double that for the agroforestry zones accounting for 21 hectares (~52 acres) in this view. The author determined this doubling by calculating the percent increase in SOC from AMP grazing methods (18%) and agroforestry systems (21%).

The analysis also included the use of iTree to determine the benefits trees contribute to air purification, carbon sequestration, and water retention in the conservation corridors and buffer system (iTree, n.d.). Two thousand trees were added to the iTree calculator. The trees added were common to the ecoregion, as were those from the list of plants identified from the fieldwork. The number of trees was an estimation of the tree density in a healthy forest of one hectare in size. The author used the Google Earth measurement tool to measure the surface area of the conservation corridors. The 34-hectare (84-acre) riparian corridor along the stream, La Morla, has the capacity for 68k trees. This system alone could sequester 207M lbs (93.9M kg) of C, saving €4.5M over 40 years. It can potentially evapotranspirate 2.1M gallons (8M L) of water, making more water available in the atmosphere for more frequent rainfall. It can also capture 162M gals (613 L) of runoff, decreasing flooding hazards and increasing water availability in the region. This design finds solutions to the challenges discussed earlier, learned from experience. It is people and farmer-focused. It will help build the local economy, relationships, and ecological interdependence.

Figure 49: The perspective view of the proposed landscape indicating the ecosystem services that contribute to the design and implementation of the plan. Image by author

SECTION 7: CONCLUSION

In conclusion, the research aspired to answer a multifaceted research question: How can agroecology serve as a framework for transitioning Bergamo's agricultural landscape towards sustainability, resilience, and community well-being? Through integrating participatory action research methods, empathy building and co-creation, and a vision for trust, reciprocity, and mutual support, this thesis aims to cultivate a landscape where ecological resilience and solidarity intersect, fostering a brighter, more sustainable future for Bergamo's rural communities.

Agroecology can be used as a planning framework. The regenerative practices learned from the case study investigation form the foundation of agroecology that will ensure sustainability and resilience. The shared values and solidarity economy aspects of agroecology will promote community well-being, integration, and togetherness. The master plan reveals a vision for change and an entry point through education, governance, autonomy, and partnerships. Decision-making strategies helped to make trade-offs and set prioritizations across the landscape. Actionable practices of regenerative farming make the plan come to life. These techniques are proven ways to create resiliency in the face of uncertainty with climate change. They increase food diversity in the local market and create jobs.

Change can start small, but many hands can create change with partnerships. The vision will create opportunities to better the lives of Villaggio Solidale and Corte dei Massari residents, the social workers, and the larger community. The plan proposes ways to achieve the goals set for the project and combat the challenges in the Po Valley region:

- Enhance soil quality through regenerative practices; build fungal energy chains of biodiversity and increase mineral content.
- Grant further access to the landscape for humans and animals through trail networks and AMP grazing.
- Expand the width and density of tree lines and corridors for air purification, water availability, carbon sequestration, flood mitigation, crop resiliency, biodiversity, and the mental well-being of residents.

- Advocate for and implement green infrastructure to offset infrastructure and transportation projects that contribute to pollution and protect the health of people and crops, especially fragile organic products and vulnerable populations.
- Develop sites for solidarity economies to thrive and create partnerships where knowledge and resources can be shared through reciprocal exchanges.
- Promote educational activities and startup opportunities for farmers and agronomists to establish regenerative and organic farms.
- Diversify land use, overlapping functions of the landscape and management practices, bringing a wider range of job opportunities, biodiversity, and activation of underutilized landscapes.
- Focus on water retention and infiltration methods that link to canals and rivers, using nature-based solutions that mitigate flood risk, increase recreational use, and make water available for food production.
- Transition away from monocultures by incorporating tree lines within agricultural fields, intercropping, and scaling down field sizes to establish a more diverse patchwork of crops.
- Organize the advancement of food sovereignty to empower rural workers and create a food system that benefits local institutions, businesses, and, most importantly, residents.
- Restrain urban development from encroaching on agricultural land by establishing policies of densification.
- Promote sustainable residential uses with integrated green areas, safe streets, accessible pathways, urban forestry, food production, and nature-based play that provides good conditions for all ages and abilities.
- Create opportunities for cultural attachment by restoring heritage sites for alternative use, promoting community socialization.
- Increase cultural identity in parks through interventions that speak to historical events and Indigenous roots through memorialization, education, art, and recreation.
- Think innovatively and develop partnerships between businesses and organizations to implement and support agroecology and solidarity.

This model could be used in other parts of the valley as well. Agroecology is being used worldwide in some of the most challenging and hottest conditions to sustain food supply and life as we know it. It can be used in Bergamo too.

The team will put the plan to the test during the proposed workshop in late June 2024. They will organize participatory activities to share knowledge, communicate the vision to the public, and enlist new partners and promoters. Recent news reveals that two young men are transforming a plot of land in Castel Rozzone, near the chapel along the canal, into a community garden. This plot, zoned as a 'Green Neighborhood,' aligns with the community's desires outlined in the plan, confirming that the plan effectively embeds the community's wants and needs.

Currently, planning decisions about a landscape, its use, and particularly agriculture, seldom involve the participation of residents and communities. This thesis and the planning framework underlining its master plan incorporated the perspective of many landscape users. The author, research team, and community partners invested over three years of time and effort into the project. Consorzio Fa gave their full support to this research project and the vision it produced, which they will now take into their own hands and implement. Co-creation and participatory action research helped establish relationships and trust. Now, this plan can be presented to those partners and handed off to the larger community of the region so they may embrace and own it.

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