

Reconnecting with Cultivated Biodiversity and Traditional Agroecological Knowledge for a Fruitful AgriCulture

Methodological Proposal for a Participatory Network of Agrobiodiversity Guardians in the Natural Park Sierra de Espadán, Spain

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Abstract

Problem and Urgency: A global loss of cultivated biodiversity and traditional knowledge and practices can be observed. It is, however, essential to preserve this heritage that contributes to climate resilience, diversification of ecosystems and the dynamization of rural areas. **Approach:** Based on the work with Connecta Natura in the Sierra de Espadán (Spain), this thesis makes a proposal for a network of Agrobiodiversity Guardians for the *in-situ* conservation of traditional fruit tree varieties. It draws on a transition management and governance approach to analyse the system, the vision, and the potential. **Findings:** The knowledge, skills, and territory accessible to the organization present a fruitful foundation for the stepwise development of a centralized network. **Conclusions and Implications:** The organizational structure opens opportunities while the lack of participatory culture and the few working members can challenge the project. This thesis can help bridging the gap between diverse knowledge productions and transformative action.

Resumen

Problema y Urgencia: A nivel global se puede observar una pérdida de la biodiversidad cultivada y de los conocimientos y prácticas tradicionales agrícolas. Por lo tanto, es fundamental preservar este patrimonio, ya que contribuye a la resiliencia climática, a la diversificación de los ecosistemas y al dinamismo de las zonas rurales. **Enfoque:** Basado en el trabajo con Connecta Natura en la Sierra de Espadán (España), esta tesis hace una propuesta para la implementación de una red de guardianes de la agrobiodiversidad, para la conservación *in-situ* de variedades tradicionales de árboles frutales. Utiliza un enfoque de gestión y gobernanza de la transición para analizar el sistema, la visión y el potencial de la propuesta. **Hallazgos:** El conocimiento, las habilidades y el territorio de la organización presentan una base fructífera para el desarrollo gradual de una red centralizada de guardianes de la agrobiodiversidad. **Conclusiones e Implicancias:** La estructura organizativa de la organización abre oportunidades, mientras que la dependencia del financiamiento y el número limitado de personas son potenciales desafíos para el proyecto. Esta tesis puede ayudar a cerrar la brecha entre la producción de conocimiento diverso y la acción transformadora.

Keywords: Agroecology, *in-situ* conservation, Participatory Action Research, sustainable agriculture, traditional crop varieties, Transition Management and Governance

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"You can't come back to something that is gone."

Richard Powers

Preface

Xinquer, Spain, 26.02.21, 7.35am

The air is cold and humid, the night is slowly saying goodbye, making us see the forests and hills around us, against the light blue of the clear sky. The sun has not yet found its way over the mountains to shed light on the stone walls. On the other side of the valley the pine trees are already covered in golden glow, while drops of melted ice slowly roll down the outside of the tent towards the red soil.

The morning is calm between the olive trees and the air is fresh and soft. The birds announce the warmth of this spring day that still seem to be so far away. A warmth that will arrive more sudden and intense than we can imagine now, wrapped in all the layers, with sleep in our eyes and tea in our hands.

Rays of sunshine now make the silhouette of the abandoned village glow and bring imaginations of how life has been there, centuries ago, when the streets were filled with people and animals climbing up the hills to work on their fields and the bells of the church were still ringing. Now these images are only alive in a few people's memories and will be forgotten if we do not listen to them. *Pera de Invierno, Pera Christalina, Perote, Manzano Gandía, Ciruela Cascabel, Ciruela Yemas, Higuera Ull Perdiu*,¹ these fruit varieties are known to them but forgotten to the world which is moving too fast around them. They still know the taste of them, the use of them, how to conserve them, how and when to grow them, and how to take care of them.

The walls are covered with wild plants, hiding the stones that they are made of. A giant fig tree fills the ruins that once have been the house of a family and their animals. An ancestor of this tree might have been their life insurance, feeding the family throughout the whole year, giving fruits unconditionally and reliably, not letting them down even in the driest years. The hills have been home to the figs and other fruit trees for ages and their presence and resistance reminds us that they do not want to be forgotten.

¹ These are traditional pear, apple, plum, and fig varieties of the province of Castellón, Spain.

1 (Dis-) Connections and Agrobiodiversity

Alexander von Humboldt highlighted in 1800 that everything on this planet is interconnected, the landscapes and ecosystems as well as humans and their cultures. Humboldt focused his scientific work on the diversity and the equilibrium of these human-nature interconnections (Wulf, 2018). Human needs, lifestyles, as well as cultural practices and values are often linked to elements of biodiversity or certain landscapes, as societies and ecosystems have been evolving in coexistence of humans and nature over the centuries (Guerrero Lara *et al.*, 2019; Heinonen, 2014; Paprštein *et al.*, 2015). What is nowadays known as *agroecosystem* emerges when humans influence an ecosystem to use its resources and thereby drastically change the dynamics between the elements (Gliessman, 2014). In line with this, Humboldt was one of the first to realize the destructive impact that human activities can have on nature (Wulf, 2018). Therefore, Humboldt argued that humanity should reflect itself in nature, by strengthening the interconnections, the equilibrium, and dependencies between us and nature, honouring the responsibility that we have to protect the foundation of our lives, and of the lives of the ones that come after us (Wulf, 2018).

Today, we still seem oblivious to these interconnections, and the responsibility that Humboldt and many after him described. Modern agriculture is dominated by tendencies such as specialization, intensification, mechanization, and expansion (Isgren, 2018). As a result, the landscapes and the agroecosystems are undergoing rapid change and degradation (Darnhofer, 2014). Around the world, social, environmental, and economic clashes are taking place between the traditional and the modern lifestyle, agriculture, and relations to nature (Rosset, 2011). The industrial agriculture is causing the decline of traditional local varieties² as well as the loss of the connected traditional agroecological knowledge³ and practices (Connecta Natura, 2015; IPBES, 2019).

There is increasing international recognition of the importance of traditional local varieties and traditional agroecological knowledge for the sovereignty and stability of the food system, today and in the future (Wezel *et al.*, 2018). Humans are known to have cultivated and harvested over 4.000 plant species (Gruberg *et al.*, 2013). Today however, according to the Food and Agriculture Organization of the United Nations, around 75 % of this diversity has been lost (Gruberg *et al.*, 2013). The varieties

² In this thesis, 'traditional local varieties' is used synonymously with traditional cultivated biodiversity and traditional plant genetic resources. Plants are considered as local varieties after being cultivated and present for over thirty years in a certain area.

³ 'Traditional agroecological knowledge' is based on the concept of traditional ecological knowledge and includes the collected knowledge around agricultural practices and the interaction between culture, traditions, and the surrounding agroecosystems over time (Guerrero Lara *et al.*, 2019). In the following this will also be just called traditional knowledge or local knowledge when referring to traditional agroecological knowledge.

(forest trees, fruit trees as well as horticulture) have been selected by nature or humans over centuries, and present therefore a high degree of adaptation to the local conditions and cultures, and are resistant to changes (IPBES, 2019; IPCC, 2019; Wezel *et al.*, 2018).

Slowing down the disappearance of local traditional varieties can make the richness of cultivated biodiversity available and accessible for future generations and their needs; this, however, is not without challenges (Hammer & Teklu, 2008; Pautasso *et al.*, 2013; Heinonen, 2014). Many private, public, and state initiatives are making efforts to conserve these varieties. Currently most measures focus on *ex-situ* conservation, the storage of genetic material in seed banks or botanical gardens (Wezel *et al.*, 2018). However, by conserving the varieties planted in their natural environment, *in-situ* conservation promises their continuity, their adaptation to changing climate conditions as well as benefits for food sovereignty (Gruberg *et al.*, 2013). *In-situ* conservation can further contribute to the revaluation of traditional knowledge (Guerrero Lara *et al.*, 2019; Altieri, 2004) and AgriCulture, meaning here, the reconnection of cultural aspects with the work on the ground and the environment, that are currently neglected in the dominant agricultural activities.

To achieve this, we need to, as Guerrero Lara *et al.* (2019, p.3) put it, '*darle la vuelta a la tortilla*' ('flip the tortilla'), referring with this Spanish saying to a "radical change [...] from something negative to something positive". The reconnection with nature and the restoration of AgriCulture can present important steps toward this change. Agroecology, known as the 'science of sustainable agriculture', can be a good approach for this kind of shift and a way to re-establish a healthy relationship between humans and nature, and their interaction in the landscape (Altieri, 1995). Networks, collaboration, and awareness are important tools to strengthen and spread agroecological practices (Grain, 2019; Rosset, 2011). In line with this, the internship partner Connecta Natura is looking for methods to make a change in the Natural Park Sierra de Espadán, in Spain. Their efforts to prevent the loss of biodiversity and local culture, present responses to the destruction of nature that Humboldt already observed 200 years ago, and that is increasingly happening throughout the world and visible in the case study today.

1.1 Research Gap

The global loss of biodiversity and AgriCulture through the agro-food system have been investigated by the scientific community. Although different alternatives are being proposed, traditional landscapes, practices, and knowledge and their contribution have not been considered sufficiently in the academic research and literature (Wezel *et al.*, 2018). The research gaps are especially apparent in the lacking investigation of *in-situ* conservation (IPBES, 2019), the role and potential of cultivated biodiversity (especially fruit tree varieties) for the protection of traditional agroecological knowledge,

and participatory ways of conservation and rural dynamization (Anderson *et al.*, 2019; Connecta Natura, 2015; Wezel *et al.*, 2018). Furthermore, little research has been done around networks as tools for conservation (Pautasso *et al.*, 2013). Especially, the network structures and conditions most successful for the conservation of agrobiodiversity present a gap in the research (Pautasso *et al.*, 2013).

Although a lot of research has been done on Agroecology, a gap between the scientific findings and the practice can be observed (Wezel *et al.*, 2018). More investigation is needed on how to bridge the gap because research-based action is needed to change the agricultural system.

This thesis can contribute to close these gaps, and to the revaluation and the conservation of the environmental and cultural heritage. This is done by focusing on the creation of a network of Agrobiodiversity Guardians, (also called Guardian in the following) referring in this context to a person who takes care of the cultivated biodiversity and is involved in participatory research and rural organization.

1.2 Practical Aim and Research Questions

The practical aim of this work is to explore and assess the development of a network of Agrobiodiversity Guardians in the Sierra de Espadán to strengthen traditional agroecological knowledge and *in-situ* conservation of fruit tree varieties. The primary goal of the network is the conservation, enabling the secondary goal that addresses Participatory Action Research, which can contribute to the tertiary goal, the dynamization of the rural area.

This thesis addresses the following research questions:

1. What are the (pre-)conditions and the vision of Connecta Natura for the implementation of a network of Agrobiodiversity Guardians for the revaluation and conservation of cultivated biodiversity and traditional agroecological knowledge in the Sierra de Espadán?
(Sections 5 and 6)
2. How can such a network be designed and implemented in the case study? Which role can Connecta Natura, local actors, and Participatory Action Research play in this process?
(Section 7)
3. What are the potential, opportunities, and challenges for Connecta Natura and for a successful implementation of a network of Agrobiodiversity Guardians in the case?
(Section 8)

1.3 Contribution to Sustainability Science

The complexity of the current agricultural and economic structures, alongside with the globalization and standardization trends and the environmental consequences they drive, present wicked problems in the interaction of humans and the environment. Utilizing a transdisciplinary approach to address these problems and identifying the leverage point to finding holistic solutions to transform the agricultural system and the human-nature interactions, responds to both, the “descriptive-analytical” as well as “transformational” research stream of Sustainability Science described by Wiek & Lang (2016, p.32). The niche of *in-situ* conservation of traditional fruit varieties can be addressed by drawing on integrated problem-solving approaches from Governance, Agroecology, and Participatory Action Research. This way, this work can contribute to the body of Sustainability Science through the solution-oriented consideration of the interconnected elements of the natural and human systems while applying Agroecology and conservation to a specific social and geographic context. It can also close the gap between different forms of knowledge production and transformative action (Loorbach, 2010).

1.4 Thesis Outline

This thesis is structured as follows. The background (section 2) gives insights into the problem of the food system and the current crises as well as alternatives and the case study. Section 3 and 4 present the concepts and theories as well as the methodology used for the investigation. The analysis is split into three parts: Systems Analysis (section 5), Vision Analysis (section 6) and Strategy Design for the structure and implementation of the network (section 7). After the discussion (section 8) that includes the potential, challenges and future steps, the conclusion (section 9) highlights the main findings and gives an outlook.

2 Setting the Scene: Crisis, Agriculture, Conservation, and Local Case

This chapter serves to deepen and further explain the dynamics mentioned in the introduction, globally (2.1) as well as in the territory under study (2.2).

2.1 Crises, Industrial Agriculture, and Sustainable Responses

This section follows the structure of the DPSIR (*Figure 1*), a tool for systematic problem evaluation and solution finding in Sustainability Science (Burkhard & Müller, 2008). It addresses the current state and

its drivers and pressures as well as possible responses. The boundaries of the DPSIR are the elements directly or indirectly relevant for the case.

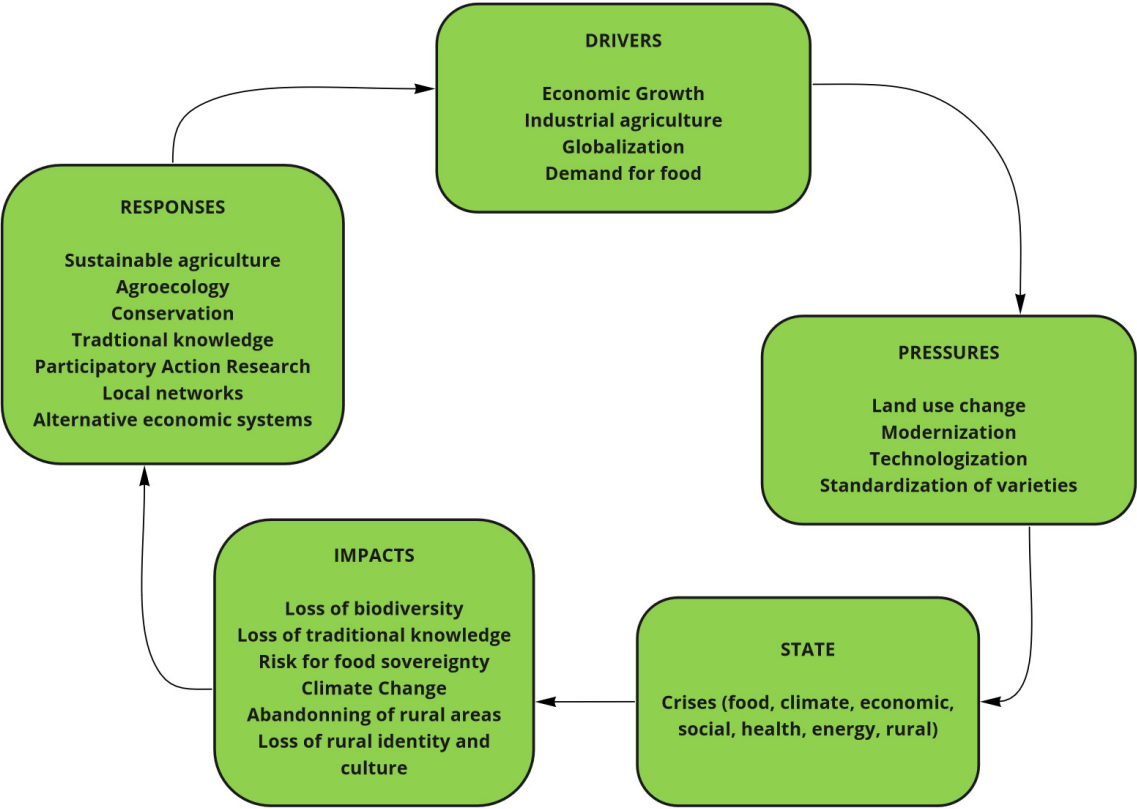


Figure 1. DPSIR illustrating the current agricultural system with its drivers, pressures, state, impacts and responses. *Source:* Own Creation.

2.1.1 Interconnected Crises (State)

The current state includes the crises that we are facing on several levels. The industrial agro-system contributes to a food crisis, a climate crisis, an economic crisis, a social crisis, an energy crisis, and a financial crisis (Grain, 2019; Rosset, 2011). The current Covid pandemic as a health crisis and the rural crisis can also be added to this list. These crises underline that we are dealing with a production challenge, a consumption challenge, and a socio-economic challenge in the agricultural sector (Garnett, 2013). This current state leads to the impacts that have been object to the introduction to this thesis.

2.1.2 Industrial Agriculture and Land Use Change (Drivers and Pressures)

The main drivers and pressures of these crises are changes in the agricultural system, climate change and the decline of natural resource, all presenting wicked sustainability problems (Gruberg *et al.*, 2013;

Guerrero Lara *et al.*, 2019). Since the industrialization, and accelerated since the globalization, industrial agriculture, demand for food, land use change as well as the standardization of agricultural products harm the ecosystems and increase climate change (Patel, 2012; Pautasso *et al.*, 2013; Sthapit & Lamers, 2013). The IPCC (2019) states in its report, that human activity is directly influencing 70% of the world's ice-free surface. Although today we are changing the world in an irreversible way, it cannot be neglected that we need healthy ecosystems and land, as they provide the foundation for human well-being and livelihoods (IPCC 2019).

2.1.3 Sustainable Agriculture, Agroecological Knowledge and Conservation (Responses)

There is a wide range of sustainable agricultural practices (Agroecology, regenerative agriculture, permaculture etc.) that try to respond to the aforementioned challenges and crises, their drivers and pressures as well as to the impacts (Darnhofer, 2014; IPCC 2019). Unlike the “ecological wasteland” of modern agriculture (Rosset, 2011, p.28), these approaches do contribute to the nature-human-balance in agricultural practices (Bellon & Pervern, 2014) and are promising for the conservation of diverse biodiversity and for carbon sequestration (Büscher *et al.*, 2012; Kremen, 2020; Muller & Aubert, 2014). Although the activities are based on strong ethical and social values (Chable *et al.*, 2014) and consider Agriculture and traditional knowledge (Gliessman, 2014), they are often neglected by the modern agricultural system (Guzmán *et al.*, 2013). To use the full potential that the field of (sustainable) agriculture provides, integrated and holistic perspectives and knowledge are needed (Darnhofer, 2014).

Traditional agroecological knowledge holds transformative potential for the current food and agricultural system (IPCC, 2019). Together with agroecological practices and the restoration of landscapes this knowledge can contribute to a shift and the adaptation to climate change (Altieri, 2004; IPCC, 2014; Weiss, 2018). Traditional agroecological knowledge should therefore not be considered as old fashioned, but rather as a “dynamic, constantly evolving body of knowledge” (Guerrero Lara *et al.*, 2019, p.2). It can complement academic knowledge and modern practices and create sustainable and transformative knowledge for current challenges (Guerrero Lara *et al.*, 2019). Historically, especially women have been the ones preserving the landscape, the varieties and Agriculture through agroecological knowledge and practices and they should therefore also today, play an important role in measures for a more sustainable agricultural system (Agosto, 2017).

As the diversity of local varieties presents a lot of benefits for food sovereignty and climate change resilience, it is important to ensure its conservation (Gruberg *et al.*, 2013; Sthapit & Lamers, 2013). Efforts for conservation imply the sustainable use of varieties and ecosystems, and the storage of plant

material for the future (IPBES, 2019). Complementing *ex-situ* conservation, more *in-situ* conservation of landraces should be exercised (Douma *et al.*, 2016) to bring the varieties from “gene banks to life” (Paprštein *et al.*, 2015, p.6). Using the method of *in-situ* conservation, the varieties are grown on farms, in gardens or arboretums under similar conditions as their natural environment. Especially traditional varieties, often well adapted to the local (changing) conditions and closely connected to people and cultures, can be managed through this type of conservation (Altieri, 1995). Grafting as a conservation technique can assure the continuity of the variety (Connecta Natura, 2020). Hereby, one branch of a variety that should be conserved because of its fruit or flower, is merged with a new rootstock with properties like firm roots and resistance.

2.2 Local Case and Study Site: Mediterranean Landscape and Sierra de Espadán

There are places in the world, at the margins of the globalized system, where a rich traditional cultivated biodiversity is still present but threatened by the economic dynamics. One example is the case study in the Sierra de Espadán, Spain.

2.2.1 Mediterranean Landscapes

Humans have been playing an important role in the design of the rich Mediterranean landscapes. These environments present a mosaic of agriculture, forest, and pastureland, providing multiple benefits for humans and for the biodiversity, while presenting a great range of biological, soil and cultural properties. Those landscapes are the result of historical lifestyles and have been evolving through a “dynamic coexistence of human and natural living systems” (Blondel, 2006, p.714). Therefore, they present high stability, productivity, adaptability, resilience, and a rich diversity of wild and domesticated plants (Blondel, 2006). Preserving and recultivating traditional varieties of fruits and vegetables of the Mediterranean region can have ecological, nutritious as well as cultural and economic benefits.

2.2.2 The Case of Spain

Spain plays an important role in the European fruit and vegetable production; often at the cost of the cultural and environmental heritage (Guerrero Lara *et al.*, 2019). Further, a decrease in family and small-scale farming can be observed, together with a loss of local horticultural and fruit varieties through the “erosion of traditional practices and knowledge that fostered this bio-cultural diversity in the past” (Guerrero Lara *et al.*, 2019, p.3). The specialization on commercial fruit and vegetable

varieties is orientated towards higher yields, neglecting the role that local varieties and agriculture play in the culture, the history, and traditions of the places (Guerrero Lara *et al.*, 2019).

2.2.3 Province of Castellón and Sierra de Espadán

The different crises and tensions between humans and natural systems are also evident in the local example of the province of Castellón, especially in the Sierra de Espadán in the East of Spain, putting at risk the social, economic, and environmental sustainability of the rural communities. Despite this, the area is still rich in traditional fruit tree varieties and is known and studied for its environmental, cultural, and historical richness (Agost i Andreu, 2019).

3 Theoretical Landscape: Governance and Agroecology

In this section, the theories and concepts that are used and applied throughout this thesis will be presented. These are: Governance, focusing on the approaches of Transition Management and Governance and Network Governance as well as Agroecology, and the connected approach of Participatory Action Research. These theories and concepts underline the position of the thesis in the field of Sustainability Science, as well as the design of the network of Agrobiodiversity Guardians.

3.1 Governance

Starting from the point that plant genetic resources can be considered a common good, the question that arises is, how this environmental heritage, conserved over centuries, can be managed, and preserved for future generations (Sthapit & Lamers, 2013; Wezel *et al.*, 2018). Agri-food systems and natural resources can be governed through new environmental behaviour and networks (Agrawal, 2005; Fletcher, 2010). This thesis mainly focuses on governance to coordinate “collective action in order to generate change” (Evans, 2012, p.22) through a network of Agrobiodiversity Guardians.

3.1.1 Transition Management and Governance

Transition Management and Governance presents one integrated sustainability problem-solving approach.⁴ Brundiers *et al.* (2020) draw on Rotmans *et al.* (2001) and Loorbach (2010) to identify the following steps for this concept: (1) Problem Analysis, (2) Vision and its Sustainability, (3) Transition

⁴ Other approaches are: Complex problem handling, backcasting, transdisciplinary case study, and transformational sustainability research (Brundiers *et al.*, 2020).

Strategy Design, (4) Implementation, (5) Evaluation, (6) Multiplication and Collaboration. These steps are used in this thesis as a guidance for the preparation and implementation of the network. The first four steps of the framework are conducted in the three analysis sections, while the steps five and six are addressed in the discussion.

3.1.2 Network Governance

The entire world consists of networks: between elements, systems, people, as well as between human and non-human spheres (Evans, 2012). Networks can present one form of governance. It is important to pay attention to the connectivity and centrality of a network and the consequences that this implies for the dynamics and functioning (Evans, 2012). *Figure 2* illustrates four simple ways how networks can be structured with different levels of connectivity (illustrated through reachability and density) (Evans, 2012).

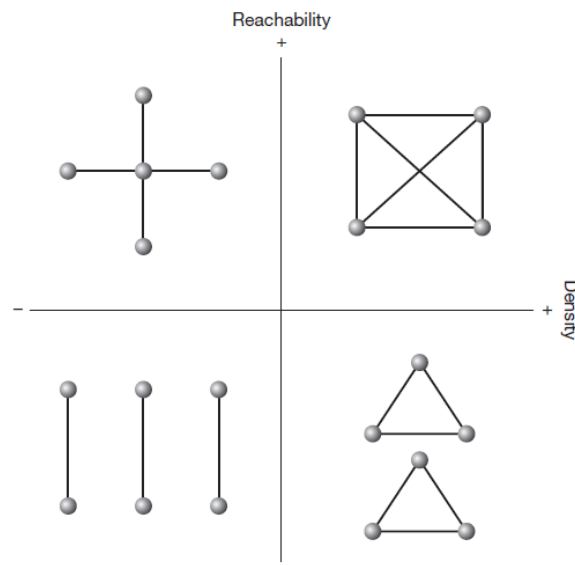


Figure 2. Different structures of networks with high or low connectivity. *Source:* Janssen *et al.* (2006), in Evans (2012).

As for all adequate governance, being “essentially about procedures”, also for the network in the case study, the following questions must be answered: Who will do what by when, how will they do it and at what cost? (Evans, 2012, p.187). These procedures can furthermore fulfil other aims, such as the rural dynamization or local organization in the case (Wezel *et al.*, 2018).

Social capital provides the foundation for governance and relationships, the building of cooperation and trust, and conflict resolution (Provan & Kenis, 2008). Complementary strengths, interactions, collaboration, and mutual benefits for the actors, the environment as well as the rural area are

important aspects of network governance (Evans, 2012). They also play a fundamental role for the network of Agrobiodiversity Guardians together with the elements pointed out by Provan and Kenis (2008) like efficiency, stability, and external legitimacy that will be elaborated in the design of the network.

3.2 Agroecology

With the concept of Agroecology, scholars, and practitioners refer to “an alternative way of conceiving and managing farms, and food systems based on ecological and agronomic principles, which recognizes experiential, indigenous as well as scientific knowledge” (Dumont, Gasselin & Baret, 2019, p.100). Agroecology presents therefore an answer to the challenges in the dominant agri-food system (Guerrero Lara *et al.*, 2019) by dealing with the social, sustainability and cultural aspects of agriculture (Isgren, 2018). Agroecology is being described by different actors as either a practice, a science, a vision, a social or political movement, or a combination of these aspects (Francis *et al.*, 2003; Gliessman, 2014; Méndez *et al.*, 2013; Wezel *et al.*, 2009). It serves as a theoretical entry point for the assessment of the existing alternatives and the development of the network proposal.

3.2.1 Agroecology as a Science and Practice

Agroecology as a science, also referred to as ‘the science of sustainable agriculture’, focuses on “action research, holistic and participatory approaches, and transdisciplinarity” and draws on different ways to collect and produce knowledge (Wezel *et al.*, 2018, p.2). Agroecology takes hereby a systemic and holistic approach considering and analysing all the aspects of the system, the interactions between the elements and the broader consequences (Guerrero Lara *et al.*, 2019). Furthermore, the analysis of the opportunities and solutions for action and change underline the highly political and transformative dimension of Agroecology (Anderson *et al.*, 2019).

Agroecology as a practice focuses on sustainable use of natural resources and conservation, drawing on traditional agroecological knowledge and farming techniques for transformative action to create broad benefits for ecosystems and actors (Méndez *et al.*, 2013; Wezel *et al.*, 2018). Agroecological practices can further be described as “particularly knowledge intensive” (Isgren, 2018, p.78), meaning that when aiming at putting agroecological principles into place, holistic understanding of the local conditions, the processes in the agroecosystem and the relationships is required (Altieri, 2004). These aspects become relevant for this thesis, as it develops a network aiming at participatory knowledge production and the implementation of agroecological principles for conservation. It therefore includes the sciences, the practice as well as the vision of Agroecology.

3.2.2 Participatory Action Research as a Tool for Agroecology

Participatory Action Research can be described as part of the branch of Agroecology that is transdisciplinary, participatory, bottom-up, politically engaged, action-oriented, aiming at the transformation of agro-food systems (Méndez *et al.*, 2013). *Participation* is done through direct interaction and inclusion of the society, *Action* through the experience and the measures put in place, *Research* through different ways of knowledge production (see Figure 3).

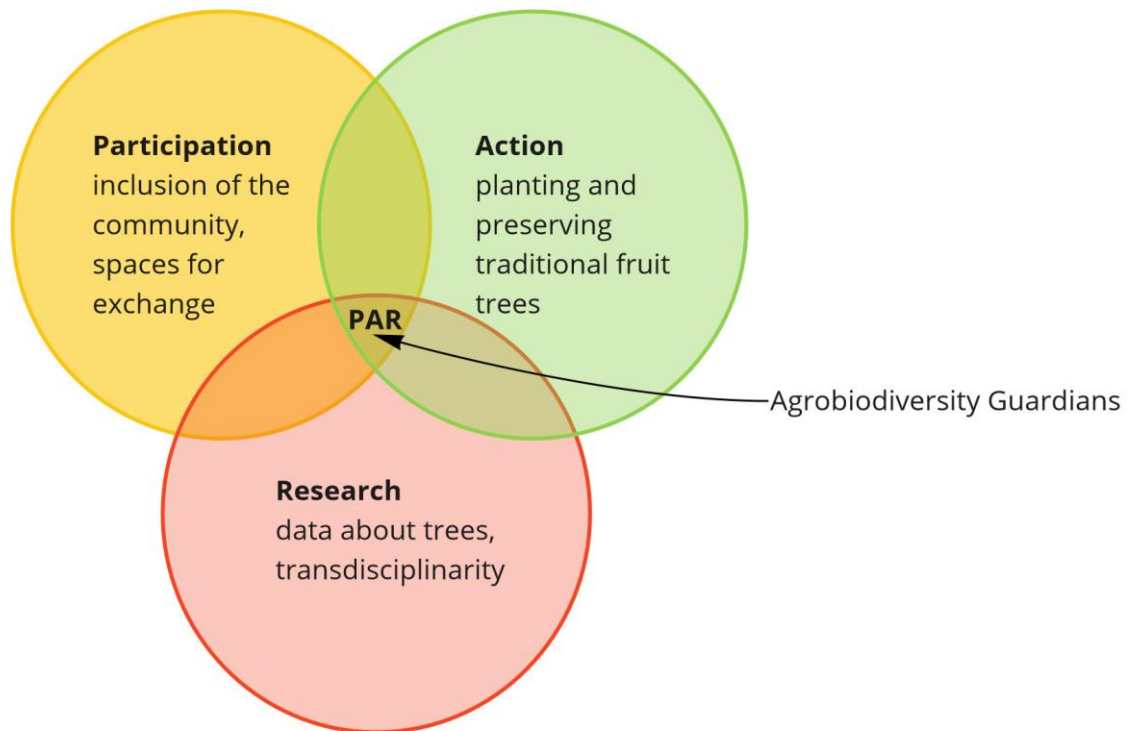


Figure 3. Participatory Action Research. *Source:* Own creation, inspired by Chevalier & Buckles (2013).

Participatory approaches can present an important aspect in the creation and the success of network governance (Provan & Kenis, 2008). Here, focusing on “social and ecological diversity” can foster a research that is holistic as well as legitimized (Méndez *et al.*, 2013, p.11). The IPCC (2014) sees Participatory Action Research as an essential tool to address the loss of biodiversity and climate change. This makes Participatory Action Research, beside Agroecology, a suitable pillar of the network of Agrobiodiversity Guardians, especially because these approaches go together in many aspects: involvement of local communities, application to a certain local context; holistic perspective for transformative action, long-term benefits and transdisciplinarity (Méndez *et al.*, 2013). Participatory Action Research can involve a wide range of constellations, from civic research to university driven investigation. In the case, the Agrobiodiversity Guardians do research for the improvement of their

own conservation efforts, the future of the local varieties and the rural development of the area. “Participatory approaches may require more time and effort than top-down interventions”, but experience shows, that the data and the outcome are often more fruitful, holistic and sustainable in the long-term (Pautasso *et al.*, 2013, p.158).

4 Methodological Landscape

This thesis draws on qualitative research methods and Pragmatism as methodological entry points and further utilizes a literature review, the experience from the internship, and the case study, and ethnographic notes.

4.1 Pragmatism

This work uses the research paradigm of Pragmatism as it follows an abductive method, moving between data and theory back and forth during the research process (Kaushik & Walsh, 2019). Being closely linked to social sciences, pragmatists make use of a mixed method approach, applying the method that works best for the case (Kaushik & Walsh, 2019). Pragmatism implies identifying and defining a problem in a certain context and then initiating the research and the process to address it (Kaushik & Walsh, 2019). Like Agroecology, Pragmatism follows a problem-solving, action-oriented, transdisciplinary and open-ended approach that is based on transformative action in the real world, linking science and democracy (Frega & Carreira da Silva, 2011; de Mello & de Barros, 2013; Popa *et al.*, 2015). In Pragmatism, knowledge is linked to the social circumstances, action, experimentations, and the context (Kaushik & Walsh, 2019). Past experiences are used as source for knowledge and as the foundation for action (Minteer, 2017). Participatory Action Research can be combined with pragmatic philosophy (Huffmann, 2013) through close engagement and knowledge creation with the local actors (Robinson, 2011). The focus lies here on empowerment, the social sphere and action (Frega & Carreira da Silva, 2011).

4.2 Literature Review

By conducting a literature review, the problem, the context, the solutions, and the matching theories could be defined. Scientific peer-reviewed articles and journals were found by using libraries and data bases. The search included the aspects: global agriculture, conservation, traditional varieties, and knowledge and the field of Agroecology, Governance, as well as Participatory Action Research. Articles were chosen between 2010 and today, as well as classical writings on Agroecology (Alteri, Francis etc).

Around 130 scientific articles and book chapters were selected and around 70 resulted to be directly relevant to inform the different chapters of this thesis and contributed to the framing of the research and its design.

4.3 Internship and Case Study

The association Connecta Natura in the province of Castellón, Spain, presented a collaboration and internship partner, facilitating the contact with the territory, the people involved, as well as the vision and idea for the network. The organization is active in the conservation of biodiversity and mosaic landscapes, the promotion of agroecological practices, and environmental education. With this work the association is contributing to sustainable agriculture, the transition towards food sovereignty, and the conservation of traditional varieties and agricultural knowledge (see more in section 5).

The internship took place during mid-January and end of March 2021, after the first contact with the organisation in October 2020. The internship was focused on my participation in diverse activities on the land in the Natural Park Sierra de Espadán, Spain, and my support for the design of a network of Agrobiodiversity Guardians. My engagement alternated between days of intense labour on the ground, as well as days to write and translate the practical work for the thesis. Around 20 whole days were spent in the field. The ethnographic notes taken during this time (see section 4.4) have been combined and complemented with supporting documents provided by Connecta Natura. After the internship, a close contact was kept with the internship partner. Parallel to the elaboration of this thesis, Connecta Natura was working on the proposal for the funding of the network. I hope to be able to take part in the actual implementation of the network in the future.

4.4 Participant Observation and Ethnographic Notes

During the active participation in the organization and their activities, I took ethnographic notes to be able to reconstruct the activities, explain and observe dynamics, as well as understand the relationships and ideas. My own experience of the place, the people, their work, and their motivation helped me to map out the problem and the local context, the potential as well as the possibilities for the network.

Following Gobo & Molles (2008) approach, observations and ethnographic notes can be divided in theoretical, environmental (scenery), interactional, emotional (reflective, own emotions) as well as methodological (network) notes (Gobo & Molle, 2017). In practice, this has been done through colour coding applied to the notes taken during the internship. The results drawn from the ethnographic

notes are presented in the analysis of the system, the vision, as well as contribute to the proposal for the design of the network (sections 5–7).

4.5 Positionality and Limitations

My academic background in social sciences with emphasis on politics, intercultural studies and sustainability justify the social science focus of the research and this thesis. Because I come from another geographic, social, political, and cultural context and an urban environment, the gradual approximation to the case and the rural setting became part of the research process. The internship enriched the theoretical examination with practical work and tangible impressions of the case and closed the gap of my knowledge as well as the gap about the local context in the literature. The boundaries were already given through the collaboration with Connecta Natura. Working as a woman in an organization and context with mainly men posed its own challenges like physical strength, experience in the countryside, as well as gender clichés.

Due to the Covid pandemic, the activities of the internship partner were limited mainly to the work with the six working members, reducing the possibility for the observation of interactions and dynamics with external actors. Nevertheless, the activities were broad and the ones directly relevant for the network could take place. The proposal for the network is based on personal experience and observations and their combination with the theory and literature, which consequently can be subject to personal bias.

The following analysis sections (5–7) are structured around the steps of Transition Management and Governance, identified by Brundiers *et al.* (2020). The sections give first an holistic idea of the system of the case, then secondly, point out the vision and its sustainability by using insights from the ethnographic data. In a third step, a suggestion is made for a transition strategy design, including the proposal for the design of the network as well as the four phases for its implementation. All these elements are illustrated in *Figure 4*.

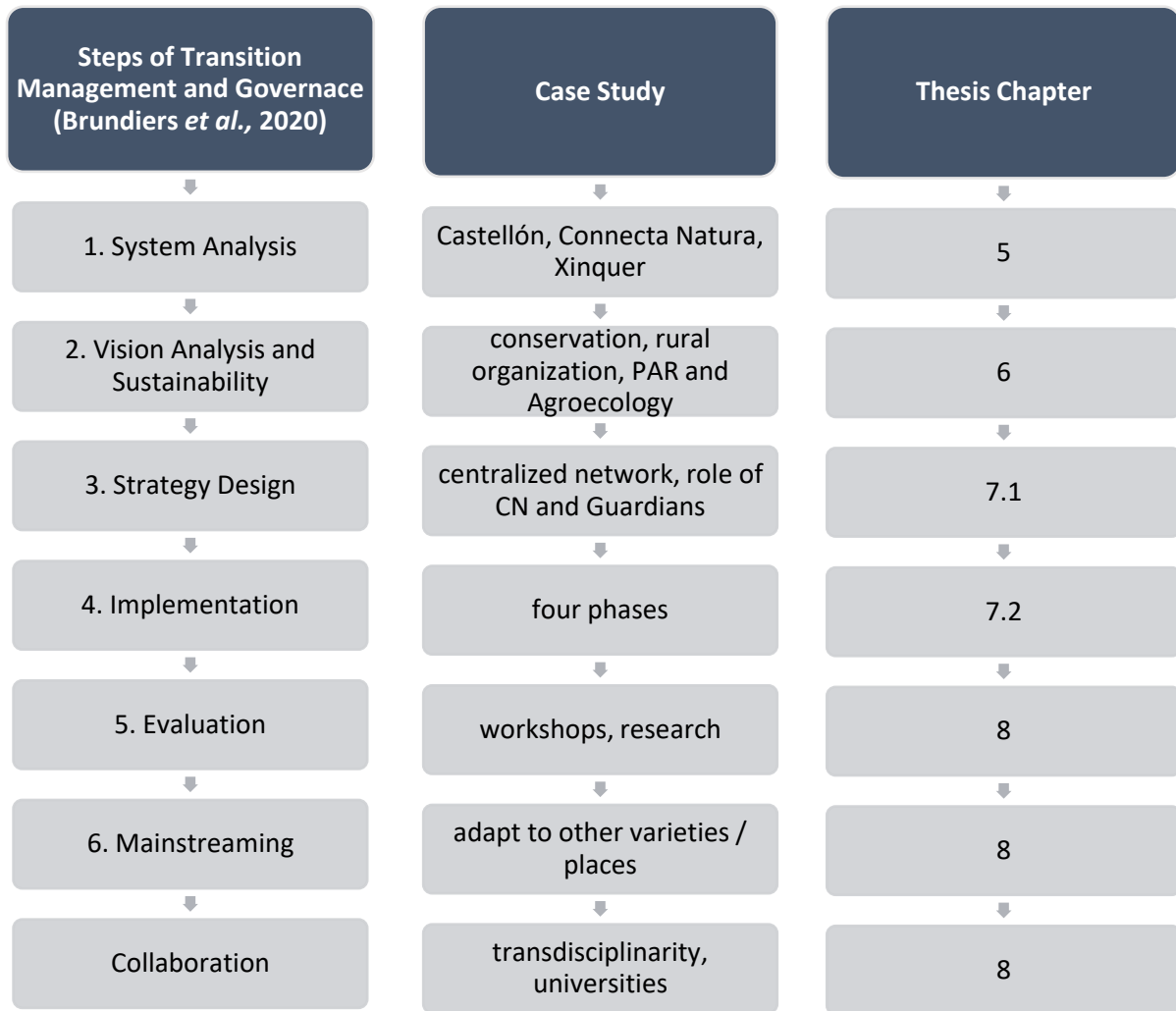


Figure 4. Illustration of the steps of the framework, the aspects, and actions in the case, as well as where they can be found in the next chapters of the thesis. *Source:* Own Creation.

5 System Analysis: Castellón, Connecta Natura and Xinquere

The following section illustrates and analyses the system of the case study, including the problem, the organization and the place.

5.1 The Problem: Loss of Rural Life and Traditional Varieties in the Province of Castellón

The rural areas of the province of Castellón, Spain are experiencing an alarming loss of agricultural activity, rural life, old varieties, and traditional agroecological knowledge (Connecta Natura, 2015). Concurrently, depopulation, out-migration, and political exclusion are observed, causing aging and masculinization of the population and threatening the economic and social sustainability of rural communities (Agost i Andreu, 2019; Mallach, 2013). As locals report, the Covid pandemic is further

worsening these processes, increasing the struggle for local people and their livelihoods. Furthermore, in only a few decades, the diverse agroecosystems of agriculture and horticulture, pastureland, and forestry have been replaced by specialized ones, mainly citrus fruits that are dominating the agricultural landscape in the province of Castellón, today.

Private, public and state initiatives have been successful in preserving local traditional horticulture varieties, but the effort for traditional fruit tree conservation in the region is mainly put on citric trees (Agost i Andreu, 2019). However, diverse fruit trees present a vital part of the Mediterranean agroecosystem (Guerrero Lara *et al.*, 2019) and as drawn from several conversations, those trees have played an important role in the economic security in many villages of the province of Castellón during decades. Nowadays, the region still is home to a great but rapidly decreasing diversity of local fruit tree varieties (Connecta Natura, 2015). The association Connecta Natura is therefore trying to recover and conserve these varieties through collective measures. In informal conversations during the internship, it became clear that these traditional fruit trees are mainly found in remote areas or are unnoticed and forgotten. Especially elderly people in the rural area ('key stakeholders') are presented as being the main source of traditional knowledge, practices, and plant material (fruit trees and horticulture) for the conservation.

The Sierra de Espadán is a rural mountainous area in the south of the province of Castellón, (*Figure 5*) and since 1998 a declared Natural Park. The area is dominated by Mediterranean climate and a lot of agricultural activity. In the Sierra de Espadán especially almond and olive tree plantations can be found.

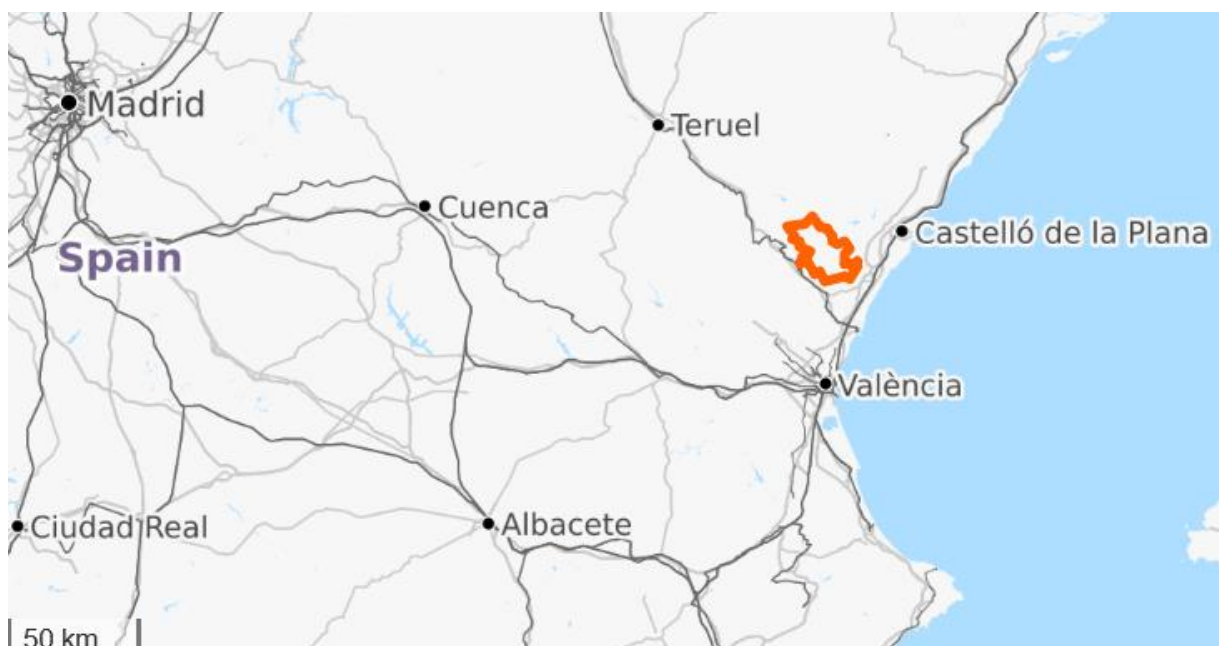


Figure 5. Location of the Sierra de Espadán (marked with an orange line). *Source:* Open Street Map (2021).

5.2 The Organization: Connecta Natura, Working Members, and Dynamics

From reports and the website of the organization it becomes clear that their main objectives are the transition towards a more sustainable agri-food system, the revaluation of the environmental and cultural heritage and the reactivation of the rural life (Connecta Natura, 2015; www.connectanatura.org). The tools to do this are environmental education, land stewardship, social participation, volunteering, and the creation and the spreading of knowledge. These activities are partly supported by the local administrations and municipalities. While some working members argue that their work is not particularly political, others are convinced that their actions and motivation have a highly political dimension. One member said in an intense discussion about this topic, “Después de haber participado durante años en grupos políticos y protestas, Estaba cansadx de mirar, criticar y esperar, lo que yo quería era actuar. Entonces, he decidido de hacer lo que me parecía lo más importante, y espero que eso puede ser una inspiración para otrxs y introducir un cambio.” (“after having been active for years in political groups and protests, I did not just want to watch, criticise, and wait, I wanted to act. Therefore, I decided to do what I think is the right thing to do, and hopefully this will inspire people and create a change.” Fieldnotes, 28.02.21).

The organization Connecta Natura has been founded in 2014 and consists of forty members and a group of six working members, that are keeping the organization alive, taking the decisions, and running the projects. Several of the working members are employed through the association, others contribute voluntarily. Mainly men are active in the organization, but as experienced during the internship, women are very encouraged and welcomed to join. The working members all have an academic background in environmental studies, Agroecology, or related fields, making their knowledge and skills well adapted and applicable to the case and their activities.

As it became evident during the interaction and conversations, most of the working members were raised in the rather rural settings and agricultural areas around Castellón and València. Therefore, they have a deep understanding and emotional bond with the territory, the tradition, and practices. Making a *tortilla* with different vegetables from the garden and eggs from their own chickens, one member said, “*solamente nos falta hacer la sal*” (“the only thing we do not make ourselves is the salt.” Fieldnotes, 04.03.21), underlining that they are proud and aware of their lifestyle and that they partly ‘eat what they grow and grow what they eat’. As they strongly identify themselves with the organization, the area and the activities, it is visible and can be felt, that they put their energy, time, creativity, knowledge, and motivation in the advancing of the association and its projects. Their families, agriculture, and rural life play an important role in their everyday conversations, presenting a

sign for the fluidity and overlap between their personal and work life. Also, the use of Valenciano, the local dialect, as main language in the organization, underlines this connectivity to the area.

5.3 The Scene of Action: Xinquèr

Although the association is active in different territories, the main activities currently take place in the region of Castellón, in and the Natural Park de la Tienença de Benifassà and the Natural Park Sierra de Espadán. An important focus of the work lies on activities in Xinquèr, an abandoned village (red dotted squares in *Figure 6*), and its surrounding agricultural sites, located in the Sierra de Espadán. During my first visit to the place in January 2021, one of the working members explained that a mosaic landscape of forest, agricultural sites, and pastureland has been present in the territory of Xinquèr in the past and told the story of the village, that had been populated until the end of the 1930s, when the civil war in Spain took place. The land and the mosaic structure are today being recovered and restored by Connecta Natura in the project *Mosaics de Vida* (Mosaics of Life), supported by funding from different municipal, public, and government bodies, and foundations. Regarding the land, the organization has a land stewardship contract with the private owner. In a conversation with the owner, he expressed his positive feelings about this agreement and gratitude for the motivation and life that the young people bring to the place. The whole property can be seen in *Figure 6* framed by the black line.

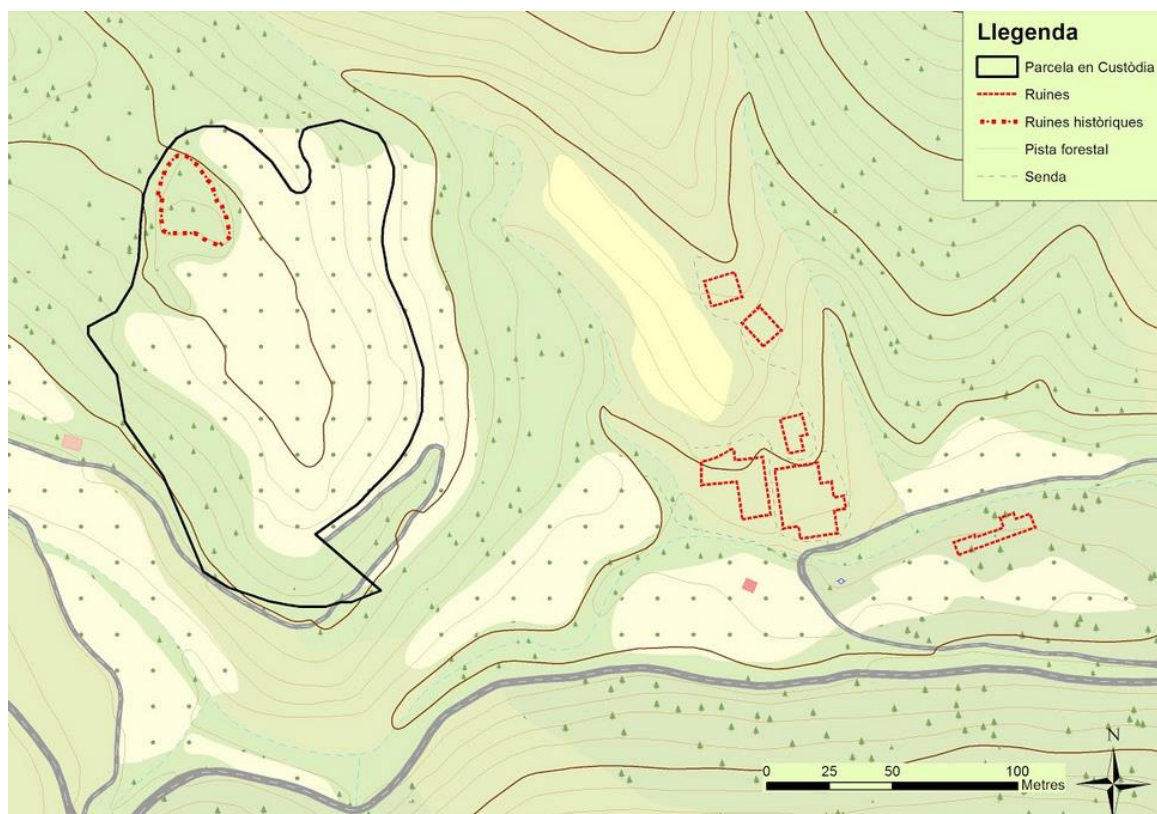


Figure 6. Map of the location and the territory of Xinquèr. *Source:* Connecta Natura (2016).

Today, the area mainly contains agricultural terraces of almond and olive cultivations with stone walls, providing the typical landscape of Mediterranean mountain agriculture (Connecta Natura, 2015). The working members have restored a small house ('Caseta', pink square in *Figure 6*), where they keep the tools and material as well as store and prepare food. The rest of the activities mainly take place outside, especially during the internship due to the Covid restrictions.

In the heart of the territory lies the ruin of the Castle of Xinquer (line red dots on the left in *Figure 6*). Next to the ruin and between the old almond trees, Connecta Natura is establishing an arboretum (collection of plant species, *Figure 7*) of the local traditional fruit tree varieties which should function as the central place and provision of material for the network of Agrobiodiversity Guardians.⁵



Figure 7. Castle of Xinquer and the site where the arboretum is being planted. *Source:* Own photograph (2021).

Three examples of each variety were planted in the arboretum during the work on the ground. As has been apparent in the activities in Xinquer and the tree nursery, many traditional varieties have already

⁵ Connecta Natura is doing similar efforts to maintain horticultural diversity. They have a seedbank with a great variety of local corn, tomatoes, legumes and other fruits and vegetables. This seedbank should be broadened and be a seedbank with local varieties of the region of Castellón.

been recovered. Once branches of the trees have been cut, they are reproduced and maintained through grafting techniques, which the working members explained.

During the internship, especially the clearing of the territory for the trees, the planting and mapping of seedlings of traditional varieties of forest and fruit trees, the maintenance of olive trees, the arboretum, as well as the activities in the tree nursery, and the organization of the seedbank were advanced during the spring 2021. These activities were, as far as the Covid situation allowed, done with the participation of volunteers.

6 Vision Analysis: What Does Connecta Natura Imagine for the Network and in Which Way is it Sustainable and Participatory?

After having presented the system and the functioning of the case, the following section addresses the next step of the Transition Management and Governance Framework (Brundiers *et al.*, 2020), the vision that Connecta Natura has for the network of Agrobiodiversity Guardians, and the assessment of these ideas regarding their sustainability.

This section is structured around the principles that Agroecology and Participatory Action Research have in common, as they present important pillars for the network. The criteria are: application to a local context, long-term benefits, empowerment and involvement of local communities, and diverse actors, holistic perspective for transformative action and transdisciplinarity (Méndez *et al.*, 2013).

Becoming evident from reports and conversations, the vision of Connecta Natura for the network of Agrobiodiversity Guardians involves firstly, the environmental purposes of the *in-situ* conservation of traditional fruit tree varieties and traditional knowledge conservation. Secondly, the momentum to create spaces for community organization. Thirdly, it includes Participatory Action Research to further broaden the knowledge about the varieties and their adaptability to different conditions. Connecta Natura responds with this vision to the demonstrated challenges and problems and follows a solution-oriented approach.

6.1 Local Context and Long-Term Benefits: Agroecology and Conservation

During the work on the ground and in conversations, it was highlighted that the network should especially be concentrated on the *in-situ* conservation of local fruit trees varieties like figs, apples, peaches, cherries, plums, pears, and apricots from the region of Castellón. The working members pointed out that they suspect many varieties still to be discovered somewhere in the territory. Some

of these traditional varieties have already been identified, extracted, and classified by Connecta Natura, and have been grafted and planted in the arboretum.

In the project description for the network (Connecta Natura, 2021) and in conversations, the working members explained their idea, how to apply *in-situ* conservation and Participatory Action Research to analyse the response of the varieties to different (changing) environmental and climatic conditions. Knowledge about the characteristics of these varieties and their adaptability and resilience, could contribute to the diversification of the agriculture in the province of Castellón. Moreover, it could help to identify the most promising varieties for the rural development and long-term benefits for the local economy, because the area is increasingly getting dryer, which is highly impacting the livelihoods of the rural population and the local agriculture.

6.2 Involvement and Empowerment of Local Communities and Diverse Actors: Knowledge Exchange and Rural Organization

The aim of the network should go beyond the pure conservation idea. It should include the local community and actors. By linking ecological and social diversity, the network can bring agroecological practices and participation together.

The working members point out that the network, by revalorizing and conserving the traditional fruit tree varieties and local organization, can also present a foundation for the conservation of the agroecological knowledge and practices connected to these varieties. The recreation of social (intergenerational) spaces of exchange, that strengthened the community in the past, is envisioned to also strengthen the local identity, knowledge, and culture today. In conversations with working members and local volunteers, they made transparent that these spaces are imagined to be fruitful for local empowerment and social organization for future struggles in the area, like climate change and rural crises. The working members of Connecta Natura point out that empowerment should especially focus on women in the rural context, as they have historically been the main guardians of the agrobiodiversity. The spaces should at the same time foster democratic processes, tolerance, and collaboration, and dismantle prejudices and boundaries in the rural area. Connecta Natura envisions that through these spaces of exchange, the quality of life in the rural areas will rise and foster rural dynamization.

One of the houses in the abandoned village that is envisioned to be restored can present one of the locations, where these encounters could take place. When visiting the ruin, the working members were enthusiastic and playing around with ideas for this place. One member said to the other: “*Ya nos veo*

sentadxs aqui con mucha gente motivada, y tu cocinando paella” (“I already see us sitting here with a lot of motivated people, and you cooking Paella.” Fieldnotes, 26.02.21).

6.3 Holistic Perspective for Transformative Action and Transdisciplinarity: Participatory Action Research and Alternative Systems

Participatory Action Research together with Agroecology are envisioned to contribute to the previously mentioned ideas through inclusive ways of knowledge creation and the combination of agricultural work with scientific research; it can this way present a transfer from ‘practice to knowledge and knowledge to practice’.

Furthermore, this Participatory Action Research can contribute to the continuation and autonomous development, and progress of the conservation of these varieties beyond the funding and support of this project by Connecta Natura. The Agrobiodiversity Guardians as well as local actors of the food chain and scientists can be part of this transdisciplinary process. A process with the participation of diverse actors might be more time intensive, but the working members are convinced that this leads to a long-term conservation and sustainability, as well as valuable scientific research. Different working members state as the ideal outcome, that the network can, in the long run, function on its own without too much guidance by the Connecta Natura.

Informal conversations about the future gave insights into the dream, to contribute with the network to a more sustainable food system, more resilience against climate change, while making the social as well as the economic system less vulnerable and dependent on the global market and its dynamics. The revaluation and conservation of the traditional varieties can further inspire new economic ideas and enable farmers and local actors to use their sovereignty and scope of action. Cooperatives, local shops or other ways of sustainable food production, distribution, and consumption are envisioned and aspired to result from the network, fostering social-economic activity, livelihoods, and the autonomy of the rural area. A summary of the above-mentioned vision is illustrated in *Figure 8*.

The envisioned conservation, exchange, participation, and research can create rural systems that are socially, economically, and environmentally sustainable. The vision of Connecta Natura present the foundations for the proposal for the design and the implementation of such a network.

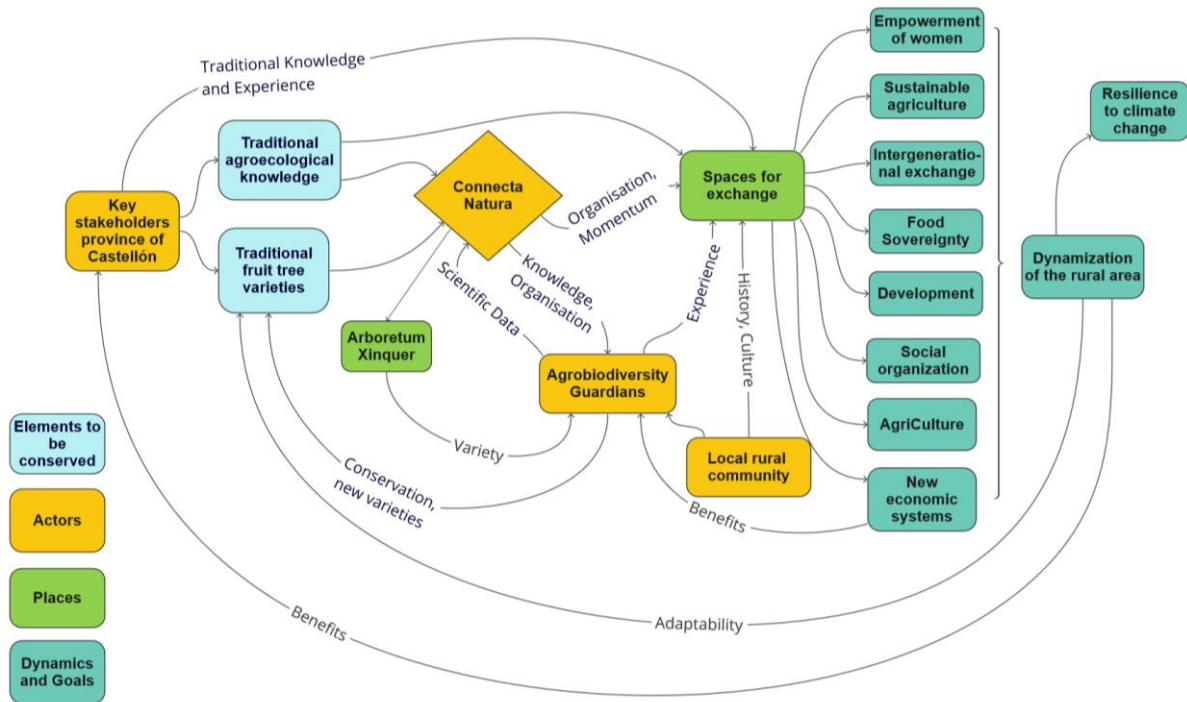


Figure 8. The vision for the network. The arrows present actions and transfer, while the boxes present the elements to be conserved, the actors, the places, and the dynamics and goals. *Source:* Own creation.

7 Strategy Design: Proposal for the Design and the Implementation of the Network

This section makes a proposal for the Transition Strategy Design (Brundiens *et al.*, 2020) in the form of a network of Agrobiodiversity Guardians. Building on the results from the system and vision analysis, the design of the network is closely linked and adapted to the location, the local conditions, and the potential, motivation and needs of the organization Connecta Natura, the local community and ecosystems. These elements can present the momentum for the rest of the envisioned objectives.

7.1 Proposal for the Network Design

The proposal for the network made here, is a centralized network with Connecta Natura as the lead organization. It presents a mix of the models presented by Evans (2012), visible in *Figure 9*. It is centralized around Connecta Natura but with interconnections also between the Guardians. The complexity of the project and the geographic dispersal (Provan & Kenis, 2008) of the Guardians through the province of Castellón makes this structure essential to govern the network. In line with network governance (Evans, 2012), this form of network has high centrality, high reachability, and

medium density, facilitating collective action and conservation efforts. This leads to the benefits that the network is easier to coordinate, implement and to hold accountable (Evans, 2012).

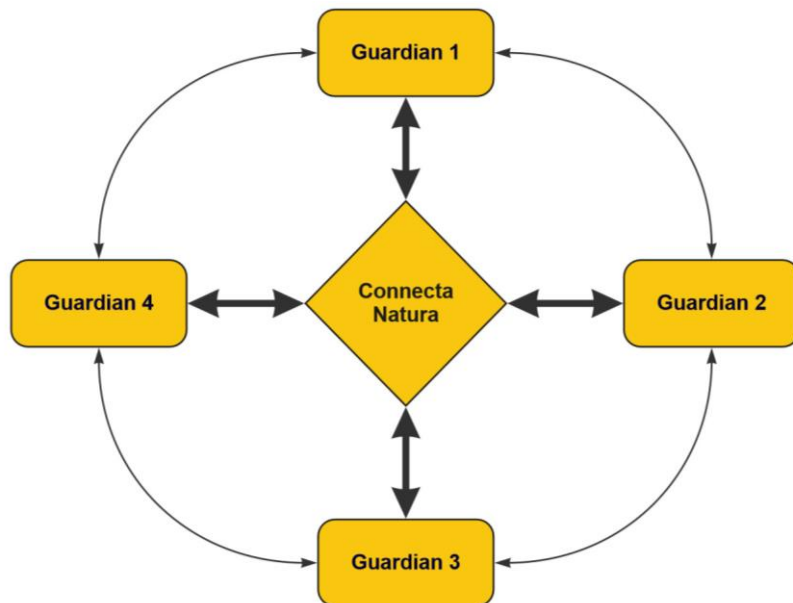


Figure 9. Schematic and simplified structure of the Network of Agrobiodiversity Guardians. There are strong bonds between Connecta Natura and the Guardians and loose bonds between the Guardians. *Source:* Own creation, adapted from Evans (2012).

Inspired by different other networks (Altieri, 1995; Guzmán *et al.*, 2013; Pautasso *et al.*, Wezel *et al.*, 2018), the design of the network of Agrobiodiversity Guardians is structured around the arboretum in Xinquer, in the Sierra de Espadán, as collection, provision, and conservation place for the traditional fruit tree varieties. In this core of the *in-situ* conservation project for the with ‘living’ examples of the varieties, three examples of each kind to assure its conservation over time. These varieties have been collected from farms, key stakeholders, and abandoned agricultural sites throughout the Sierra de Espadán. The collection can grow and be elaborated over time, with people getting engaged and more varieties being identified and conserved (Altieri, 1995). Out of this collection, each Guardian receives one or more varieties to be planted and maintained in his or her territory around the area. Information about the state of the tree(s) and its growth is reported back to Connecta Natura in a Participatory Action Research approach.

As Connecta Natura is highly linked to local actors, the network gets local and public support while being embedded in local authorities, and procuring the support of European, national, and regional institutions through collaboration, funding, and activities.

The ideas and structure for the network illustrated in *Figures 8 and 9*, can give momentum to other environmental and social benefits such as knowledge and skill exchange as well as dynamization of the rural area.

7.1.1 Role of Connecta as Lead Organization

Following this design proposal, Connecta Natura plays the leading role in this network based on the Network Governance approach of Provan & Kenis (2008). Being the lead organization in this context means, that Connecta Natura is part of the network while being responsible for the overall management, the coordination of the preparations, the strategies, decisions, and activities. Furthermore, the goals of the organization are closely tied to the purpose of the network. Connecta Natura has the legitimacy to play its leading role by the resources, activities, and structure inherent to the functioning of the association in the past and the present. It lies in the hands of Connecta Natura to use their contacts, network, and structure to raise awareness about the cultivated diversity through environmental education and events for all generations. Their role implies further to facilitate the independency of the actors in their action while providing them with information, tools, methods, and knowledge and taking the central role in coordinating the project. This position may also enhance high efficiency, stability, and external legitimacy of the network (Provan & Kenis, 2008). Additionally, this role involves gaining and maintaining the trust of the participants, supporting the bonding and bridging, the exchange and cooperation among them, while being a mediator in conflicts (Provan & Kenis, 2008). The association Connecta Natura can further provide the resources and the momentum for the Participatory Action Research as well as the criteria for, and the use of the collected data.

Based on this way of knowledge production and experience, the organization can advance in the process, by initiate the collaboration between the network and universities to create exchange between academic and practical findings and the different actors, promoting action-oriented science.

The just illustrated role of Connecta Natura for and in the network is especially important in the preparation and the starting phase of the network. Later, their interference might not be needed anymore, and as envisioned, the network could function solely through the autogestion of the actors involved.

7.1.2 Funding

To start the process and exercise this leading role in the network, Connecta Natura needs financial assistance. Funding could be received directly through European, regional, municipality or private support for projects dealing with social participation, but also indirectly through funds given for

conservation, education, and rural development projects. Different funding is being requested for November of 2021 (Civic Europe) to start the network. It can be drawn from the application for funds (Project: Connecting Roots, Civic Europe, 2021) that they are calculating with a total sum of 45.352 € to cover the costs of preparation and implementation.

The network can be established in different phases, each concentrated on one (or few) tasks at a time. The financial support is especially needed for the first four phases of the network which are the preparation, training, the creation of relationships, and the participatory research. After this (in phase 5), when the financial support ends, the network could function more independently through the Agrobiodiversity Guardians.

7.1.3 Agrobiodiversity Guardians: Characteristics, Motivation, and Role

It would be favourable to have a broad diversity of people as Agrobiodiversity Guardians and a variety of cultivation grounds for fruitful exchange, interesting multifaceted research, and enriching collaboration. The Guardians can be of all genders, ages, and origins and the trees can be planted in gardens, on farms, or in school yards throughout the province. According to Ratna Stapit & Lamers (2013), the motivation of Agrobiodiversity Guardians can be very different and be driven by personal, social, economic, cultural, or environmental interests. No matter what their motivation is, their role implies taking care of their variety of tree(s) by using agroecological methods. For the research, they are asked to carefully document the properties and changes of the tree(s) and its(their) growth. By collecting knowledge and experience, and ideally promoting the urgency for conservation and their activity to other people, the Agrobiodiversity Guardians can contribute to local food sovereignty, collective action and new knowledge to preserve the natural richness for the future (Farmers Pride, 2019).

7.2 Proposal for the Implementation Strategy

The network can be implemented according to the following different phases and actions. This section addresses the implementation phases 1 to 4, as they present the creation of the network, while phase 5 will be explained in the discussion, already dealing with the functioning network. *Table 1* gives an overview over the phases and the proposed actions to take as well as their position in the framework of Transition Management and Governance (Brundiers *et al.*, 2020).

Table 1. Summary of the phases and actions for the implementation of the network (in the context of the whole thesis and the framework). *Source:* Own Creation.

| | | | | | | |
|--|--|------------------------------------|---|---|---|---|
| Steps Transition Management and Governance (Brundiers et al., 2020) | Steps 1-3: The system, the vision and its sustainability and transition strategy design | Step 4: Implementation | | | | Step 5 and 6: Evaluation, Mainstreaming and Collaboration |
| Phases | | Phase 1 | Phase 2 | Phase 3 | Phase 4 | Phase 5 |
| Title in the Thesis | Systems analysis, Vision analysis, Strategy design | Preparation and Recruitment | Training as Agro-biodiversity Guardian | Relationships and Legitimacy | Kick-off and Participatory Action Research | Recommendations for the Future, Research, and Action |
| Action | Analysis of the preconditions and ideas for the network | Workshops and events | Provision of knowledge and skills | Subgroups, rules, internal and external activities | Participatory Action Research | Transdisciplinary work, apply to other contexts and varieties |

7.2.1 Preparation and Recruitment (Phase 1)

In the first phase of the network, potential Guardians are to be found and contacted in the province of Castellón. If it is possible and safe (regarding the Covid pandemic), diverse events and workshops can be held to interest and motivate people to get involved in the network. These encounters address topics like Agroecology, biodiversity, traditional knowledge, and the history of the area and the local agriculture. These events are very broad in the variety of methods and formats used (movies, talks, discussions, workshops, excursions), to address a large audience and heterogeneous public. The experience of Connecta Natura in environmental education will be very helpful in this stage.

Collaborations and engaged local actors are a crucial aspect to build the foundation for strong agroecological networks (Anderson et al., 2019). In the case study, there are different actors and entities that are loosely linked to Connecta Natura. Strengthening these connections at first to create the network for the recruitment and motivation of Guardians holds benefits and results especially doable during ongoing Covid restrictions, in small groups or personal interactions. The interested individuals are encouraged to contribute to spread the word and interest within their contacts, broadening the scope without a lot of effort by the lead organization. This means that some people are “made interested” and then potentially become additional “spokespeople” for the project

(McElwee, 2016, p.23). Once people or groups have expressed interest, their needs, and the resources for the cultivation (land, what kind of soil, climate etc.), as well as potential problems and challenges need to be identified.

7.2.2 Training as Agrobiodiversity Guardian (Phase 2)

In the second phase of the implementation of the network, Connacta Natura, together with an entity experienced in group facilitation and gender issues, holds workshops and trainings for the Agrobiodiversity Guardians willing to cooperate. This training as an 'Agrobiodiversity Guardian for the conservation of traditional fruit tree varieties' take place for example in Xinquer to gain practical insights in the techniques and the place (grafting, *in-situ* conservation). These workshops provide knowledge about the global problem and Agroecology and the network as a solution, and hands-on technical knowledge for the *in-situ* conservation and the participatory research. Personal contacts and social bonds are likely to be built between the actors during this process. Also, the field notebook (*cuaderno de campo*) is introduced at this point, stating what must be observed, documented, and communicated for the investigation (see section 7.2.4).

7.2.3 Relationships and Legitimacy (Phase 3)

In the third phase, the relationships are strengthened through common activities in nature, visits in Xinquer, and on each other's land, garden, village, or farm. The necessities of the people involved, and the process are analysed and reflected upon, as well as the structures and relationships that have been established since the beginning of the process. Again, through group facilitation, subgroups in the network are established according to criteria that must be decided upon (e.g., location, varieties, personal interest, experience). These subgroups should function as small networks in themselves for support, exchange, and creativity and may strengthen the structure of the whole network.

According to Provan & Kenis (2008) two different types of legitimacy are needed for successful network governance: Internal legitimacy and external legitimacy. In this phase further internal as well as external activities are planned and proposed to underline the legitimacy of the network.

Internal legitimacy is achieved through exchange, common evaluation, events, and agreement on general rules. These rules include common values, how often and where to meet and how to stay in touch. The activities can be in the form of: Online check-ins, weekend trips, lunch meetings, knowledge exchange etc. Online forums and chat groups ideally contribute to the sense of community, where pictures, experiences, tips, and challenges are shared, and support is given among the Guardians.

Connecta Natura as lead organization already has external legitimacy through their organization and the activities and prominence in the area (Provan & Kenis, 2008, p.244). Newsletters, events, guided visits, and volunteering further foster external legitimacy and are very important for the recruitment of new Guardians, the awareness and support of the community, and the overall benefits of the network (Provan & Kenis, 2008, p.244). Some activities even contribute to both, internal and external legitimacy, like seed exchanges, fairs, and conferences.

7.2.4 Kick-off and Research (Phase 4)

The fourth phase consists of the actual kick-off for the network, which will probably take place at, or after the end of the funding. This is also the phase where the scientific data collection begins.

Participatory Action Research

The aspect of Participatory Action Research asks of all the Guardians the careful management, monitoring, observation, and documentation of the processes connected to the tree(s) and their development and environment. By doing so, the network includes actors in scientific work that are normally excluded from research (Méndez *et al.*, 2013). A lot of valuable data and knowledge can be created between all the participants, contributing to research and knowledge about the adaptability of the varieties to different locations, useful for climate change resilience, and long-term conservation. There are no limits to the participants, varieties, and results. A detailed and broad data collection can contribute to interesting and fruitful knowledge.

Field Notebook and Research

Different elements must be documented and communicated to Connecta Natura to be able to gain a holistic perspective on the characteristics of the varieties under different conditions through the research. To collect the data, a field notebook (*cuaderno de campo*) is used to record all the findings and observations. It can either be in paper format or be an online version, the latter being directly accessible to Connecta Natura (and for transparency reasons also to the other participants). Information can include: time of planting, sprouting, flowering, cutting, fruits, success of grafting, climate and soil conditions and changes, response to agroecological management, signs of illness or plagues, and size and taste of the fruits.

This data generated through the Agrobiodiversity Guardians serves different purposes. The Guardians can summarize and analyse it themselves to improve the cultivation, it may be helpful for the local food actors and dynamics, and can also be used in the work of the universities and contribute to future

investigation. The main idea is the generation of data underlining the function of the traditional varieties for the social, environmental, and economic benefit of the region and the rural development (Connecta Natura, 2021).

Spaces for Exchange and Dynamization of the Rural Area

During the fourth phase, in parallel to the Guardians doing their part of the management and research independently, spaces for interaction are created or even emerge on their own. These spaces are ideally diverse and intergenerational to enable an interesting exchange about the history, the present, as well as the future of the place, and the livelihoods of the people. These spaces can contribute to the improvement of the life quality and empower the rural population as actor for change of the economic, environmental, social, and political dynamics through exchange of knowledge, skills and experiences, common action, solidarity, alternative markets and economic systems as well as infrastructure and sustainable rural development (Sevilla Guzmán & Woodgate, 2013). They can present a stage for the reevaluation of traditional agroecological knowledge and foster rural identity.

8 Discussion: Final Considerations and Recommendations

The system, vision, and design presented in the previous sections form the foundations for the network of Agrobiodiversity Guardians. The work of Connecta Natura in the province of Castellón and Xinquér presents local responses to the loss of biodiversity and traditional knowledge, observable in the area, and in the whole world. As scholars agree that networks display a good way for the implementation of measures for conservation and dynamization (Sthapit & Lamers, 2013; Wezel *et al.*, 2018), the proposal made in this thesis offers a way of how to preserve traditional fruit tree varieties and agroecological knowledge through a centralized network, while answering to different research gaps identified in the literature.

8.1 Potential and Challenges

The fact that the group of Connecta Natura is composed of motivated people, knowledgeable about the area, the traditional varieties, Agroecology, and local cultural and environmental conditions, facilitates the work as well as the contact with the key stakeholders and the local community. The network makes an essential contribution to conservation while bringing people of all ages and gender together for exchange, action and research and creating a healthy interaction between nature and humans (Pautasso *et al.*, 2013, p.162).

The experience on the ground, seeing their energy and their hard physical and organizational work in Xinquer, promises a lot of potential for the realization of their vision for the network of Agrobiodiversity Guardians. Moreover, the horizontal interactions between the working members, the owner, and the volunteers, enables an open exchange, often building upon similar experiences and values or celebrating the diversity of approaches. Great awareness exists within the group about gender equality, non-violent communication, political impacts, and power dynamics and these elements are topic to ongoing discussions.

The network proposal made in this thesis is based on ethnographic notes, the literature, documents of Connecta Natura, and tools of Governance and Agroecology. Connecta Natura as lead organization together with the Agrobiodiversity Guardians present the ones shaping and holding the network together. The design of the network, and the different phases to guide the implementation process, are aligned with the competencies and possibilities of Connecta Natura. The workshops for recruitment and training profit from the experience with environmental education, connecting nature and people and with horizontal and inclusive way of functioning. The kick-off and the participatory research can be facilitated by the academic as well as practical experience and contacts of the association.

Despite being restricted through Covid measures, the potential of the association and the network became visible in the few events with volunteers that took place. The participants were really fascinated and inspired by the place, the atmosphere, and the work. Also, the support for the network was observable; two young families directly wanted to participate and plant traditional fig varieties in their garden, which can underline the diversity of Agrobiodiversity Guardians that can get motivated to participate in the network. Furthermore, there is the advantage that the network fulfils a great aim but does not require a lot of work and change in the lives of the Guardians. However, the sum of the work of the Guardians is very helpful and fruitful (Provan & Kenis, 2008) to improve the environmental and social condition in the place and foster a vivid AgriCulture in the Sierra de Espadán and the whole province of Castellón.

Besides this potential, the project also encounters challenges; from the lack of participatory culture in the area, to the often very intense way of working, and the sometimes very direct communication that can influence the work atmosphere. In virtue of this, Connecta Natura could take more care of the limits of the people involved, to promote a sustainable and enjoyable work environment through more check-ins, reflections, and more and shorter breaks. Further, the limited number of working members may present a challenge and potential risk for the success of the project, especially because the few

working members are often fulfilling a lot of tasks and work intensely. Also, despite the advantages that working in a team offers, there are also disadvantages, especially in a group of friends, where conflicts are commonly more complicated and personal.

The findings from this thesis can facilitate the work of Connecta Natura and serve as guidelines for the implementation of the network. That being said, it is now up to Connecta Natura and the local community to start the network and the operational Transition Management and Governance (Loorbach, 2010) in the Sierra de Espadán and the province of Castellón by adopting the different phases. This way, the network can make its contribution to the conservation of traditional fruit tree varieties and agroecological knowledge and foster rural dynamization. Depending on how the Covid situation evolves, the proposals can be either performed online or in person. A face-to-face implementation of the network very likely presents a better outcome, through the experience of being in direct contact with each other and the local environment.

8.2 Recommendations for the Future, Research, and Action

The above-mentioned challenges, as well as the fifth phase (Evaluation and Mainstreaming (Brundiers *et al.*, 2020), not part of the analysis of this thesis), can be object to future research, to strengthen the network in the Sierra de Espadán. When the network functions and fulfils its purpose of conservation, research, and contribution to the rural dynamization, the fifth phase serves to evaluate the success and progress and to make modifications. Concrete and context specific indicators for the monitoring, evaluation, and success (Rotmans *et al.*, 2001; Brundiers *et al.*, 2020) of the network could be developed through further research based on this thesis. The network can also be broadened through collaboration or be applied to other places and varieties. Connecta Natura is, for example, establishing a similar network and a seedbank for local horticulture in the province of Castellón, currently focused on traditional tomato varieties.

The vision of Connecta Natura to retrieve its influence and give more responsibility to the Guardians and their experience and knowledge (which could also take place in phase 5) is partly not in line with what is being said in the literature about network governance processes. Provan & Kenis (2008) present it as rather unlikely that a network governed through a lead organization can be transformed into a network with shared governance, because of high dependencies and trust mainly directed towards the lead organization. Nevertheless, strong subgroups can favour the stability of networks even when they are transforming their structure (Provan & Kenis, 2008). A special focus should therefore be on strengthening these entities, built in phase 3. Merging approaches of local and academic knowledge and research is also helpful to support the network structure by focusing on

transdisciplinary cooperation and interaction between scholars and practitioners (Anderson *et al.*, 2019). Additionally, the produced knowledge can be reintegrated in the network to improve its functioning (Lang *et al.*, 2012). It can also be further investigated how the transition from a centralized network for conservation to community-based network governance can be accomplished.

Scaling up the network and including it in other regional, national, European, or global networks can hold advantages and increase its impacts. Different initiatives are trying to connect local networks to build one strong European network for *in-situ* conservation of traditional varieties (proposed by the European Commission in 2016; Farmers Pride, 2019). The network of Agrobiodiversity Guardians in the province of Castellón could be one puzzle piece in these joined forces for the protection of the cultivated biodiversity, the transformation towards a sustainable food system, as well as for more resilience of the agricultural system against climate change.

9 Concluding Remarks

This thesis has intended to develop a proposal for the design and the implementation of a network for the conservation of traditional fruit tree varieties and the connected agroecological knowledge and practices. Agroecology functioned as a tool, in its practical and scientific character, to link the aspects of the network, so it can strengthen ecosystems, conservation, participation, and rural dynamization.

A centralized network with Connecta Natura as lead organization and the implementation in four phases, as proposed in this thesis, can be realized by drawing on the potential that the place, the local conditions, and the organization Connecta Natura present for the creation of the network of Agrobiodiversity Guardians in the province of Castellón. Personal limits, intensive ways of working, direct communication, and the limited number of people, present challenges in the case. Despite this, the working members of Connecta Natura can make use of their knowledge, contacts, skills, bonds, and motivation to implement their vision to contribute to the reconnection with cultivated biodiversity and traditional knowledge. Moreover, this network can foster new ways of participatory knowledge creation and implementation, as well as give momentum to the dynamization of the rural areas in the province. Merging scientific and traditional knowledge with direct action is needed to preserve the natural richness and the AgriCulture.

Because there has been little research on *in-situ* conservation and on the types of network best suitable for conservation efforts, the findings from this thesis can help to strengthen agroecological *in-situ* conservation of fruit trees through a network designed for a specific location. At the same time,

they contribute to the body of sustainability science by following a solution-oriented approach, visualizing the problem, the system, the vision, and an implementation strategy, through elements of Transition Management and Governance. On this basis, the network proposal can be adapted and applied to other places and regions to mainstream conservation through networks. This work can also function as a foundation for future network and conservation research.

Humans and their cultures are closely connected to the natural environment, landscapes, and agricultural practices. To persist and resist in the future, landscapes, cultures, varieties, and people need a slow adaptation to changing climate, agricultural, social, and economic conditions. These processes should occur in parallel, between society and environment, the past and the future; in this way reconsidering and re-establishing the connections between the environmental and cultural heritage. Connections that we seem to have forgotten. AgriCulture has a lot of transformative potential and can benefit the environment, as well as human livelihoods. Learning from the past and applying it to the present may create new and fruitful interactions, practices, and knowledge. Putting ecological conservation as well as human-wellbeing in the focus of action leads to long-term sustainability and resilience. As Humboldt described two centuries ago, we should reflect ourselves in nature: the revaluation and conservation of cultivated biodiversity and agroecological knowledge can present the roots for the present and provide the seeds for the future.

10 References

(The references marked with * are not available in the full version in the zip file.)

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