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Faculty of Landscape Architecture, Horticulture and Crop Production Science

Building resilience through food

– The case of the Network of Agroecological Peasants´ Markets of Valle del Cauca (Red MAC), Colombia.

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Att bygga resiliens genom mat

Ett fallstudie av the Network of Agroecological Peasants´ Markets of Valle del Cauca (Red MAC), Colombia.

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Foreword

When I started the Agroecology Programme, my interests were about the relation between rural poverty and agriculture. I wanted to study the possibilities of eradicating poverty through agriculture without ´eradicating´ the environment as well. Over the courses, I broadened my interests and wrote my individual papers on issues around potato farming, sustainability and social protests; biodiversity in environmental economics and ecological economics; agrobiodiversity and transitions; and resilience of coffee farming. Further, my attention was always captured by topics on homegardens, agroforestry, and food security; and increasingly I am intrigued by the possibilities of peacebuilding trough agroecology.

After two years of studying these topics, and more, I have learnt a lot. However, the greatest learning is to think differently. To think in terms of processes and relations instead of outcomes, to prioritize quality over quantity.

To think differently, in my opinion, is the biggest challenge and the most needed change for solving our global problems. As explained by Capra (1997:4) "*these problems must be seen as just different facets of one single crisis, which is largely a crisis of perceptions. It derives from the fact that most of us, and especially our large social institutions, subscribe to the concepts of an outdated worldview, a perception of reality inadequate for dealing with our overpopulated, globally interconnected world*". Only when we start thinking differently and change our understanding of how our world works, can we start acting differently and forge change.

Recently, I came across the conclusions of the 3rd Latin American Congress of Agroecology held in Mexico in 2011. Which state that "*the ideal agroecologist is one who does science, farms, and is committed to making sure social justice guides his or her action for change"*[1]. Being a good agroecologist is a process, not a final goal. In my own process, I have been fortunate to have worked in social and rural development for several years. Having seen the ups-and-downs of social justice in Colombia has only strengthen my commitment to work in this regard. Additionally, the Programme made me take important steps to practice agroecology; I started my own homegarden project in Colombia, I have been doing small herb gardening wherever I can, and I am definitely a more conscious consumer. Finally, this study is my small contribution to the science of agroecology, an input to the understanding and promotion of sustainable alternatives to the global food system.

With this research, I hope I will be able to transmit a holistic version of myself, a version where my working experience; my education in economics, development studies and agroecology; and my personal worldview and values; interact synergistically to reflect a whole bigger than the sum of its parts.

Sweden, May 2016.

[1] Gliessman (2012).

Summary

The dominance of conventional (chemical and industrial) agriculture has eroded the ecological, economic and socio-cultural conditions to sustain production for a growing population, undermining humanity´s capacity to feed itself (Gliessman, 2007; Altieri & Toledo, 2011). As a consequence, we have a decoupled global food system: the social is decoupled from the ecological; farmers are decoupled from the land; farmers and consumers are decoupled from each other; and culture is decoupled from agri-culture. However, the foundations of a renewed and sustainable food system, or rather food systems, are being built by the resistance, struggles and practices of both farmers and consumers. An expression of these efforts are Alternative Food Networks, as food-driven localized initiatives, aimed at re-connecting consumers, producers, and landscapes under new or different governance models on the basis of a new culture of sustainability.

Bearing in mind the increasing dynamic, complex and interconnected nature of our world, it is desirable that these alternatives position resilience as one of their core elements. In Colombia, specifically, this has the potential of contributing to sustainable rural development and peacebuilding. In light of this, the research seeks to analyze *how alternative food systems can build resilience in rural Colombia*. The research examines the case of the Network of Agroecological Peasants´ Markets of Valle del Cauca (Red MAC), and uses a combination of qualitative methods such as semi-structured interviews, participant observation and PRA tools. The analysis is shaped by agroecology, and uses concepts and frameworks from Alternative Food Networks, Social-Ecological Resilience, and Seeds and Agro-biocultural diversity.

The findings suggest that agroecological networks like Red MAC have a great potential for contributing to both resilience and sustainability. In particular, *agricultural and social diversity* offer the seeds for new opportunities amid change, and increase the options for coping with disturbances and dealing with uncertainties and surprises. Similarly, the use of *agroecological practices* like agroforestry, home-made composting, and botanical or natural pesticides, contributes to the ecological resilience at the farm level. Furthermore, Red MAC is enabling spaces for *learning and exchange* and generating *participatory and trust building processes* around food, through which it has been able to exercise *collective action*. Finally, the conservation and promotion of *agro-biocultural diversity* appears as a fundamental element for the resilience of food systems, since it enlarges the knowledge and materials available to respond to change; it delivers significant ecosystem services; and has a potential to improve human health and nutrition.

The study and examination of the processes and challenges of these initiatives are of utmost importance for the peacebuilding process in Colombia, as they can inform how to implement the peace agreements on the basis of principles of social-ecological resilience and sustainability.

Keywords: Alternative Food Networks, social-ecological resilience, agroecology, food systems, collective action, agro-biocultural diversity, Colombia.

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Chapter 1 – Introduction

1.1. Background and problem statement

The world has changed more during the last 80 years than during the previous eight centuries. Our actions are progressively pervasive and profound at local and global scales in complex, interactive and accelerating ways. We have changed the basic functioning of life, putting in danger our own existence as species (Steffen et al*.,* 2006). This is evident when examining how our food system is (not) working today. It is a broken system facing a multidimensional crisis: high levels of hunger and poverty; loss of livelihoods; increasing obesity and other diet-related illness; ecological degradation; biodiversity loss; and inequity in the distribution of income, land, seeds, water and other resources. These are all increasing and persistent problems (Altieri & Toledo, 2011; Wibbelmann et al*.,* 2013).

The practices of conventional (chemical and industrial) agriculture have eroded the necessary conditions to sustain production for a growing population, undermining humanity´s capacity to feed itself (Altieri & Toledo, 2011:589). There is growing evidence highlighting the cause-effect relationship between our industrial-based food system and factors such as soil degradation and erosion; overuse of water and hydrological systems; pollution of the environment; and loss of genetic diversity; among others (Gliessman, 2007).

These ecological problems are intertwined with political, economic and socio-cultural ones, with both consumers and farmers suffering the consequences. Imbalanced power relations and unequal distribution and access to resources have resulted in an increasingly concentrated food system in the hands of few transnational corporations, and the domination of large food chains and global supermarkets at the expense of small farmers (Pretty, 2002; Allen, 2010; Bailey, 2011). In Latin America, the unequal process of agricultural modernization with its emphasis on capital intensive farming, limits the survival of the peasant producers and perpetuates rural poverty (Kay, 2006).

Likewise, the food system has removed culture from agri-culture and from our food. “People have lost more and more control over the source and quality of their food, and have become increasingly distanced from food practices and knowledges” (Allen, 2010: 296). Regional and local differences in cuisine and diet are disappearing along with agrobiodiversity, and consumers –particularly in the north- are unaware by whom or how is food produced. Progressively, we have more ‘food from nowhere’, food detached from the socio-cultural and ecological processes that have nourished civilizations for centuries (Pretty, 2002; Gliessman, 2007).

In sum, we have a decoupled food system: the social is decoupled from the ecological; farmers are decoupled from the land; farmers and consumers are decoupled from each other; and culture is decoupled from agri-culture.

In Latin America, the transformation of the food systems has been increasing since the 1990s as part of a process of agrarian change shaped by neoliberal policies of privatization, liberalization and de-agrarianization (Kay, 2006; UNDP, 2011). This process is characterized by a growing articulation of farmers to value chains and agro-industrial complexes dominated by powerful groups linked with

transnational corporations (Llambí, 1993; Teubal, 2001). Similarly, there has been a change of focus in the public policies, where peasants are excluded from comprehensive productive policies and become targets of welfare ('assistentialist') programs whose objective is to hold up their survival (Rubio, 2000), and where the governmental support for basic food production is changed for new supports to non-traditional agricultural exports (Teubal, 2001). In Colombia, the current rural development model has proved inadequate to promote sustainable human development and resolve rural crises. According to UNDP (2011), the model increases vulnerability, it does not promote equity, it hides gender inequality and discriminates against women, it is exclusive, it is not environmentally sustainable, it concentrates rural property, it does not deepen democracy, and it does not consolidate rural institutions.

The importance of developing and strengthening resilient alternative food systems in Colombia is twofold.

(1) On the socio-economic subsystem, the development of the peasantry is a necessary condition for sustainable rural development and peacebuilding. Enforce peasants' rights, as well as acknowledge and value their knowledge, practices and organizational structures is a necessary and fundamental step for building an inclusive and equitable Colombian society (Ardila, 2011; UNDP, 2011). The Colombian Government and FARC-EP[2] have recognized this in the ongoing Peace Talks. The promotion of peasant-, family-, and communitarian-economy is one of the pillars of the proposed 'Integral Agrarian Development' for peacebuilding (Gobierno de Colombia & FARC-EP, 2014).

(2) On the ecological subsystem, there are two main concerns: adaptation to climate change, and soil health. It is estimated that by 2050 temperature in Colombia will increase on average 2.5 °C, rain will be more erratic, and plagues and diseases are likely to increase. As a consequence, we will face soil degradation and loss of soil organic matter in the Andean zone; floods in Caribbean and Pacific coasts; defrosting of glaciers; and loss of agricultural niches for coffee, cacao, and some fruits. Climate change will have the largest impacts on poor and small-scale farmers (Lau et al., 2011). Additionally, soil erosion is a growing problem in the country. Estimates indicate that 40% of the total soils and 73% of the soils with agricultural use, have some degree of erosion, presenting a threat for food security, rural livelihoods and environmental quality (Montañez, 2015).

As a consequence, we are facing a social-ecological crisis where both environment and society are being increasingly harmed by the dominant development path and the dominant food system. If Colombia aims to build 'sustainable, stable, and lasting peace' as promoted by the current Peace Talks, a different approach is needed. An approach guided by systems able to provide sustainable livelihoods to its population while managing changing and challenging economic, environmental, and sociopolitical circumstances. Alternative Food Networks existing in the country may provide essential guidelines in this direction. Therefore, it is of utmost importance to have a better understanding of how these networks operate and how they can build resilience in rural Colombia.

[2] The Revolutionary Armed Forces of Colombia—People's Army (FARC-EP), is the main guerrilla in Colombia and is active since 1964.

1.2. Agroecology

This research is motivated and framed by agroecology. Agroecology can be defined as the ecology of the food system (Francis et al., 2003), and it refers to the science, movement, and practices (Wezel et al., 2009) that study and promote the application of ecological concepts and principles to the design and management of sustainable food systems (Gliessman, 2007). Agroecology encourages us to embrace the wholeness and connectivity of systems (Francis et al., 2003) and to adopt transdisciplinary, participatory and action-oriented approaches (Mendez et al., 2013).

It emerges as a resistance, a response, and an alternative to the above-explained crisis of the food system, brought by the dominance of globalized, industrial agriculture (Pretty, 2002; Gliessman, 2007; Altieri & Nicholls, 2012). However, agroecology does not endorse a ´one-size-fits-all´ solution for the transformation of our global food system. Rather, it promotes a multidimensional, holistic and systemic view of food and agriculture.

> Agroecology consists of principles, concepts and strategies that must form the foundation of any system of food production that can make a legitimate claim to being a more sustainable successor to industrial agriculture. These principles, concepts and strategies are more oriented towards offering a design framework for sustainable agro-ecosystems than they are prescriptions or blueprints for the construction or management of actual agro-ecosystems, and they do not dictate the specifics of an entire world food system. Nonetheless, agroecological principles do suggest the general elements of a sustainable food system, and describing these elements will help us visualize some of the goals towards which the agroecological approach points. (Gliessman, 2015: 6)

Some of the most important agroecological principles are summarized in Figure 1.

- Enhance soil fertility and nutrient cycling, managing organic matter and improving soil biotic activity.
- Preserve and enhance agroecosystem biodiversity over time and space.
- Enhance beneficial interactions and synergisms among components of the system.
- Adjust to local environments and cultures.
- Minimize use of toxics and external inputs.
- Conserve water.
- Support ecological pest- and disease-regulating mechanisms.
- Maximize renewable energy potential.
- Diversify livelihoods to minimize risk exposure to shocks and stresses.
- Integrate local and scientific knowledge through appropriate practices and technology.
- Empower people and local organizations.
- Prioritize and enhance local food security in culturally appropriate ways.
- Guarantee equality of access to appropriate agricultural practices, knowledge and technologies.
- Enable local control of agricultural resources.
- Re-connect people with land, and people with people.
- Remove social, economic and political injustices from food systems.

Based on Altieri and Nicholls (2005, 2012); Gliessman (2007, 2015); Scarborough & Mendez (2015).

Figure 1. Key agroecological principles

The need and feasibility of agroecology-based food systems is gradually more supported by the scientific community (IAASTD, 2009; Wezel & Soldat, 2009) and by international agencies and organizations (UNEP, 2012; UNCTAD, 2013), as the evidence of its viability and sustainability increases. For example, Pretty et al. (2006) show how 286 interventions in 57 low income countries,

have used agroecological practices in 37 million hectares, increasing productivity on 12.6 million farms while improving the supply of critical environmental services. Similarly, Altieri & Nicholls (2012) review several studies showing the potential of agroecological systems in Africa, Asia and Latin America for food security and resilience. Further, De Schutter (2010) exposes the central role that agroecology can play in ensuring the right to food, since it raises productivity, contributes to improve nutrition, and reduces rural poverty, while mitigating climate change.

However, for an agroecological transformation of the food system to take place, it is necessary that agroecology integrates research, practice and social change in all parts of our food systems (Gliessman, 2015:8). Furthermore, it requires a paradigm shift of our perceptions, thinking and values, and a holistic worldview that sees "the world as an integrated whole rather than a dissociated collection of parts". It requires a paradigm based on "deep ecological awareness"; recognizing "the fundamental interdependence of all phenomena and the fact that, as individuals and societies, we are all embedded in (and ultimately depend on) the cyclical processes of nature" (Capra & Luisi, 2014:12).

1.3. Aim and research questions

Bearing in mind the increasing dynamic, complex and interconnected nature of our world, it is desirable that the alternative food systems that are being built, position resilience as one of their core elements. In Colombia, specifically, this has the potential of contributing to sustainable rural development and peacebuilding.

In light of this, the overarching research question is: **How can alternative food systems build resilience in rural Colombia?** The aim is to analyze how the actions, relations, and structures of alternative and local food systems, create opportunities for communities to manage change better, and in doing so, improve their well-being.

In particular, and through the analysis of the case of the Network of Agroecological Peasants´ Markets of Valle del Cauca (Red MAC), the research focuses on the following subsidiary questions:

SQ1- How and why does the particular initiative emerge?

SQ2- What are the main functions, structures, and practices of the alternative food system?

SQ3- How are different levels of the system responding to social, economic, and environmental pressures (adaptation and/or transformation)?

SQ4- How can agroecological peasant markets contribute to Social-Ecological resilience?

SQ5- How can these initiatives inform public policies in the context of peacebuilding in Colombia?

1.4. Thesis outline

This research is organized in seven chapters. Having presented the introductory chapter, Chapter 2 establishes the analytical framework that guided the research, and is composed of three sections: Alternative Food Networks, social-ecological resilience, and agro-biocultural diversity. Chapter 3 continues with methodology and displays the research design, the participants, and the methods employed. This is followed by a description of the study area and the case, in Chapter 4. Consequently, Chapter 5 presents the results and analysis of the research. The chapter is organized following the three main organizational levels of Red MAC (farms, markets, network) and a section on seeds and agrobiodiversity. In turn, Chapter 6 discusses the main limitations and recommendations for further research as well as several implications for public policies. Finally, Chapter 6 concludes the research by summarizing the main findings and ideas.

Chapter 2 – Analytical framework

This chapter presents the analytical frames that shape the research. It starts by giving a discussion of what are Alternative Food Networks and their main characteristics. Next, it defines the main concepts of Social-Ecological Resilience, and presents some specific concepts on social resilience, and agroecological practices for ecological resilience. Finally, the third section addresses the importance of seeds and agro-biocultural diversity for resilient food systems. Figure 2 outlines the chapter.

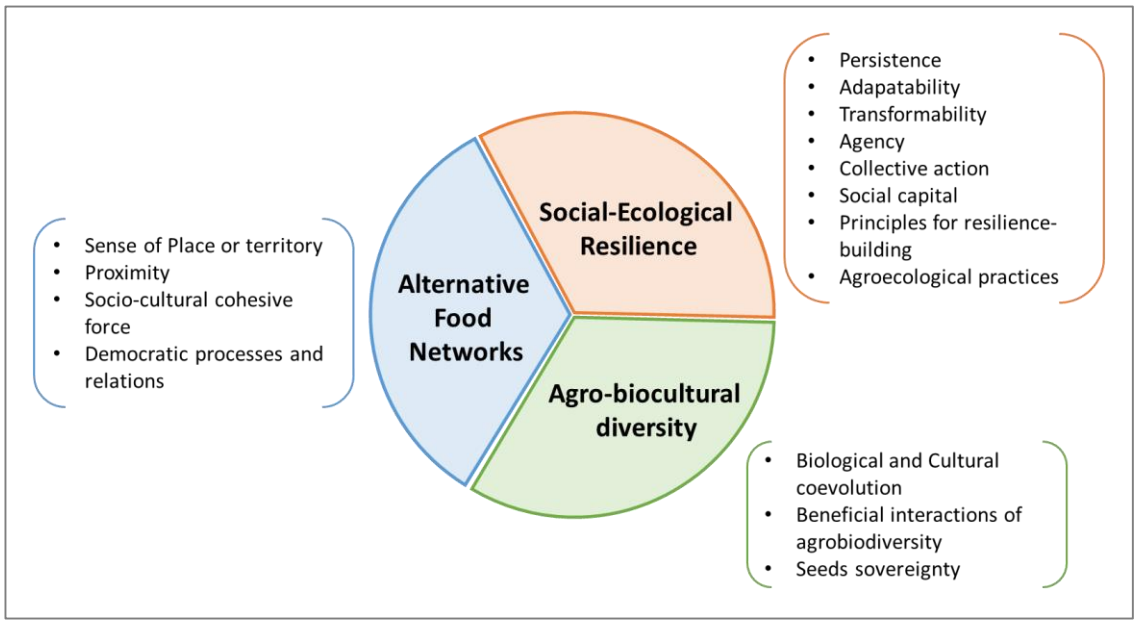

Figure 2. Outline of the analytical framework

2.1. Alternative Food Networks- AFN

The globalization and industrialization of food and agriculture have generated a decoupled food system. It is a system that has failed to realize the right to food (De Schutter, 2014), and whose sustainability is restrained by processes of intensification, specialization, distancing, concentration and homogenization (Sundkvist et al., 2005). However, and despite the increasing and persistent character of this crisis, the foundations of a renewed and sustainable food system, or rather food systems, are being built by the resistance, struggles and practices of both farmers and consumers. These initiatives have been commonly studied under the category of Alternative Food Networks, especially by scholars from economic geography (Watts et al., 2005; Sanchez, 2009) and from agroecology (Pretty, 2002; Gliessman, 2007; King, 2008).

The range and importance of Alternative Food Networks are wide and vary in size, scope, location, and intent, but among them we find: Farmers´ markets, Community-Supported Agriculture (CSA), Box schemes, Community gardens, Consumer cooperatives, Urban gardens, Farm stores, Local food businesses (shops, restaurants, tourism, retailers), Permaculture groups, and Organic agriculture movements (Gliessman, 2007; King, 2008; Sanchez, 2009). In Latin America, networks of the farmers´ market are the most common, although cooperatives and local food business are increasingly

appearing (see Figure 3 at the end of the section for an insight on agroecological markets in the region).

In general, Alternative Food Networks (hereafter AFN) can be understood as food-driven localized initiatives aimed at re-connecting consumers, producers, and landscapes under new or different governance models on the basis of a new culture of sustainability (Gliessman, 2007; Sanchez, 2009; Lamine et al., 2012). Due to their diversity, AFN can contribute to the creation of sustainable food systems through the promotion and adoption of four inter-dependent elements (Gliessman, 2007), which are, in turn, the main characteristics of AFN.

First, they emphasize the sense of place or territory. As opposed to the global food system, AFN attempt to bring ´localness´ back into food and agriculture. For this, they stress agriculture´s connections to local ecologies and communities (Pretty, 2002) and prioritize the consumption of locally grown or raised food (Gliessman, 2007). Kloppenburg et al. (1996:2) elaborate on the notion of spatial proximity of AFN by using the term *foodshed*, an analogue of watershed to describe "self-reliant, locally or regionally based food systems comprised of diversified farms using sustainable practices to supply fresher, more nutritious foodstuffs to smallscale processors and consumers to whom producers are linked by the bonds of community as well as economy". By promoting proximate self-reliance, ´foodshed-guided´ food systems turn soil and water conservation, social welfare, and energy efficiency, into issues of immediate practical concern. When a community depends on its surrounding lands, neighbor humans, and local biodiversity to fulfill the majority of its needs, it must ensure the health of those social and natural resources on which it relies (Kloppenburg et al., 1996). Furthermore, Sundkvist et al. (2005) point out how an increased reliance on local resources and ecosystems can create a more knowledge-intensive agriculture, with a deeper understanding of local agroecosystems, and taking a better advantage of local ecosystem services; and thus, tightening food system´s feedback loops to respond better to change.

Second, and as a consequence of the notion of proximity, AFN seek to reduce the distance that food travels between the places of production and consumption (the *foodmiles*) by shortening food value chains. In doing so, local or proximate food systems demand less energy for transportation, processing and storing; food waste can be more easily put back into farming nutrient cycling; diversity is more easily supported; and local economies thrive as money recirculate in the community (Gliessman, 2007). Short Food Supply Chains (SFSC) have been extensively studied, and its importance for rural development has been recognized (Renting et al., 2003). Through SFSC, both farmers and communities can retain more value added in their territories, promoting livelihoods diversification and jobs creation, and generating attractive opportunities for farmers to diversify production (ECLAC, FAO & IICA, 2015). Further, Sanchez (2009) points out that, when combined with ´localness´, shorter food chains facilitate the ways in which consumers incorporate into their habits the values of geographical proximity, trust and commitment to the community.

Third, AFN highlight the socio-cultural aspect of food systems and the role of food as a cohesive force in creating and strengthening communities (Gliessman, 2007). For most of us –who are not farmers, the most important connection with nature is by eating food (Pretty, 2002). Being the most fundamental, and daily human need, throughout our biological and cultural evolution humans have always come together as bands, tribes, villages or societies to ensure food supplies (Gliessman, 2007).

By bringing back the centrality of food to human life as a dynamic force around which to build non-market relations between -increasingly distanced- individuals, groups, and institutions; the production, transformation, and consumption of food could be the source of revitalization of familial, community and civic culture (Kloppenburg et al., 1996:7). In this sense, AFN create spaces for the formation of social capital. Creating opportunities for diverse people to come together, to talk, plan together, solve problems, to get to know and trust one another in the context of a common purpose –food (Feenstra, 2002). For instance, Watts et al. (2005:33) argue that becoming involved with local food initiatives help re-establishing trust between consumers and producers and promote a sense of community integration. Similarly, Nousiainene et al. (2009) indicate that the localization agenda of AFN tend to create solidarity and social capital through the establishment of more intimate social relations and networks, while at the same time empowering actors to influence processes and outcomes of the food system. In turn, King (2008) argues that different AFN contribute to community resilience by creating networks across rural-urban interface, as well as opportunities for collaborative and deliberative learning.

Fourth, AFN create opportunities for democratic processes and relations. In the current global food system, corporations and powerful actors want consumers to know (and do) as little as possible about the social, ecological and economic settings in which food is produced; focusing rather on fetishized aspects like diets' trends, convenience, and image and status (Gliessman, 2007). In opposition, the possibility to buy food in the area where it was grown and directly from the producer, or through a short food chain, improves the flow of information and knowledge among the actors of the food system; increasing food traceability and reducing the scope for commodity fetishism (Watts et al., 2005). A free flow of accurate, unfiltered information and knowledge exchange is the basis for active and engaged consumers and the first step for democratizing our food system (Gliessman, 2007). In this regard, citizen-consumers in collaboration with citizens-producers within AFN, are actively reshaping their relations with different stages of the food system and they are revaluing the multidimensional meanings of food beyond a simple commodity (Renting et al., 2012). Organized communities within AFN are carving political spaces for a democratic food system (Feenstra, 2002), revitalizing the role of civil society-based governance mechanisms for food production, distribution and consumption (Renting et al., 2012). By doing this, AFN are promoting *food democracy*; defined by Hassanein (2003: 83) as equal and effective opportunities for all members of an agro-food systems to participate in shaping that system, and to have the knowledge about the relevant alternative ways of designing and operating the system.

Making use of different combinations of these four elements, many AFN share the common goal of transforming the global food system into "mutually supportive, productive and interconnected systems that foster the health of nature, people and communities" (Pretty, 2002:188). However, AFN are not free from criticism, and two specific caveats are worth mentioning here. The first is related to the process of production. We can find AFN with a territorial approach; with short supply chains, strengthening the bonds of a community, and opening democratic spaces; yet still relying on agrochemical inputs or depending on organic and fair trade certifications that can be coopted by corporations (Jaffee & Howard, 2010). In other words, some of the AFN can still be operating at ´shallow levels´ of sustainability (Hill, 1998), therefore it is important to analyze the ´agroecological

character´[3] of the agricultural production within these alternatives. The second caution refers to the notion of justice. Allen (2010) stresses that, in order to work towards equity and justice, AFN must be aware that the transformations they are pursuing are usually embedded in and must act within social, economic, geographic and demographic structures that may be contrary to their goals and values. In fact, to avoid that ´localism´ promoted by AFN end-up excluding particular groups, reflexivity in the food movements is needed to take into account different visions of justice, community, and good food (Goodman et al. 2012: 24-32).

Peasant Agriculture, Farmers´ Markets and agroecology

Family or peasant agriculture in Latin America is highly heterogeneous, however, several studies have distinguished three main types of family farming in the region: subsistence family farming constituting 60%, transition family farming 28%, and consolidate family farming 12% (CEPAL, FAO & IICA, 2014). Despite the bias towards export-oriented agricultural markets and rural industrialization during the last decades (Teubal, 2001; Kay, 2006), more than 90% of the family farms in the region still work for and depend on domestic markets (Berdegue & Fuentealba, 2011:33). Further, they sell most of their products in local markets using a variety of practices, including: sales to intermediaries at the farm-gate or at local collection centres, sales to local wholesales, and decreasingly, directly at local farmers´ markets.

In Colombia, even though the direct sale of products at farmers´ markets (*plazas de mercado* or *galerías*) is still an important channel for peasant agriculture, most of the production nowadays is being distributed through local and regional ´open market´ chains dominated by large wholesalers (Forero, 2003). Excluding some commodities (coffee, cocoa, cotton, flowers, and tobacco), approximately 50% of the national agricultural production is distributed through 13 regional wholesale supply centres and 1500 local *plazas de mercado* (Ramírez, 2013). However, it is increasingly common that most of the sellers at traditional farmer´s markets are intermediaries, not farmers, and that most of the products are grown under conventional (chemical-intensive) farming.

<u>New markets for agroecology</u>

A recent study from CEPAL, FAO & IICA (2015) highlights two important perspectives for the commercialization of family farming products. First, domestic markets and short food supply chains are expected to increase. Second, a larger demand for safe and healthy food will be an opportunity for agriculture in the region. Additionally, in the context of corporate control over the agri-food system, the development of strategies to improve the access to markets and the value added to agricultural production is one of the biggest challenges faced by peasant agriculture (Petersen, 2013). Under this panorama, many agroecological initiatives in Latin America are developing strategies to revitalize or re-organize local and regional markets, building suitable spaces for the economic exchange of biologically diverse and culturally contextualized agricultural production (Petersen, 2013).

Many of these initiatives are building on the experience and importance of traditional farmers´ markets in the region (*ferias libres* in Chile, *tinaguis* in Central America, or *plazas de mercado* in Colombia), and stablishing Solidarity Fairs, Peasants´ Markets, or Ecological Markets; in an attempt to build just and sustainable food systems.

Figure 3. Agroecological markets in Latin America

[3] While organic farming may produce chemical-free food, it can be trapped in an input substitution process or become ´corporate commercial organic´. In contrast, ´agroecological farming´ goes beyond this by incorporating broader ecological concerns (e.g. agrobiodiversity schemes, nutrient cycling) as well as socioeconomic criteria (*i.e.* labor practices, role of consumers), and political concerns (e.g. governance of the food system) (Altieri & Nicholls, 2005; Gliessman, 2013).

2.2. Resilience in Social-Ecological Systems

2.2.1. Food systems are social-ecological systems

Even though these alternative mechanisms for food are commonly called networks, they should be understood as food systems. Such approach pursuits a holistic comprehension of the "web of actors, processes, and interactions involved in growing, processing, distributing, consuming, and disposing of foods, from the provision of inputs and farmer training, to product packaging and marketing, to waste recycling" (IPES-Food, 2015:3). Moreover, food systems, and consequently many Alternative Food Networks, are Social-Ecological Systems[4]. Coupled human-environment systems shaped by natural, institutional, and regulatory factors, linked through biophysical and socio-economic feedbacks (Naylor, 2009; Ericksen et al., 2010; IPES, 2015; Tendall et al., 2015).

The current multidimensional global crisis reflected in the food system is taking place amid environmental, economical, and socio-cultural changes (Tendall et al., 2015). However, most of the current approaches to agriculture and natural resource management fail to acknowledge how this crisis is operating. They "ignore major disturbances, and seek to optimize some components of a system in isolation of the others". By focusing almost exclusively on efficiency, and in the case of food systems in productivity, they fail "to acknowledge secondary effects and feedbacks that cause changes in the bigger system" (Walker & Salt, 2006:14). On the contrary, resilience thinking has emerged as a tool to understand and analyze Socio-Ecological Systems (hereafter SESs). Resilience thinking seeks to understand and engage with a changing world. By understanding how and why the system as a whole is changing, it facilitates capacity building to cope with, adapt to, and shape change, as opposed to being a victim of it (Folke, 2006; Walker & Salt, 2006).

In this sense, resilience thinking can contribute to the understanding of the food systems´ problems and to the design of alternatives, as noted by the increasing number of studies exploring food systems from a resilience perspective (*e.g.* Hodbod & Eakin, 2015; Lengnick, 2015). By conceiving food systems as SESs we are better placed to understand the whole system and its internal interactions between components (Tendall et al., 2015), in opposition with the static and linear model commonly used by conventional approaches to food and agriculture (Hodbod & Eakin, 2015). Moreover, the use and application of resilience concepts and principles offer important theoretical and practical contributions to the study and transformation of food systems in the midst of global change (Naylor 2009; Tendall et al., 2015).

2.2.2. Main concepts of resilience thinking

The concept of resilience has been used in several bodies of literature: from mechanics in the late XIX Century, to psychology in the 1950s, and systems ecology in the 1970s (Alexander, 2013). In the later, Holling's (1973) seminal paper discusses the existence of multiple stability domains or landscapes of ecological systems; and their relation with ecological processes, uncertain events and disturbances,

[4] Social-Ecological Systems can be defined as social systems that are inseparably linked to and embedded in ecological systems, where changes do not occur in a predictable and linear manner, and with the potential to exist in more than one stable state in which their function, structure and feedbacks are different (Walker & Salt, 2006; Folke, 2006).

and diversity of spatial and temporal scales. Holling describes resilience as the capacity of an ecosystem to remain in a particular domain or regime in the face of change. However, the concept of resilience has evolved and broaden since then, and its analysis in SESs has received great attention during the past years (Carpenter et al., 2001; Folke, 2006; Walker & Salt, 2006). ***Social-ecological resilience*** is commonly understood as "the capacity of a system to absorb disturbance and/or reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks" (Walker et al. 2004: 6). A large part of the literature analyzing social-ecological resilience has employed analytical frames like regime shifts[5] (Crepin et al., 2012), or adaptive cycles and *panarchy*[6] (Gunderson & Holling, 2002).

One important distinction and discussion in resilience of SESs is related to specified and general resilience. As suggested by its name, ***specified resilience*** is "the resilience of some specified part of the system to a specified shock—a particular kind of disturbance" (Walker & Salt 2012: 18). In this sense, Carpenter et al. (2001) stress that when measuring and managing for resilience, it is crucial to specify what system's state or part is being considered (resilience of what) and what perturbations are being considered (resilience to what). However, focusing too much on the resilience of particular parts or on particular disturbances, may cause the system to lose resilience in other ways (Folke et al., 2010:4). It may reduce ***general resilience***; the resilience to disturbances of all kinds, including novel, unforeseen ones (Walker & Salt, 2012).

Following Folke et al. (2010), I consider here three prerequisites or *capabilities*[7] for resilience that are important in the context of agroecosystems and food systems: persistence, adaptability and transformability. Because human actions generally dominate in SESs, these capabilities are a function of the social component, and their actions influence resilience both intentionally and unintentionally (Walker et al., 2004).

Persistence or buffer capability, refers to "conserving what you have and recovering to what you were" (Folke et al., 2010:6). It is concerned with the ability of assimilating a disturbance without changing the structure or function of the system and it is particularly important to buffer small disturbances (Darnhofer, 2014). Persistence at the farm level, for instance, may be expressed by the mobilization of financial resources or labor reserves, by using excess capacity (*e.g.* in land, human labor, equipment, or social networks), by shifting to conservation practices, or by substituting inputs (Darnhofer, 2014).

[5] Crepin et al. (2012: 15) define a *regime shift* as "a substantial reorganization in system structure, functions and feedbacks that often occurs abruptly and persists over time".

[6] Based on Holling´s model, Folke et al. (2010:3) define the *adaptive cycle* as an "heuristic model that portrays an endogenously driven four-phase cycle of social-ecological systems and other complex adaptive systems. The common trajectory is from a phase of rapid growth where resources are freely available and there is high resilience (r phase), through capital accumulation into a gradually rigidifying phase where most resources are locked up and there is little flexibility or novelty, and low resilience (K phase), thence via a sudden collapse into a release phase of chaotic dynamics in which relationships and structures are undone (Ω), into a phase of re-organization where novelty can prevail (α). The r-K dynamics reflect a more-or-less predictable, relatively slow "foreloop" and the Ω - α dynamics represent a chaotic, fast "backloop" that strongly influences the nature of the next foreloop. External or higher-scale influences can cause a move from any phase to any other phase".
Panarchy, on the other hand, is understood as "the interactive dynamics of a nested set of adaptive cycles".

[7] According to Darnhofer (2014:467) "the term capability is used to denote that it is not an asset or an automatic response that can be deduced from the characteristics of the farm [or system], but the ability to identify opportunities, to mobilise resources, to implement options, to develop processes, to learn as part of an iterative, reflexive process".

Secondly, ***adaptability*** refers to the capacity of the actors of a system to recover from shocks and disturbances in order to maintain basically the same functions and structure (Martin-Breen & Anderies, 2011). It requires resourcefulness and the ability to combine experience and knowledge to adjust responses to a changing context or to changing preferences (Darnhofer, 2014). Adaptability implies incremental changes without questioning the goals, values and structures that were governing the system before the shock or event (Darnhofer, 2014), and hence it can lead to a reinforcement of structures or regimes that in the first place generated the disturbance.

Finally, ***transformability*** indicates "the capacity to create a fundamentally new system when ecological, economic, or social structures make the existing system untenable" (Walker et al., 2004:5). It entails a transition over a period of time, where it can be difficult to isolate a clear break between the 'old' and the 'new' system (Darnhofer, 2014). In this sense, transformability is related to the capacity of self-organization and learning of the system, thus requiring analysis of adaptive governance in order to understand the social dimension that enables the transformation of SESs (Folke, 2006). These transformations can be gradual, with a series of incremental transformative changes, or abrupt and surprising (Darnhofer, 2014). It implies changing the components and the way of living of the system itself, and it usually leads to a change in the values and paradigms that rule the system.

The relative importance of these 'resilient-abilities' depends on the structure, dynamics and goal of the SES itself; on whether the system is close to a regime shift; on the type of change the system is undergoing (the phase within the adaptive cycle); and on the influence of the dynamics and states of subsystems at other scales (the *panarchy*) (Walker et al., 2004; Darnhofer, 2014). For the promotion and management of resilience, it is also important to identify whether the disturbances are originated from changes in the internal structure and feedbacks of the system, or by external factors. When facing external disturbances, it is equally necessary to understand if these are coming from a sudden event (a shock), from a long-term trend that undermines the potential of the system (a stress), or from a combination of both. In sum, understanding the different components, the internal and external connections of the system, its vulnerability, and the phase in which this is transiting –the complexity of the system; is crucial in managing for resilience as different policies and management interventions are needed at different phases (Walker & Salt, 2006).

2.2.3. Deepening the ´social´ in social-ecological resilience

Despite the increasing attention on the resilience of SESs, most studies continue having an ecological emphasis. Resilience thinking has not effectively transcended the disciplinary boundary to incorporate the meaning of resilience of a community or a society (Adger, 2000), nor has it been systematically applied to the ecosystems used specifically for the production of food and fiber (Rist et al., 2014). Consequently, with the aim of enriching the analysis of the resilience of SESs it is important to add theoretical layers or include approaches from the social sciences. For instance, Cote and Nightingale (2012) argue that, in order to capture more accurately the scope of options available for the resilience of specific SESs, it is imperative to move towards situated analysis that include elements of agency, power and knowledge –as they are integral to social change. Similarly, Adger (2000) highlights the importance of social institutions, particularly relevant in resource dependent

communities where social resilience can be observed through the analysis of positive and negative aspects of social capital, marginalization and social exclusion. Due to the nature of this inquiry and the characteristics of the selected case study, three interrelated concepts from the social sciences are particularly important to develop here: agency, collective action and social capital.

Although extensively debated and studied within the social sciences, ***agency*** can be understood as the individual or collective capacity of humans to decide what action to take (Berner, 1998), it accounts for what leads people to act in the face of larger shaping forces and structures (Coghlan & Brydon-Miller, 2014:31). Agency, then, has an important role to play in how human-driven SESs, like food systems, respond to or ´navigate´ times of change. In the same direction, Berkes and Ross (2013) identified agency and self-organization as the most important aspects for community resilience. Further, they conceive adaptability, but I argue that the same holds for transformability, as a latent property of the social part of the SES that can be activated when people exercise agency, and often works through social networks and learning communities. For example, in a case study on disaster recovery in Thailand, Larsen et al. (2011) highlighted the importance of stakeholder agency for resilience, and how the vulnerability of each stakeholder was co-dependent on the ability to exert their agency by mobilizing the social relationships.

More generally, Davidson (2010:1143-1144) points out five manifestations of human agency related to responses in times of changes and crisis. First, a social system can purposefully transmit the effects of ecological disruption elsewhere, ´elsewhen´ or ´elsewho´. Second, human agency is distributed unequally, which has enabled an extraordinary concentration of control through the exercise of power and privilege. Third, human imagination is the driving force behind creativity and innovation, and influences heavily social evolution. Fourth, we are capable of anticipating risks or opportunities, and hence we have the potential to take conscious, transformative actions in this respect. And fifth, while creativity, innovation and anticipation can lead to individual actions and benefits, their potential influence on resilience is enhanced collectively – which leads us to the second concept.

The discussions and studies on collective action and natural resource management have increased during the last decades, and much has been written about it since Ostrom´s *Governing the Commons* (1990). ***Collective action*** can be defined as the actions "taken by a group (either directly or on its behalf through an organization) in pursuit of members' perceived shared interests" (Scott & Marshall, 2015). Although the role of collective action in agriculture has been studied with a focus on the management of common natural resources such as watersheds, forests, or grazing lands (Pretty, 2003), its importance has been also recognized in more specific agricultural issues.

For instance, Vanni (2014) argues that, in the case of agricultural public goods, collective action presents three benefits. First, it can have ecological scale merits and through the mobilization of coordinated resources (human, social, financial) it may reduce costs of public provision (economy of scale) and improve coordination mechanisms (economy of scope). Second, it enhances the possibility of sharing knowledge and learning for the participants of the action, increasing the legitimacy and credibility of decision-making. Third, it improves the efficiency and capacity of tackling local issues thanks to the flexibility and responsiveness that is generally found in this initiatives. Similarly, Eyzaguirre et al. (2004) point out that *in-situ* conservation of plant genetic resources benefits from the coordination of farmers and other actors. Seed-based collective actions can facilitate the

maintenance of germplasm-related local knowledge, and they improve local capacity to conserve and improve local crop varieties. Munk (2004) highlights that the best results for integrated pest management is gained through coordinated implementation over a wide geographic area and based on sustained collective action.

Several authors have pointed out the significance of social capital for collective action (Vanni, 2014) and its relation with agency (Lind & Dale, 2014), thus it is important to clarify what is understood here by social capital. Putnam et al. (1993) define ***social capital*** as ´features of social organizations that facilitate coordination and cooperation for mutual benefits´. In the case of agriculture and natural resource management, social capital can be characterized by four features: (i) relation of trust; (ii) reciprocity and exchanges; (iii) common rules, norms and sanctions and (iv) connectedness in networks and groups (Pretty & Smith, 2003).

Bearing this in mind, it is essential to analyze the role, possibilities and restrictions of agency and collective action to enhance persistence, adaptation or transformation in human-driven SESs. In this sense, the study of food systems and Alternative Food Networks can contribute to a more interdisciplinary analysis and management of resilience in SESs, and this research seeks to make a contribution in this regard.

2.2.4. Principles for building resilience in agroecosystems and food systems

The diversity of disciplines and approaches studying the resilience of SESs has led to a relatively diffuse and fragmented understanding of the importance of different factors for building resilience in a particular social-ecological setting, and how these can be operationalized (Biggs et al., 2015). In order to fill this gap, several authors have proposed ´rules of thumb´ or attributes to enhance resilience in general or specific contexts. Building on some of these works, I synthesize the factors suggested in Folke et al. (2003), Biggs et al. (2015) and Berkes & Ross (2013)[8], and propose the following three principles as prerequisites for building resilience, having in mind the nature of agroecosystems and food systems.

- Diversity and Redundancy: Diversity plays an important role in spreading risks and creating buffers, and it is essential in the reorganization and renewal process following disturbance, where the social and ecological memory become significant (Folke et al., 2003). Similarly, functional redundancy (the presence of multiple components that can perform the same function) can act as an ´insurance´ by allowing some components of the system to compensate for the loss or failure of others. Further, it can provide the system with response diversity if the ´redundant´ components also react differently to change and disturbance

[8] Folke et al. (2003) synthesize a series of studies on the resilience of SESs for resource and ecosystem management, by stressing four critical factors for resilience. First, learning to live with change and uncertainty. Second, nurturing diversity for reorganization and renewal. Third, combining different types of knowledge for learning. Fourth and finally, creating opportunities for self-organization. Similarly, Biggs et al. (2015) identified seven principles that are consider crucial for building resilience in SESs, particularly when seeking to sustain ecosystem services. These principles are: (1) maintain diversity and redundancy, (2) manage connectivity, (3) manage slow variables and feedbacks, (4) foster an understanding of SESs as complex adaptive systems, (5) encourage learning and experimentation, (6) broaden participation, and (7) promote polycentric governance systems. Further, Berkes & Ross (2013) argue that community resilience can be enhanced through agency and self-organization, which in turn are a function of a number of strengths or characteristics: Social networks; Engaged governance; Positive outlook: Community infrastructure; Diverse and innovative economy; People-place relationships; Leadership; Knowledge, skills and learning; and Values and beliefs.

(Biggs et al., 2015). Several kinds of diversity are relevant for agroecosystems and food system: diversity of practices, livelihoods, actors, organizations, knowledges, information sources, or genetic and crop diversity. The role of biodiversity has been particularly highlighted both in the cases of ecosystems (Folke et al., 2004; Hooper et al., 2005) and agricultural production (Collins & Qualset, 1999; Altieri et al., 2015), and hence it will be explored in more detail at the end of this chapter.

- Knowledge and Learning: Since the knowledge of a system is generally incomplete and partial, efforts to enhance resilience must always be supported by continuous learning and experimentation (Cundill et al., 2015). Making use of and combining different knowledge systems (in particular experiential and experimental knowledge) facilitate a better understanding of the system (Folke et al., 2003). This, in turn, benefits the response that the actors of the system execute in times of change, and can contribute to the identification and management of slow variables and feedbacks (Biggs et al., 2015). Further, creating social and institutional spaces for dialogue and innovation is key to encourage learning and resolving uncertainties (Folke et al., 2003), since adaptability and transformability are often activated through capacity building and social learning (Berkes & Ross, 2013).

- Self-organization and polycentric governance: Self-organization has been identified as an essential element in post-disturbance situations. From a social perspective, self-organization activates capacities already inherent in a community (Berkes & Ross, 2013), while from an ecological point of view, it is crucial because nature´s cycles involve renewal and reorganization. Berkes (2007), points out that opportunities for self-organization can be created by: (i) strengthening community-based management, (ii) building cross-scale management capabilities, (iii) strengthening institutional memory, and (iv) nurturing learning organizations and adaptive co-management. These factors, in turn, can be enabled by polycentric governance structures. Polycentricity, is considered one of the best ways to achieve collective action for resilience since it: improves connectivity, creates modularity, enables broader levels of participation, improves potential for response diversity, and builds redundancy (Schoon et al., 2015).

2.2.5. Defining the ´ecological´ in agroecosystems resilience

While the previous section was concerned with general principles for resilience of SESs, it is equally important to advance in the operationalization of resilience in particular settings. In the case of this research, agroecology offers us specific insights of how to promote ecological resilience in agriculture.

Conventional agriculture has made farms more vulnerable to climate and weather events. The ´Green Revolution package´ led to an extension of monocultures and thus, to a significant loss of agrobiodiversity, to accelerated soil erosion, and to increased greenhouse gas emissions (De Schutter, 2014). However, traditional farming systems can be seen as models of resilience, and contrary to conventional industrial agriculture, they offer a wide array of management options and designs to cope with and adapt to environmental changes (Altieri et al., 2015).

It is increasingly accepted that agroecology improves resilience to climate change (Nicholls et al., 2013; IPCC, 2014). Agroecological modes of farming are better equipped to support more frequent and more severe droughts and floods, and increasing invasion of new pests, weeds and diseases; as it is expected with more extreme weather-related events (De Schutter, 2010). Numerous studies illustrate how several agroecological practices generate higher resilience to climate events, and small-holder families who employ these practices have been able to cope and even prepare for climate change, minimizing losses of their crops (Nicholls, 2013). One of the most cited examples regarding the resilience of agroecological systems to climate events is related to the Hurricane Mitch in Central America. Drawing on a large-scale research on 180 communities of smallholders in Nicaragua, Holt-Gimenez (2002) found that, following Hurricane Mitch in 1998, small-scale farms employing simple agroecological practices (rock bounds, green manure, crop rotation, stubble, windbreaks, alley cropping, contour plowing, etc.) were more resistant than their conventional neighbors. In particular, after the hurricane, agroecological farms had 40% more topsoil, lost 18% less arable land to landslides, and had a 49% lower incidence of landslides; as compared to conventional farms. Similarly, agroecological plots had higher field moisture, less erosion and lower economic losses than plots on conventional farms.

The type and complexity of the agroecological practices that promote resilience depend on the specific geographical, bio-physical, and socioeconomic characteristics of the agroecosystem. However, and based on Nicholls (2013), Wezel et al. (2014), and Altieri et al. (2015), Table 1 presents a general set of practices that have been identified as builders of resilience in agroecosystems, and that will be considered in this research.

Table 1. Agroecological practices that enhance resilience

Diversification	– Mixed or intercropping – Agroforestry – Silvopastoral systems	– Crop rotation – Local varieties of crops or cultivars
Soil Management	– Cover cropping – Mulching – No-tillage	– Green manures – Compost applications
Soil Conservation	– Contour farming – Living barriers – Check dams along gullies	– Grass strips – Terracing
Water Management	– Water harvesting	– Drip irrigation
Fertilization	– Organic fertilization – Incorporation of nitrogen-fixing plants/trees	– Green fertilizer – Biofertilizers
Weed, Pest and Disease control	– Allelopathic plants – Natural / botanical pesticides	– Integrated Pest Management – Biological Pest control

Source: Based on Nicholls (2013:19), Wezel et al. *(2014:4-7), and Altieri* et al. *(2015:886).*

2.3. Agro-biocultural diversity and Seeds

As mentioned earlier, diversity at different levels has been pointed out as an essential factor for resilience and sustainability. Biodiversity, in particular, is a key element for understanding the current multidimensional crisis of the global food system and for building solutions to it (Hainzelin, 2013). In the context of SESs it is important to conceive biodiversity as a coupled human-environmental issue.

There is “an emerging recognition that the diversity of life comprises both living forms (biological diversity) and human beliefs, values, worldviews and cosmologies (cultures)” (Pretty et al., 2009:101). Moreover, biological diversity and cultural diversity are intertwined, interdependent, and the links between them have developed and coevolved over time through mutual adaptation between humans and the environment (Maffi, 2007). This relation is acknowledged by the term biocultural diversity.

This ´inextricable link´ is particularly evident in the case of food and agriculture. But the continuous globalization and industrialization of our food system have caused a loss of on-farm and landscape habitants and species, as well as a loss of traditional diets and knowledge of foods (Pretty et al., 2009). Increasingly, we live in a world of ´mono-cultures´ (Carolan, 2012). More than 75% of the genetic diversity of agricultural crops was lost during the 20th century, and nine crops alone now account for more than 75% of plant´s contribution to human dietary energy (FAO, 1993). Reverting this trend is essential for transforming our global food system, and the understanding and enhancement of agro-biocultural diversity may provide important advancements towards resilience and sustainability (Barthel et al., 2013).

Agrobiodiversity creates potential for beneficial interactions between the components of the agroecosystem, it increases stability, and it enhances ecosystems functions (Gliessman, 2007). In fact, the level of biodiversity can make a difference for the resilience of an agroecosystem when confronting biotic or abiotic perturbations (Altieri et al., 2015). The main benefits or effects of biodiversity on agroecosystems are summarized in Figure 4.

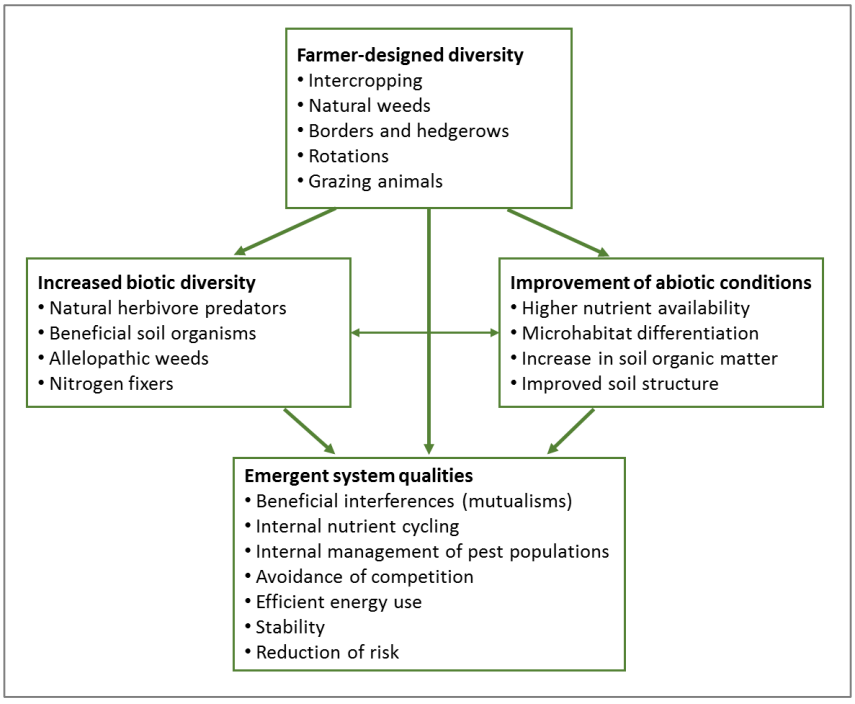

Figure 4. Management and benefits of diverse agroecosystems

Source: Reproduced from Gliessman (2007:218).

Agrobiodiversity can take many forms: polycultures, living fences, intercropping, or agroforestry systems, among others. But it always needs a diversity of seeds. Seeds are the source of life and the

first link in the food chain. “We have diversity of seeds because of the coevolution and co-creation by nature and farmers over 10.000 years. […] Seeds are therefore the repository of millennia of biological and cultural evolution. They hold the memory of the past and the potential for the future” (Shiva, 2014: 438).

Several authors have studied the importance of seeds for the resilience and sustainability of food systems (FAO, 2012; Navdanya, 2012; Martins, 2015). Some of them have stressed the importance of ´seed sovereignty´: people´s control and knowledge of the variety, production, and distribution of seeds (Wittman, 2009). This notion goes beyond ´seed security´ as it adds the dimension of *control* to the accessibility, availability and utilization of seeds; and includes the embeddedness of cultural values and knowledge in seed varieties and farming strategies (Bezner-Kerr, 2013). Seed sovereignty can enhance access to biologically diverse and resilient seeds that can be used under current climatic uncertainty, contributing to food security, food sovereignty and agro-ecological resilience (Wittman, 2009; Kloppenburg, 2010).

Throughout history, the conservation of seed diversity and the possibilities for seed sovereignty have relied on the growing and exchange of seeds among farmers (Pautasso et al., 2012; Shiva, 2014). Two expressions of this are farmers´ networks and community seed banks. Regarding the first one, Coomes et al. (2015) argue that these networks operate as open systems and constitute a significant channel for the transmission of agricultural novelty, innovation and diversity. Furthermore, the authors highlight the importance of farmers´ networks for seed dissemination; for the spatial and social distribution of genetic, morphological and varietal diversity; for building diverse and viable crop populations; and for the transmission of staple and minor crops. As for community seed banks, Veernoy et al., (2015) contend that these seed banks center their activities in conservation, access and availability, as well as in seed and food sovereignty. In general, they work on the basis of participation, collective decision-making, and shared responsibility for resources, risks, and benefits; thus strengthening the capacity for collective action and enhancing human and social capital (Veernoy et al., 2015).

To sum up, “conserving seed is thus more than merely conserving germplasm. Conserving seed is conserving biodiversity, conserving knowledge of the seed and its utilization, conserving culture, conserving sustainability” (Navdanya, 2012: 9), and I would add, conserving resilience.

Chapter 3 – Methodology

3.1. Research approach/ design

Considering the motivation and objectives of this agroecological thesis, the research is framed by a systemic approach influenced by constructivism. A systemic worldview, as opposed to a mechanistic one, understands the world as a complex whole of interconnected and interdependent elements and properties (Checkland, 1999). It sees the world "not as a collection of isolated objects, but as a network of phenomena", recognizing "the intrinsic value of all living beings" and viewing humans "as just one particular strand in the web of life" (Capra, 1996: 7). Within a systemic approach, soft systems thinking promotes the use of heuristic, dynamic and participatory methods to analyze the complexity of agroecosystems and other types of socio-ecological systems while allowing us to focus more on the question *what is?* instead of the question *what is to be done?* (Bawden et al., 1984). Additionally, constructivism stresses the existence of multiple and sometimes conflicting social realities and meanings that are both a consequence of social constructions and are in a state of permanent change (Guba & Lincoln, 1994; Bryman, 2012). In fact, "what can be known is inextricably intertwined with the interaction between a particular investigator and a particular object or group" (Guba & Lincoln, 1994:110). In this sense, constructivism adopts a relativist ontology highlighting socially based and locally constructed realities, and a transactional/subjectivist epistemology where knowledge is created in the interaction between investigator and respondents (Guba & Lincoln, 1994; Hesse-Biber & Leavy, 2005).

The conception of realities under this approach is in line with the analytical framework used here. Both resilience thinking and AFN emphasize the importance of locally situated analysis and the uniqueness of each system, although not ignoring that common features are often shared between systems and food networks (even across cultures). In this sense, the approach serves well this research as I am seeking to understand the emergence, properties and implications of a particular socio-ecological system (a specific alternative food network). Furthermore, I find the constructivist approach particularly suitable and consistent with agroecology, which promotes a multidimensional, holistic and systemic view of food and agriculture (see Section 1.1).

This research is founded upon a *qualitative case study*. A qualitative approach facilitates the understanding of the processes, structures and changes (Bryman, 2012), and enables a holistic and a reflexive approach for the generation of culturally situated and theory-intertwined knowledge through the continuous interplay of theory and methods, researcher and participants (Hesse-Biber & Leavy, 2005:3). These aspects of qualitative research serve well the purposes of this study. Firstly, it favors the understanding of the structures, functions and feedbacks of the *particular* socio-ecological system –*i.e.* Red MAC; and how these have been and can be managed to foster resilience. Secondly, it allows the researcher to include the study of the contextual conditions of the case (Yin, 2003), which is of particular relevance in situations like food systems, where the boundaries of the phenomenon are not clearly defined. However, it is important to bear in mind that due to the larger and complex setting in which the case is located, the outcome of the inquiry is a particular representation of the reality of the case, even under a systemic approach (Hammersley & Atkinson, 2007).

3.2. Participants

The case study is based on the Network of Agroecological Peasants' Markets of Valle del Cauca – *Red MAC*. Red MAC is an effort to integrate and coordinate the work of peasants' markets that base their production on agroecological principles and practices. Each market is conceived as "a space of solidarity encounter between producers and consumers, contributing to the construction of a social fabric through community participation processes" (Suarez, 2012). Red MAC was formally constituted in 2009, and it currently consists of 12 markets distributed in 10 municipalities of the Department of Valle del Cauca. These markets are conformed by over 275 families organized in approximately 62 organizations –peasants, farmers, and family-businesses (Mora, 2014). These organizations or associations get together using voluntary or simple agreements to conform a market which networks with others in Red MAC (See Figure 5 for the general organizational scheme of Red MAC).

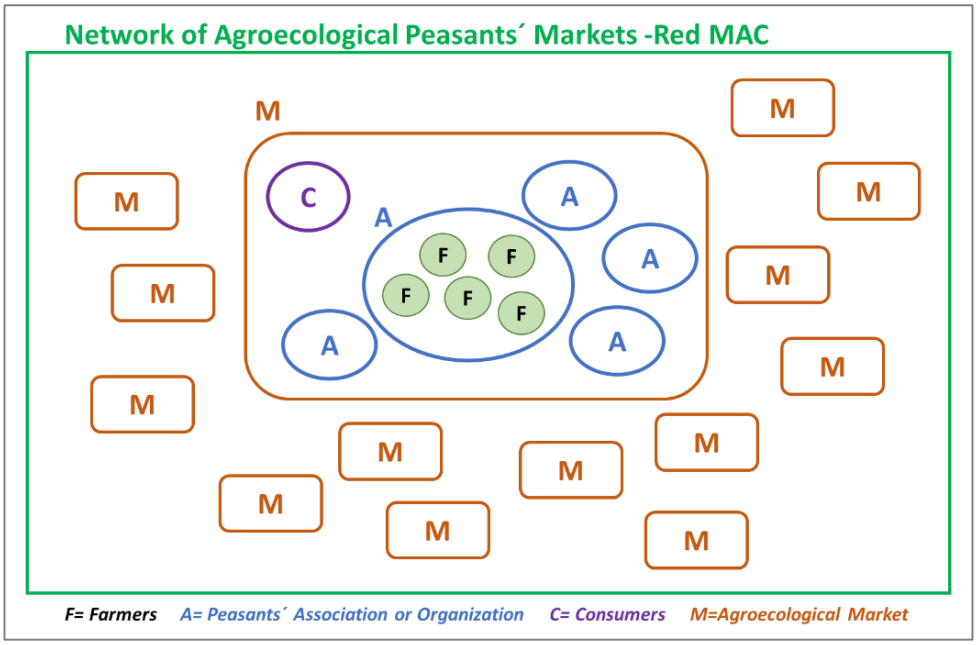

Figure 5. Organizational scheme of Red MAC

Within Red MAC, the research was carried out with participants at three levels:

i. Network: the coordination board of Red MAC, composed of representatives of the markets; and farmers from some of the markets.
ii. Market: MERCOVIDA market in the municipality of Restrepo.
iii. Farmers: four farmers who are part of MERCOVIDA.

Besides the participants of the particular case, key external informants were interviewed due to their expertise and/or acquaintance with Red MAC (See Table 2 for a full list of participants).

3.3. Methods

The fieldwork was carried out using various qualitative methods, seeking data enhancement and complex descriptions (Ragin & Amoroso, 2011), and aiming to explore different levels of the case. In

total, I conducted 11 individual interviews (four of them with farmers), four farm visits with transect walks, two workshops, two market visits, one group interview, and I participated in two events (for participant observation and small talks). A short description of each activity is provided in Table 2 and photos are displayed in Appendix 2.

Table 2. Summary of fieldwork activities and methods

Activity	Description	Level of Analysis within the case	Employed methods
Exploratory Fieldwork	* Visit to a regional market with the participation of farmers from 10 agroecological peasant markets of Red MAC. During the market, I was able to observe the dynamics between farmers and consumers, and participate as a consumer. * Informal conversations with five farmers that are part of Red MAC.	Network	* Direct observation * Small talks (informal conversations)
Interview with the coordinator of Red MAC	* Two-hour conversation with the coordinator of Red MAC regarding the evolution and current state of the Network.	Network	* Conversational interview
Planning meeting of Red MAC	* Attendance (as guest) to a full-day planning meeting with the coordination board of Red MAC. Representatives of 9 Markets were present.	Network	* Participant observation
Workshop # 1- coordination board of Red MAC.	* Two-hour workshop for discussing and identifying the main strengths and weaknesses of Red MAC in relation to critical factors for resilience building identified by Folke et al. (2003), Biggs et al, 2015, and Berkes & Ross (2013). * A list with 21 factors for resilience were presented to the participants. Three groups were formed and each group discussed and assessed the factors. * A plenary discussion was held on the 5 factors with highest and lowest scores.	Network	* Group discussions * Participatory scoring (PRA)
Participation in the launch event of Red MAC´s regional Community Seed House.	* Join a team of representatives of Red MAC in the preparation of the launch event of the regional Community Seed House (one day). * Attend the launch event (second day) * Informal interviews (small talks) with participants of the event.	* Network * Context	* Participant observation * Direct observation * Small talks (informal conversations)
Visit to women´s group on homegardens.	* Visit to and conversation with a seeds guardian * Conversation with a group of women that are working in homegardens and making herbs-based cleaning and medicinal products.	Complementary	* Semi-structured group interview
Visit to MERCOVIDA (agroecological peasant market in Restrepo).	* Visit to the agroecological peasant market in the municipality of Restrepo. * Observation of the dynamics and conversation with some consumers.	Market	* Direct observation * Small talks (informal conversations).
Workshop # 2 - MERCOVIDA participants.	* Workshop with 9 farmers from MERCOVIDA. * Participatory construction of MERCOVIDA´s timeline. * Lunch and conversation with the farmers.	Market	* Participatory timeline (PRA) * Semi-structured interview * Small talks (informal conversations)
Farm visits	* Visit and interview 4 farmers from MERCOVIDA. * Extensive visit and in-depth conversational interviews at Farm # 3 (staying in the farm for three days and sharing all the activities with the farmer´s family).	Farmers	* Transect walks (PRA) * Semi-structured interviews * Direct observation * Participant observation * Conversational interview
Academia	* Interview with the Head of the Agroecology Research Group, National University of Colombia at Palmira. * I made a presentation and held a discussion on social-ecological resilience with a group of agroecology PhD Students and researchers.	* Context * Network	* Semi-structured interview
Government interview	* Interview with an advisor of the Rural Development Unit, National Planning Agency, on peasant agriculture and commercialization.	* Context and public policies	* Semi-structured interview
UN interview	* Interview with FAO-Colombia´s coordinator of family farming and inclusive economy, on family farming and public food procurement.	* Context and public policies	* Semi-structured interview
Local NGO interviews	* Two interviews with members of the local NGO *Instituto Mayor Campesino -IMCA*, who has played an important role in the emergence and consolidation of Red MAC.	* Context * Network	* Semi-structured interview

Other NGO	* Interview with the co-founder and coordinator of *La Canasta*, a box-scheme network of agroecological products in Bogotá.	* Context and public policies	* Semi-structured interview

Apart from the exploratory fieldwork and the interview with the coordinator of Red MAC, that were carried out in November 2015, all the fieldwork activities were carried out in January 2016.

Semi-Structured Interviewing (SSI) was the most employed method. This method was selected as it places emphasis on the interviewees' frames and understanding of issues, and on their own experiences, while keeping the inquiry process flexible (Bryman, 2012). Moreover, it is a form of interviewing that enables an inter-change of views with the respondents in a reduced time, creating the inter-actions where knowledge is constructed (Kvale & Brinkman, 2009). SSI were employed with farmers[9] and external actors and were audio recorded. A short interview guide was used in all cases and it was modified for each of the external participants. Additionally, in-depth conversational interviews were carried out with the coordinator of Red MAC and with the farmer at Farm # 3. Both of them acted as ´gate keepers´, and the farmer of Farm # 3 became an important key informant with the course of fieldwork (a common feature pointed out by Bryman, 2012). All interviews were carried out at the farmer´s home or expert´s office, accordingly, and were conducted in Spanish, the native tongue of both participants and researcher.

Methods from the Participatory Rural Appraisal (PRA) tradition were employed in the two workshops and during the farm visits. Since PRA has partly evolved from a synthesis of agroecosystem analysis (Chambers, 1994) its use was considered relevant for the analysis of the particular alternative food system.

A *participatory scoring* exercise was used in a workshop with 15 members of the Coordination board of Red MAC (Workshop # 1). Three groups were randomly formed and a list of 21 factors identified in the literature as enhancers of resilience (Folke et al., 2003; Berkes & Ross, 2013; Biggs et al., 2015) was provided.[10] Each group discussed and ranked the factors, having Red MAC (instead of the individual markets) as the unit of analysis. The discussion of two groups were audio-recorded for further analysis, while notes from the third group´s discussions were taken. Fully open scoring was employed as it has been suggested to be more flexible and lead to more ´independent´ observations than other scoring or ranking methods (Maxwell & Bart, 1995; Abeyasekera, 2001). A 7-point Likert scale ranging from ´very bad´ to ´very good´ was used for ranking. The scores of each group were summed-up and the factors with the lowest and highest values were briefly discussed with the whole group.

The construction of a *participatory timeline* was the main activity of the workshop with MERCOVIDA (Workshop # 2). A timeline was considered appropriate as it puts a group´s history into perspective, identifying and discussing the broad framework of events that shaped its past and generate change (Narayanasamy, 2009). This workshop was developed with the participation of 9 farmers from MERCOVIDA, and was carried out at one of the farmer's place. The focus of the timeline was the main social-ecological events that have shaped MERCOVIDA market (threats or opportunities).

[9] The terms farmers and peasants are used interchangeably to refer to small-scale family farmers.
[10] See Appendix 1 for the full list of factors and their sources.

Additionally, *transect walks* were used to complement the four SSI with farmers. This allowed direct observation of the ecological setting (biodiversity and resource endowments) where farming takes place, the establishment of rapport with farmers, and the generation of interactive 'on-the-spot questions' (Cavestro, 2003; FAO, 2006).

Direct observations of the behavior and relations between consumers and farmers were made during the two market visits, as well as observations of the dynamics of farmers both outside their farms - during the launch event of seed house, and during the farm visits. In addition, *participant observation* was carried out at three moments. First, during the planning meeting of Red MAC; second during the preparation and development of the launch event of Red MAC´s regional Community Seed House; and third during the extended visit at Farm # 3. Participant observation complements interviewing by allowing the researcher to see through 'others eyes'; to get acquaintance with local 'argot'; to be more sensitive to the context; to come closer to a naturalistic emphasis; to revealed features that otherwise would be taken for granted; and to reduce the problem of reactivity (Yin, 2003; Bernard, 2006; Bryman, 2012). Moreover, direct and participant observation are of particular relevance for a qualitative case study since they facilitate the coverage of events in real life and their contexts (Yin, 2003).

The selection of the participants was made using a mix of purposive opportunistic sampling and convenience sampling (Bernard, 2006; Bryman, 2012). The reason for this selection was to keep a balance between field-resource restrictions (time and money) and the relevance of the participants for the research questions and objectives.

Finally, documentation was used as a source of evidence to corroborate and supplement evidence from the other sources (Yin, 2003). Of particular relevance was the collection of: 5 internal documents of Red MAC (minutes of annual meetings, project documents); 10 documents on farms or markets belonging to Red MAC (covering issues like seed diversity, ecosystem services, soil health, Participatory Guarantee Systems, etc.); and some contextual documents for the municipality of Restrepo and the Department of Valle del Cauca.

3.4. Data analysis

The analysis for this research is based on the concept of *retroduction*. As explained by Ragin (1994), retroduction can be understood as a dialectic process that describes how deduction and induction work together in research through the interplay of frames and images. On one hand, the analytical frames that are used to examine or understand a phenomenon are based on both specific everyday-life ideas, and on the cumulative pool of ideas that constitutes a theory. These frames are built through deductive processes and constitute ways of seeing the studied phenomenon. On the other hand, images are built up from evidence through inductive processes. Researchers summarize and synthetize data in order to construct more complete portraits of the subject being studied. The dialogue between evidence and ideas, through the mutual influence and interaction of analytic frames and images produce a progressively refined picture of the studied phenomenon. This picture becomes, in turn, the representation(s) and explanation(s) that researchers offer. Particularly for this

research, a general literature review on social-ecological resilience and Alternative Food Networks was established as a frame of departure before the fieldwork. Then, data was analyzed generating categories and findings (*i.e.* images), which in turn guided a refinement and deepening of the analytical framework that was eventually used and is presented in this document.

In particular, data analysis was guided by the general elements of *framework analysis* as described by Srivastava and Thomson (2009: 73) for research that seeks to understand and describe a particular situation and has "specific questions, a limited time frame, a pre-designed sample […] and a priori issues […] that need to be dealt with". I used the five-step iterative process in the following way:

(i) Familiarizing with the data: All audio recordings and notes were reviewed, and interviews were partially transcribed.

(ii) Identifying a thematic framework allowing new themes and issues to interact and reshape a priori subjects: The set of factors for resilience identified by Folke et al. (2003), Biggs et al. (2015), and Berkes & Ross (2013), was the point of departure. However, from the data analysis important themes emerged, among them: seeds sovereignty, collective action, and homegardens.

(iii) and (iv) Indexing and Charting: The interviews and workshops´ transcriptions were displayed on an Excel sheet, and segments of each of them were categorized using emerging keywords (*e.g.* biodiversity, knowledge, agroecological transition). Additionally, the factors for resilience, used in step (ii), were linked to each segment, when possible.

(v) Mapping and interpretation: With the new themes emerging from the data, a more robust analytical framework was built (reviewing more literature). Then, charted data was reviewed again and analyzed by cluster of themes, by keywords, and by levels of the case study (farms, market, network). During the process of analysis, triangulation between different farmers, internal and external participants, and documentation; was used to correlate and validate findings.

3.5. Validity and Reliability

Having in mind the systemic and constructivist approach taken here, I consider three primary criteria for assessing the quality of my inquiry process: reliability, credibility, and transferability. I understand reliability in the ´conventional´ way (Yin, 2003; Trumbull, 2005), concerned with the possibility of repetition of the research procedures. Following Guba and Lincoln (1994), I see credibility and transferability more appropriate than internal and external validity, respectively. Internal and external validity are well developed criteria in quantitative research, but their meaning is more contested for qualitative inquiries (Bryman, 2012). Guba and Lincoln (1994) argue that qualitative research should be judged or evaluated according to other, more appropriate, criteria. Instead of using internal validity (regarding cause-effect inferences) they opt to use credibility, and instead of external validity (the process of generalization of the research) they propose transferability. Credibility emphasizes internal consistency and the process of ensuring rigor in the research and communicating it to the readers. Transferability, on the other hand, refers to the extent to which the reader is able to decide how the findings may be transferred based on the information provided by the researcher (Morrow, 2005).

Hence, in order to aim for a *credible*, *transferable*, and *reliable* research, I adopted three permanent processes. First, triangulation of data sources and methods, in order to clarify meaning, verify repeatability of observations or interpretations, identify different realities (Stake, 2005), test consistency, and reduce systematic bias in the data (Patton, 1999). Second, general reflexivity but with an emphasis on philosophical self-reflection, methodological self-consciousness, and methodological and analytical self-criticism (Bryman, 2012). Finally, traceability expressed in keeping a careful and rigorous documentation and records of the inquiry process.

3.6. Limitations and ethical considerations

Three main limitations of the selected methodology have been identified. The first one is related to the sampling methods. The use of purposive and convenience sampling, and the importance of the ´gate keeper´ at Restrepo in identifying the participants of MERCOVIDA, could have excluded farms with different socio-ecological conditions from the study. The participation of more and diverse farms (and Markets) would have benefited the research by providing richer pictures of the situation, but would have required more time and resources.

Another limitation has to do with the absence of conventional farms and markets as benchmarks for the study. Analysis of the features, structures and dynamics of farmers that are not engaged in agroecological networks would have provided important elements to better judge Red MAC´s properties and its impacts. However, this limitation was partly mitigated with the use of triangulation and secondary data (*e.g.* agricultural census, other studies in the area, literature review), when available.

The third limitation is that, due to funds and time restrictions, it was not possible to employ quantitative methods as complementary means to enrich the data. Quantitative data on the ecological and economic aspects of the farms and the Markets would have strengthened the findings, especially if combined with the analysis of conventional farms and markets.

Additionally, there are some ethical considerations to comment on. All the participants took part in the research voluntarily and after having had the purpose and scope of the study explained. A verbal informed consent was obtained from all the participants, and anonymity was employed to respect their privacy. Finally, reflexivity was employed to address the ´ethics in practice´ and as a continuous reminder that the social and political locations, in which we are immersed, affect the research practices (Guillemin & Gillam, 2004). Having a constant reflective attitude and generating spaces for auto-critical examination during the fieldwork (*e.g.* taking some minutes at the end of each day to reflect on the work), was particularly important to minimize the biases generated by my passion for agroecological approaches and my admiration for the work done by Red MAC.

Chapter 4 – Context

4.1. Colombia

Colombia is located in the northwestern corner of South America; a privileged position with access to the Pacific and Atlantic Oceans (Caribbean Sea) and at the heart of the Americas continent (See Figure 6). The country has an area of 1.14 million km^2 and an estimated population of 48 million. Most of the population lives in the central highland areas of the Andes mountain system, while the eastern savannas and the southeastern Amazon forest is scarcely inhabited. Colombia is listed as one of the world's 'megadiverse' countries, hosting close to 10% of the planet's biodiversity even though it holds only 0.7% of the world's continental surface. Due to its 314 types of ecosystems, the country possesses a rich complexity of ecological, climatic, biological and ecosystem components[11].

The country has the fourth largest economy of Latin America, with an annual GDP per capita of 7970 USD and an average economic growth rate of 4.5% over the last 15 years (World Bank, 2016; United Nations, 2016). The service sector is the largest origin of GDP (56.7%) and employment (62.2%), followed by the industrial sector (36.9% of GDP and 20.9% of employment) and the agricultural sector (6.4% of GDP and 16.9% of employment). However, in recent years the country´s economy has been largely driven by oil and mining, while the informal economy has prevailed around 50%.

Colombia is one of the most unequal countries in the world in relation with access to land. According to the latest agricultural census, 70% of the agricultural units[12] occupies less than 5% of the land and owns farms under 5 hectares. On the other hand, 0.2% of the agricultural units controls 32% of the land, with farms over 1000 hectares (DANE 2014a). Additionally, there is a major land-use conflict. In 2009, from 21.5 million hectares suitable for agriculture in the country, only 22.7% was actually being used for agricultural activities. Conversely, 39.2 million hectares are used for livestock, but only 53.8% of this land is suitable for this activity (UNDP, 2011).

Regarding land use, from the 111 million hectares in disperse rural areas, 56.7% are covered in natural forests; 38.6% are being used for agriculture; (43.1 million hectares); 2.2% for non-agricultural activities; and 2.5% for other. Of the 43 million hectares dedicated to agriculture, 79.7% are under pastures and stubble fields (34.3 million Ha); 20.1% are used for farming[13] (8.6 million Ha); and 0.3% are used for agricultural infrastructure (0.1 million Ha). The production of agroindustrial crops (mainly coffee, sugarcane, palm oil, cocoa, etc); tubers and plantains; and fruits, occupy 76.3% of the agricultural land (See

Table 3). With plantain (10.8%), coffee (10.6%), sugar cane (6.9%), palm oil (5.9%), cassava (4.8%), and rice (3.6%), as the most important crops based on the cultivated area (DANE 2014a).

[11] According to the Convention on Biological Diversity.

[12] Agricultural Units (*Unidad Productora Agropecuaria*) is the unit of analysis of the 2014 Agricultural Census in Colombia. It can be formed by a part of a rural property, a full one, or a group of properties; as long as: (i) they produce agricultural, forest, or aquaculture products, (ii) they have a single producer, family, or company that takes responsibility of the production, (iii) they use any means of production. Source: DANE 2014a

[13] Farming land or land used for farming refers here to the agricultural land that is currently under any type of temporary or permanent crops.

Table 3. Participation of main agricultural groups. 2014.

	Area*		Participation of agricultural units
	Hectares	Participation	
Agroindustrial	3.298.975	36,5%	36,0%
Tubers and plantains	2.087.763	23,1%	30,2%
Fruits	1.510.372	16,7%	15,0%
Cereals	986.598	10,9%	9,1%
Forest plantations	621.339	6,9%	2,1%
Vegetables and legummes	430.106	4,8%	6,7%
Aromatic and medicinal plants	85.208	0,9%	0,5%
Flowers and foliage	14.972	0,2%	0,3%

** The sum of areas is higher than the total agricultural area because there are associated crops (intercropping) in different categories. For example coffee (agroindustrial) with plantain (tubers); or orange (fruits) with forest.*

Source: Data from DANE (2014a)

Agriculture and rural development are of utmost importance for Colombia´s peace and development (UNDP 2011, DNP 2015). Colombia is experiencing one of the longest conflicts in the world. For more than 60 years now, guerrilla groups, paramilitary forces, drug cartels, and the National Army have been fighting within the country with countless natural and physical costs and devastating human consequences: over 218 000 people killed with more than 80% of them being civilians; more than 5.7 million internally displaced people; 25 000 people disappeared; and 27 000 cases of kidnapping (Haugaard, 2014). However, during the last 15 years, the country has seen an improvement of the situation. First with the weakening of the guerrillas of FARC-EP and ELN[14] through intensive armed confrontation by the National Army; followed by the demobilization process of the AUC paramilitary forces; and recently with the Peace Talks between the Government and FARC-EP (officially started in 2012), and ELN (officially started in March 2016). Land and agriculture have been at the core of the Colombian conflict, and this has been recognized in the current Peace Talks between the Government of Colombia and FARC-EP. ´Integral Agrarian Development´ was the first of the six points of discussion in the Peace Talks, and the official releases have stressed the importance of land, food security, and the promotion of peasant, family, and communitarian economy for peacebuilding (Gobierno de Colombia & FARC-EP, 2014).

4.2. Valle del Cauca

The department of Valle del Cauca is located in the western part of the country, between 3° 05’ and 5° 01’ latitude N, 75° 42’ and 77° 33’ longitude W, and it borders the Pacific Ocean to the west (see Figure 6). The valley of the Cauca river, to which the department owes its name, is geographically bounded by the Central and Western mountain ranges and is watered by numerous rivers. The department is divided into four zones: the Pacific Fringe, which is humid and mostly tropical jungle; the western mountain range of Colombia´s Andes, also humid and full of jungle; the Andean valley of

[14] The National Liberation Army, is the second largest insurgent guerrilla group in Colombia, and it has been operating in the country since 1966.

the Cauca river, with one of the most fertile lands in the country; and the western ridge of the central mountain range of the Colombian Andes.

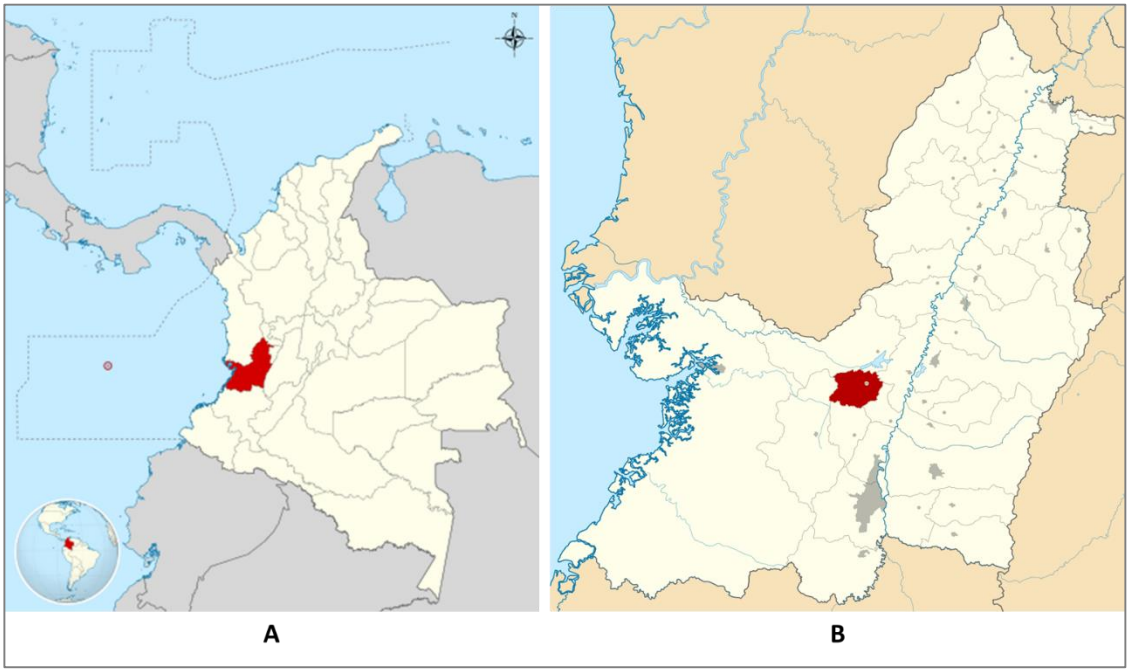

Figure 6. Maps of Colombia, Valle del Cauca, and Restrepo
Source: Maps by Shadowxfox (Own work): (A) CC BY-SA 3.0, (B) CC BY-SA 4.0; via Wikimedia Commons.

Valle del Cauca is the third most important department in the country according to population (4.6 million representing 9.57%) and share of the GDP (9.3%). Regarding the structure of its economy, the tertiary sector is the most important, with a contribution of 67% of the department´s GDP; the secondary sector contributes with 27%, and agriculture with 6% (DANE, 2014b). Land inequality is also high in the Department. Without counting the territories of indigenous people and afro-Colombian communities[15], 72.3% of agricultural units have access to 4% of the land, with farms smaller than 5 hectares; contrasting with 0.2% of the landlords who control 46.7% of the land, with extensions exceeding one thousand hectares (see Table 4). Valle del Cauca has an estimated rural area of 1.5 million hectares from which 68.3% is used for agriculture, 24.8% in forest, 5.6% for non-agricultural activities, and 1.3% for other uses (see Figure 7).

Since the 1950s an agricultural model based on territorial control of few landlords, large monocrop plantations of sugar cane, and more recently, land conversion to livestock pastures, has been in place in the Department (UNDP, 2008; Giraldo, 2014). Currently, 30.6% of the total agricultural land in the Department is used for livestock grazing; while sugar cane occupies 18.2% (and 39.8% of farming land); coffee 6.3% (13.7% of farming land); and forest 5.7% (12.5% of farming land). Plantain, pineapple, and other fruits and agro-industrial products complete the group of the most significant crops (DANE, 2014a).

[15] All the statistics in this section are based on the disperse rural areas excluding the territories of indigenous people and afro-Colombian communities, which in Valle del Cauca represents 26.3% of the total disperse rural area and 18.1% of the agricultural units. These territories were not taken into account since their land rights and productions systems have considerable differences with those of the *mestizo* peasants and the conventional farmers.

Table 4. Distribution of land under agricultural use in Valle del Cauca

	Agricultural Units		Area	
	Number	%	Ha	%
Total	**62.936**	**--**	**1.426.764**	**--**
Less than 5 Hectares	45.478	72,3%	57.091	4,0%
5 to 10 Ha	6.648	10,6%	47.156	3,3%
10 to 50 Ha	7.811	12,4%	168.761	11,8%
50 to 100 Ha	1.451	2,3%	102.795	7,2%
100 to 500 Ha	1.319	2,1%	264.184	18,5%
500 to 1.000 Ha	114	0,2%	77.828	5,5%
More than 1.000 Ha	115	0,2%	708.948	49,7%

Source: Data from DANE (2014a)

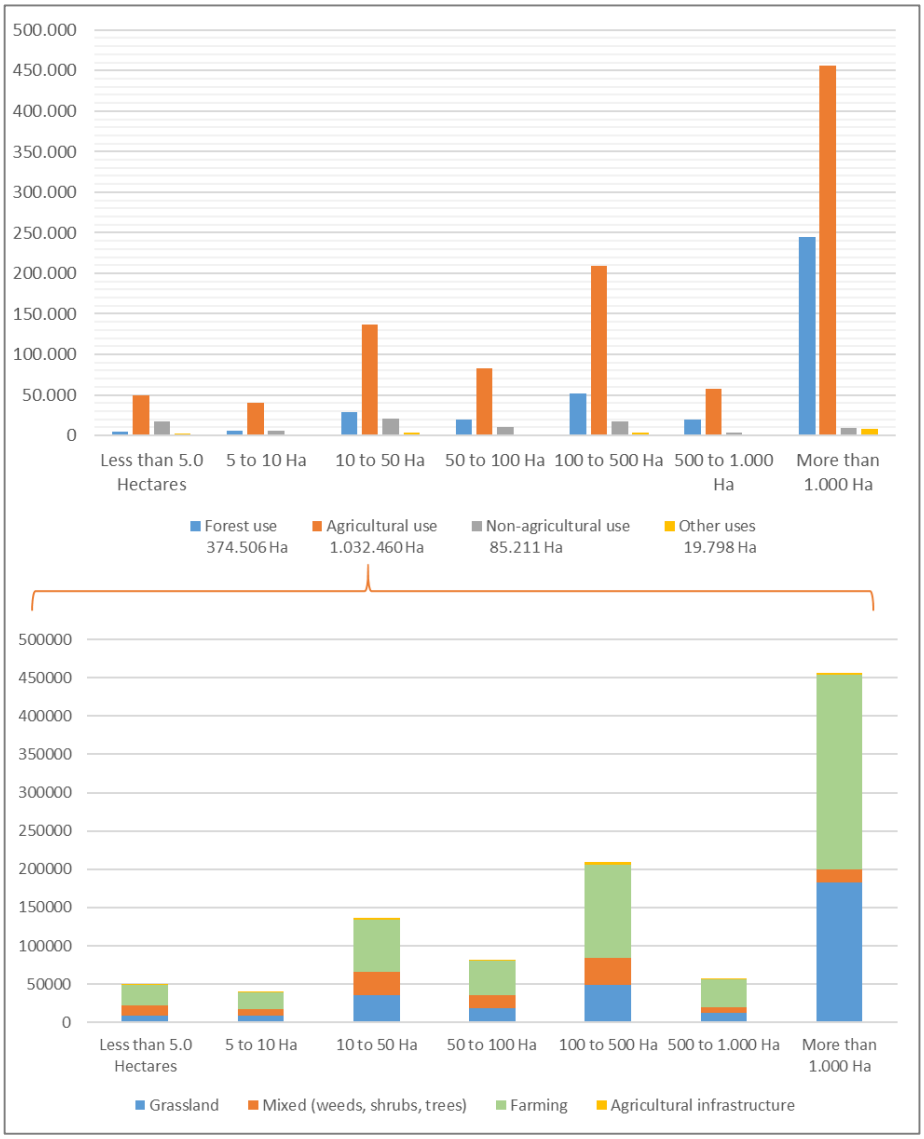

Figure 7. Land use in Valle del Cauca
Source: Data from DANE (2014a)

4.3. Network of Agroecological Peasants' Markets of Valle del Cauca – Red MAC.

During the 1990s, the Peasantry Major Institute -IMCA[16] and the Environmental Corporation of Valle del Cauca -CVC[17] started processes of promotion of organic/ecological agriculture for food security in the region, mainly through extension services and training. However, farmers participating in these programs started to produce agricultural surpluses and identified the need and opportunity for selling their products outside the conventional channels. Independent and disarticulated initiatives started to emerge in the municipalities with the support of different actors: IMCA, CVC, the Association of Organic Coffee-Growers of Colombia -ACOC[18], EPSA Foundation[19], and some local governments. As a response to this tendency, CVC implemented a base line to characterize these initiatives and to articulate their actions through strategic plans and exchange meetings. As a consequence, the first regional meeting of agroecological peasants´ markets took place in the municipality of Buga in February of 2009, marking the creation of the Network with 7 initial markets (CORPOGUADALAJARA, 2009; Mora, 2014). In their own words:

> Red MAC was born through a concurrence of wills between families from different organizations that conceive agroecology as a choice of life. This choice is manifested in a commitment to life and the planet´s health and caring, and expressed in our daily habits; in our relation with the soil; in the seeds; in the agricultural practices; in the communities; and in the people that inhabit rural and urban spaces. We depart from recognizing our role in the production and supply of healthy food and the conservation of nature; responsibilities that we perform driven by solidarity principles (IFOAM, 2013: 9).

Red MAC is currently composed of 12 markets distributed in 10 municipalities of Valle del Cauca (see Figure 8). These markets are conformed by over 275 families organized in approximately 62 organizations –peasant, indigenous, afro-Colombians, and family-businesses.

Thanks to the different temperature zones of the area, there is a great variety of products offered at the Markets: fruits; vegetables; cereals; legumes; tubers; chicken; fish; pork; rabbits; Guinea pigs; eggs; dairy products; processed products from coffee, cocoa, honey, and *panela*[20]; health and medicinal products; flowers; and handcrafts. Even though most of the products are sold in the local markets, there is a low amount sold in other markets, at farm-gate, or at specialized shops. They emphasize the local economy and consider the buyer as the ´consumer-friend´, transcending a simple commercial relation (IFOAM, 2013: 12-13). Most of the markets are exclusively local (with participants from one municipality) while others have a sub-regional character and are comprised by farmers from a vicinity, generating a positive impact beyond the municipality where the markets are located (Mora, 2014).

[16] The Peasant Major Institute –IMCA (*Instituto Mayor Campesino*) is a catholic-driven NGO that has been supporting peasants in the central region of Valle del Cauca since 1962. Their work is focused on sustainability and is currently organized in four areas: (i) Socio-environmental and economic projects; (ii) Territorial planning, (iii)Training, and (iv) Research and knowledge management.

[17] The Environmental Corporation of Valle del Cauca -CVC (*Corporación Autónoma Regional del Valle del Cauca*) born in 1954, is the highest regional environmental authority, and is in charge of managing renewable natural resources and promoting sustainable development.

[18] ACOC is the Association of Organic Coffee-Growers of Colombia (*Asociación de Caficultores Orgánicos de Colombia*), but its influence is limited to the southwest region of the country. It was founded at the end of the 1980´s and in 1992 it exported the first certified organic coffee of Colombia. Its brand *Café Sano* (Healthy Coffe), is currently commercialized in local markets and exported.

[19] EPSA Foundation is the CRS branch of the Pacific Electricity Company (*Empresa de Energia del Pacifico*), a regional company of west Colombia and established in 1999.

[20] *Panela* is unrefined whole cane sugar, a solid form of sucrose derived from the boiling and evaporation of sugarcane juice. It is typical of Latin America but a similar product is found in Asia and Africa under the name of jiggery.

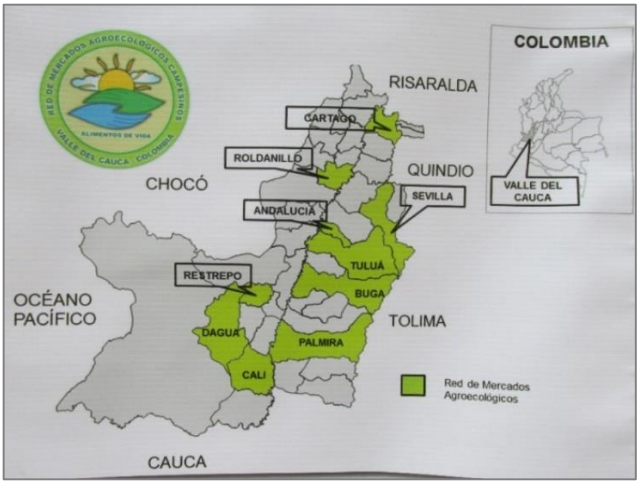

Figure 8. Location of Red MAC´s markets in Valle del Cauca

4.3.1. Restrepo and the agroecological peasant market of MERCOVIDA

The municipality of Restrepo is situated in the west range of the Colombian Andes, in the central region of Valle del Cauca (see Figure 6 above). It was founded in 1913 and it has an approximate extension of 352 km^2 and a population of 17.500 inhabitants. Restrepo is located at the coordinates 3°49'18" N and 76°31'22" W, between 1000 and 2800 m.a.s.l (with an average altitude of 1400 m.a.s.l.). The municipality has an average temperature of 18°C, and according to Holdridge´s classification, it has four life zones: Tropical dry forest, Dry premontane forest, Wet premontane forest, and Wet lower-montane forest; giving Restrepo a variety of ecosystems in mountainous areas and inter-Andean valleys. Agriculture is the main activity, with coffee, livestock, plantain, pineapple, sugar cane for *panela*, and forest plantations in some areas, as the most important products (MinTrabajo & PNUD, 2013).

The agroecological peasant market of Restrepo, MERCOVIDA, was created in April 2005 by the work of seven organizations, from which five are still active: AMUC, ACOC, FUNDER, NUEVO HORIZONTE, and PLAYAGUAY. The conformation of the market was supported by IMCA and the municipal agricultural office. The market operates every Saturday morning in a tent located at a corner of the conventional agricultural market, at the center of the municipality (Red MAC, 2014). According to Mora (2014), approximately 50 families participate in MERCOVIDA as producers, and they sell up to 0.6 tons per week, although this can vary greatly as verified during the fieldwork.

According to Red MAC (Red MAC, 2014) the Market has contributed to family cohesion, intellectual growth, and a larger participation of women (which represent approximately 80% of its members). Similarly, they state that one of the strengths of MERCOVIDA is the interest and efforts of its members in seeds´ conservation and exchange.

Chapter 5 – Results and Analysis

"Agroecology is a way of redesigning food systems, from the farm to the table, with a goal of achieving ecological, economic, and social sustainability". (Gliessman, 2016:1)

"Agroecology is life, health, wellbeing, and happiness. It is to rescue and preserve" (Female peasant, 50 years-old); "it is a lifestyle, it is not using chemicals, caring for the environment, and having good relations with your neighbors. If one is agroecological It should be so in all aspects of the life" (Female peasant, 50-55 years-old); "Agroecology is the being, the community. It is to be a child again a feel nature´s vibration and energy" (Male peasant, 40-45 years-old)

This chapter presents the main results of the research and the analysis derived from them. In order to understand how agroecological peasant markets are contributing to social-ecological resilience (subsidiary question 4 – SQ4), the chapter analyzes the main features of Red MAC´s different levels – farms, Markets, and Network (SQ2); and how each of them is equipped to cope with change (SQ3). Finally, the chapter explores the case of seeds and agro-biocultural diversity as a particular and important way by which Red MAC, as a whole, is building resilience.

5.1. Practicing agroecology at the farm level

The four farms shared several characteristics. They range between 0.9 and 4 hectares, they all produce coffee under an agroforestry system (and for three of them is the main cash-crop), and have a rich agrobiodiversity represented in more than 23 plant species cultivated in mixed- and poly-culture systems. They produce cereals (several races of maize), pulses (several races of beans and pigeon peas), roots and tubers (several races of cassava, *arracacha*, and potatoes), numerous fruits and vegetables, and raise small animals (hens, chickens, rabbits, goats, and pigs). The purpose of their agroecosystems is the family´s food security, but they also produce a few cash crops and sell a small percentage of the general production in the market. Additionally, they rely almost exclusively on family labor and they have few or non-off-farm income activities.

Farm # 1 is composed of 3 adults (2 males and 1 female) and 2 children. One of them work full time in the farm, another has full-time work in a local coffee farm, and the third one works in stints on different farms, including this one. The farm is 4.5 hectares and is characterized by a mix of forest patches, coffee grown under an agroforestry system, and fruit trees. (See Figure 9 for a map of the farm). Although coffee is the single crop that occupies most land, the farm produces more than 26 plant species (see Table 6 below) including different varieties of maize and beans, plantain, cassava, and fruits like avocado, orange, tangerine, and papaya, among others. They have egg-laying hens and chickens, and a couple of goats. Even though there is plenty of natural vegetation (weeds, shrubs and trees) along the farm, they have three patches of forest for fire wood and conservation and a *guadua* groove for construction wood and conservation.

The head of the farm started working agroecologically more than 30 years ago. This transition was triggered by the coffee leaf rust, and it was facilitated by the traditional farming knowledge and the experience of their parents. In words of one of the peasants:

> "*We started converting to clean production at the end of the 80s, when the coffee rust came* […] *we introduced new varieties but they were very demanding of chemicals, so we decided to grow coffee without them* [….] *It was not something new for us. Our parents were peasants, so a lot of knowledge about how to produce without chemicals was already installed here, in our farm and in our minds. We started putting that knowledge into practice, we started filling-up the farm with fruit trees* […] *Then, a variety of colorful maize, and beans came into place, and we continue diversifying […] always emphasizing the production for food security and our role as seed guardians*" (Male farmer, 70 years-old).

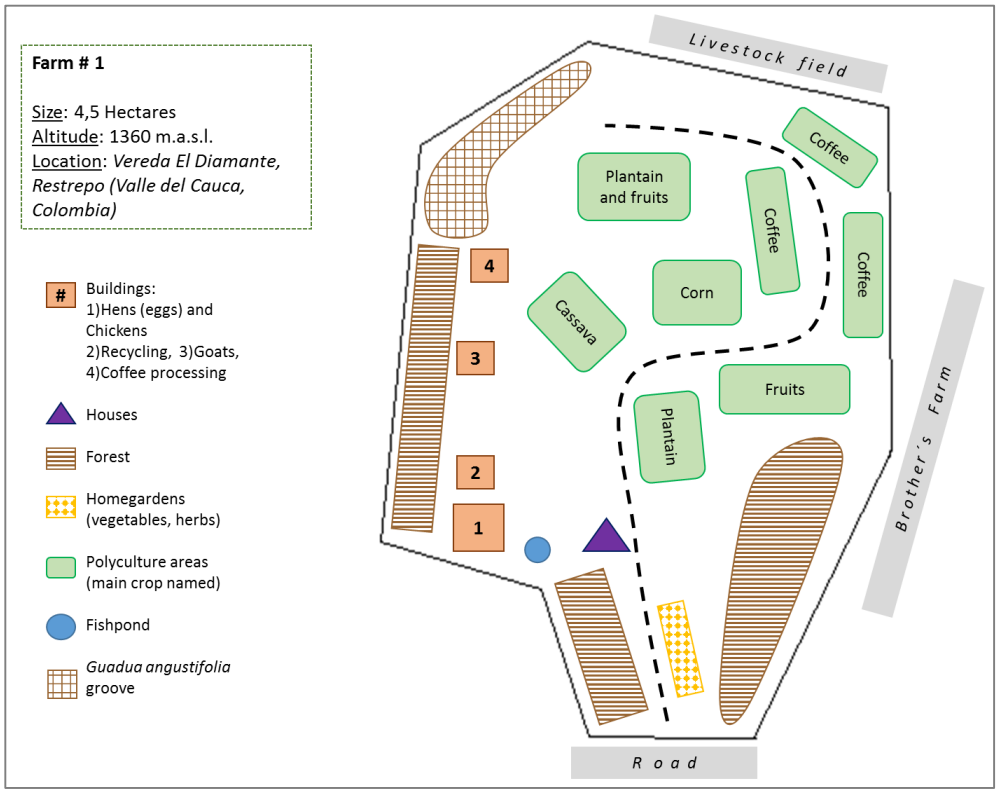

Figure 9. Representation of Farm # 1

Farm # 2 is composed of the parents and two children living in the house (they have three grown-up children that have moved out). Both parents work full time in the farm, the eldest child works off-farm, and the youngest child attends high school. The farm is 0.9 hectares and is divided in two plots (See Figure 10)[21]. The first one, where the house and buildings are located, is characterized by a large area of coffee and fruit trees grown under an agroforestry system, some patches of forest, beehives, an area for plantain and a homegarden. The second plot is located approximately 300 meters from the first one, and it contains a small pasture, a small pond, and a field of maize and pumpkin. Coffee and honey are the main income sources, but over 20 different plant and animal species were

[21] The husband has a third plot few kilometers from the house. However, this plot is new, and has just started a plantain and fruit-trees project about a year ago. The analysis of this plot was not included here.

identified in the farm (see Table 6), including different varieties of maize, beans, plantain, *arracacha*, onions, avocado, orange, *guanabana*; and small animals.

They have always been producing coffee and basic food crops, before with the use of chemical fertilizers, but in 1990 they received the support of IMCA and ACOC to convert to organic production. In this regard, the farmer said:

> "*We had 3 years of transition* [to join ACOC …] *but it was very hard, we had a lot of training in different municipalities, and then I took a 9-months course* […] *The change in the coffee production was very difficult, we drastically changed from chemicals to nothing, and the production was very affected* […] *But in the second year we started getting a coffee overprice from ACOC and they helped us buying animals for the production of fertilizer*" (Female farmer, 60 years-old).

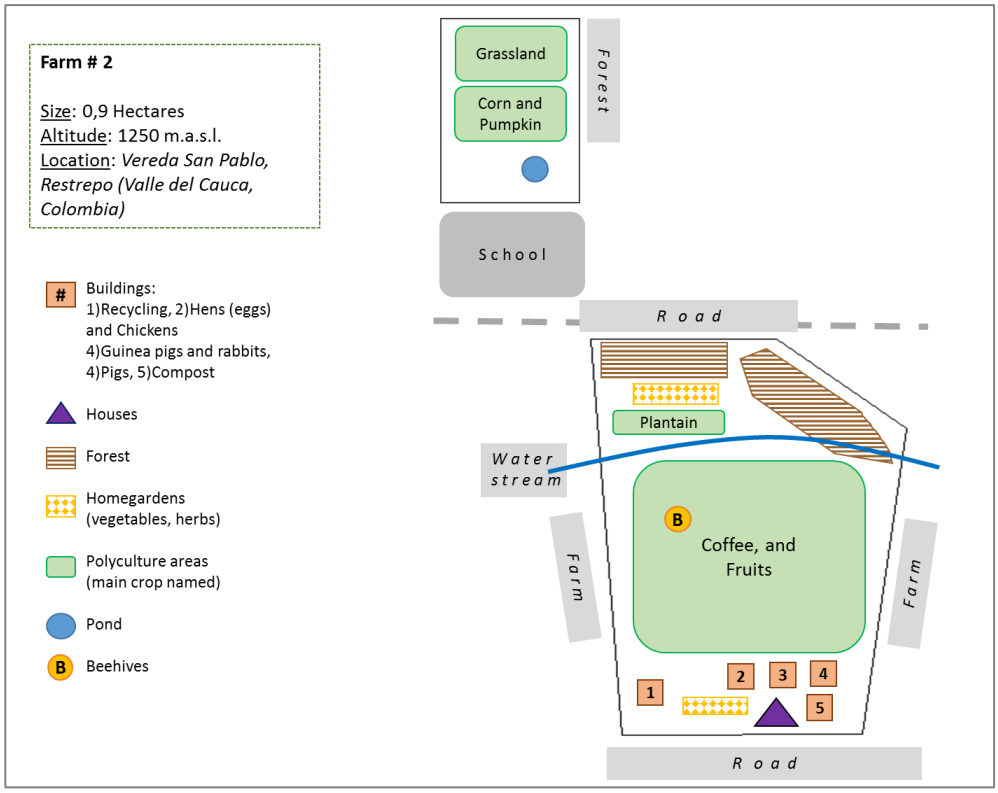

Figure 10. Representation of Farm # 2

Farm # 3 is composed of 4 adults and 2 children. One adult work off-farm in the urban are, one works full time at the farm, while the other two help with some duties in the farm. The farm is 3 hectares and is characterized by polyculture areas and two main patches of forest (See Figure 11). The main income sources are cassava and coffee, but the farm produce more than 38 plant and animal species, where maize, *arracacha*, papaya, avocado, plantain, goats, egg-laying hens and chickens, are the other main crops and animals (see Table 6 for a full list). The farm has three areas for herbs and vegetables´ homegardens, a small nursery, and an area with flowers.

"*We produce clean firstly because of our health. We don´t want to get sick by eating all the chemicals. They kill the nature and the animals, we need to take care of them as well.* […] *Also, producing clean is cheaper, we don´t need to constantly buy the chemicals*" (Female peasant, 34 years-old).

Like other farms in the area, they got support from IMCA and ACOC to produce organically.

"*At the early 1990s, we were just farming a handful of food crops and working in other coffee farms. Then we started cultivating plantain, sugar cane for ´panela´, and our own coffee* […] *They* [IMCA] *taught us how to use composting and how to prepare fertilizers from the materials available at the farm*" (Female peasant, 65 years-old).

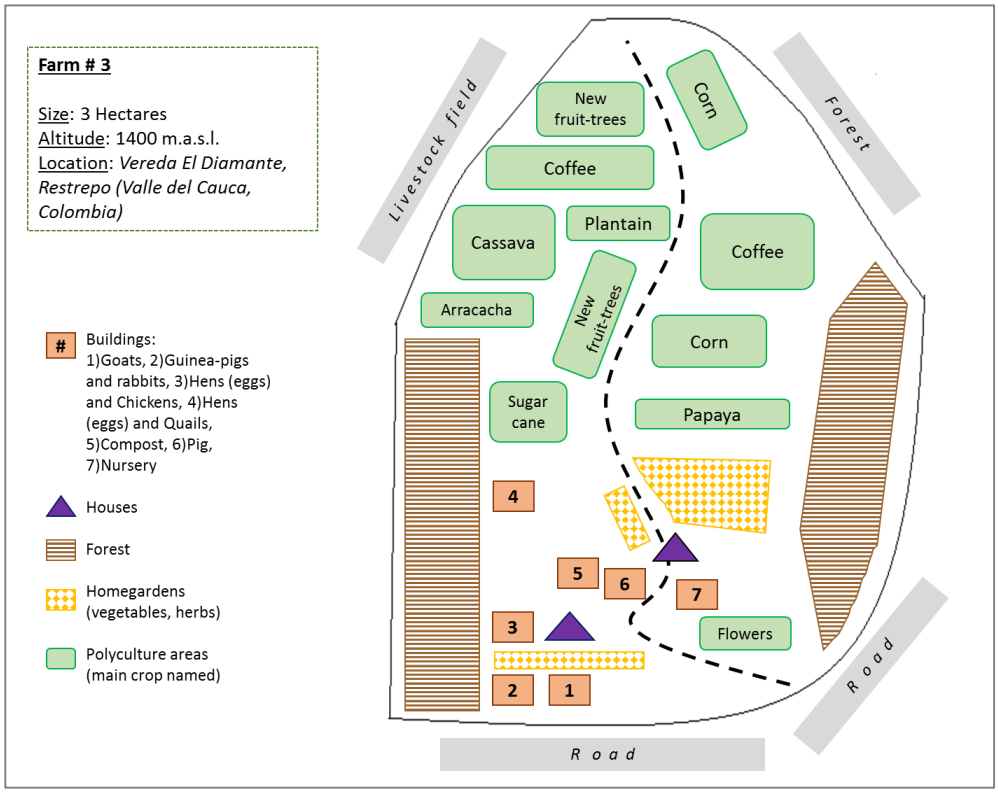

Figure 11. Representation of Farm # 3

Farm # 4 is composed of 3 adults; a married couple and his brother, with all of them working in the farm, and occasionally the two men working in other farms. The farm is 1.7 hectares and it has two plots characterized by a mix of forest patches, coffee grown under an agroforestry system, and fruit trees. (See Figure 12). Coffee is the main income source, but they have recently expanded the production of fish from house consumption (in the small pond) to production for the market (big pond). The farm produces more than 15 plant species (tangerine, banana, passion fruit, sugar cane, beans, etc.), and 6 animal species (egg-laying hens, chickens, goats, quails, Guinea-pigs, and fish) (see Table 6 below for a full list). They have a vegetables-and-herbs´ homegarden in one of the plots, and another in their neighbor´s farm, where they use his cow´s manure for making fertilizer.

"*We produce clean because we should eat healthy food, without poison and contamination. We started when I joined ACOC 12 years ago* […] *We received training from ACOC and IMCA,*

they supported us a lot […] *For producing without chemicals you need to have perseverance and patience, things are not fast. But we have learnt a lot*". (Female peasant, 55-60 years-old).

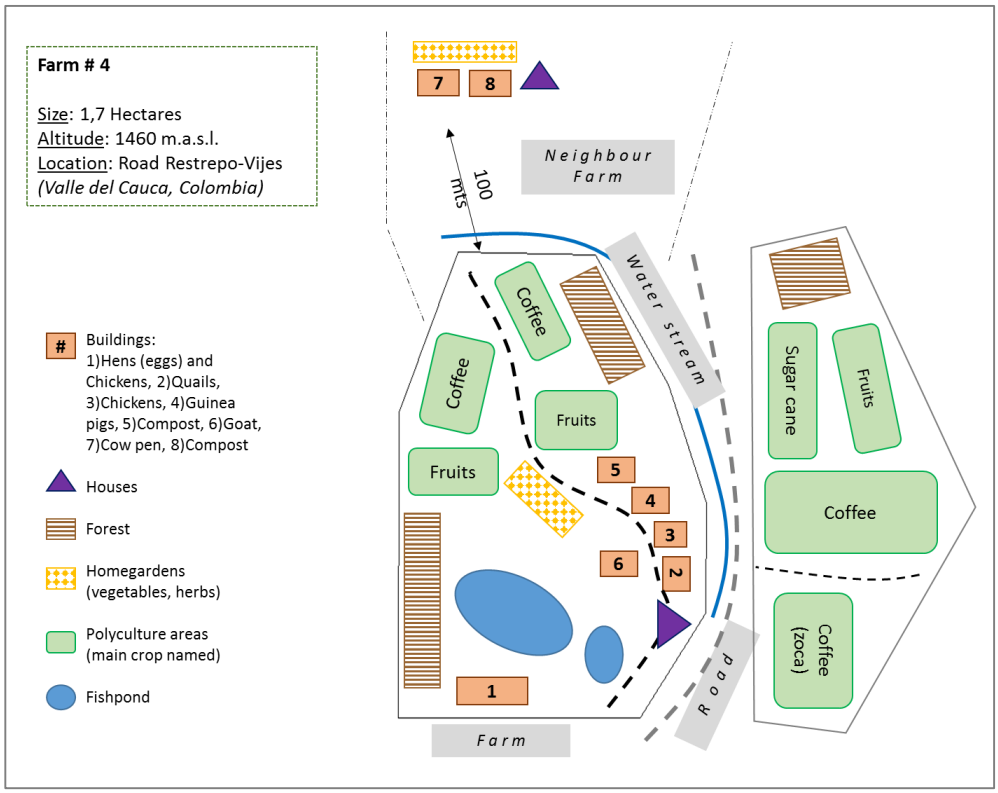

Figure 12. Representation of Farm # 4

5.1.1. Ecological Resilience

All farms employ agroecological practices that have been identified as contributors to both sustainability and resilience (Gliessman, 2007; Nicholls, 2013; Wezel et al., 2014) (See Table 5 for a list of the practices and photos in Appendix 2).

The presence of agroforestry systems, and the practice of crop rotations and intercropping, increase soil organic matter and soil cover in the farms. Which, in turn, have been shown to reduce water runoff and evapotranspiration; increase moisture retention; favor nutrient cycling; and decrease soil compaction and erosion (Gliessman, 2007, Nicholls, 2013; Altieri et al., 2015). These practices have provided farms with important resilient features, allowing them to *persist* during extreme weather conditions. Farmers recognize and value the presence of trees in their agroecosystems, especially in situations like the current drought: "*If we did not have trees, our plots would be completely dry. The things that are surviving the ´summer´ are doing so thanks to the trees*" (Female peasant, 34 years-old). In particular, farmers rotate the cultivation of cassava, maize and beans and do several ´micro-rotations´ in their vegetables´ homegardens.

For fertilization, all farms employ a variety of home-made compost (vermicomposting in three of them, and aerated static pile composting in all of them) and organic matter from the forestry system.

The use of these types of fertilizers reduces the risk of ground and surface water contamination while enhancing soil biological activity and nutrient cycling in the farm (Gliessman, 2007; Wezel et al., 2014). In fact, the process of composting is the main way in which animals are integrated in the farming activities, as goats, pigs, chickens and other animals are mainly fed by feed and crop residues produced at the farm, and their manure is used for composting. However, "*farming without chemicals demands large quantities of fertilizer*" (Female peasant, 55 years-old), and farmers need to buy commercial organic fertilizer for the leading-commercial crops, and/or rely on the organic matter released by the different strata of the agroforestry system.

For example, farmers use the benefits of nitrogen fixing plants for the fertilization of some of their crops. In the case of those grown under an agroforestry system, farmers are aware and take advantage of the properties of *guama* tree (*Inga edulis*), a leguminous tree native of tropical America. As explained by one of them: "*Guama is very effective. Under its tree canopy, coffee trees are loaded, and the grains are beautiful. So, when I do the weeding, I take the leaf litter from under the guama canopy and disperse it to other areas to benefit more trees*" (Male peasant, 70 years-old). The use of *guama* was identified in all farms; in three of them it was used for the production of coffee and in Farm # 3 for the production of cassava.

Table 5. Main agroecological practices employed at the farms

Agroecological practices	Farm # 1	Farm # 2	Farm # 2	Farm # 4
Crop choice/ Spatial distribution	* Traditional / adapted seeds * Agroforestry * Crop rotation	* Traditional / adapted seeds * Agroforestry * Cover crops	* Traditional / adapted seeds * Agroforestry * Intercropping * Crop rotation	* Traditional / adapted seeds * Agroforestry
Fertilization	* Commercial organic fertilizer * Plant residues from trees * Home-made compost	* Commercial organic fertilizer * Plant residues from trees	* Commercial organic fertilizer * Plant residues from trees * Home-made fertilizers: vermicomposting. * Biofertilizer	* Commercial organic fertilizer * Plant residues from trees * Home-made organic fertilizers: vermicomposting.
Irrigation	* Rain-fed * Gravity-manual (vegetables garden)	* Rain-fed * Sprinkled irrigation (partially)	* Rain-fed * Gravity-manual (vegetables garden)	*Gravity (when fertilizing the coffee)
Weed control	* Manual * Small electric scythe	* Manual	* Manual * Small electric scythe	* Manual * Small electric scythe
Pest and disease control	* Natural/ Botanical pesticides * No control	* Natural/ Botanical pesticides * No control	* Natural/ Botanical pesticides * No control	* Natural/ Botanical pesticides * No control
Tillage management	* No tillage	* No tillage	* No tillage	* No tillage
Animal integration	* Free-range chickens	* Use of animals' manure	* Low integration of goats * Use of animals' manure	* Low integration of goats * Use of animals' manure
Other	* Seed guardians	* Organic coffee certification	* Seed guardians	* Organic coffee certification

Additionally, in contrast with chemical-based mechanisms, manual weeding and control of pests and diseases using botanical or natural pesticides, reduces wind and water erosion and increases soil organic matter, soil biota activity, and carbon sequestration (Wezel et al., 2014). Adoption of these practices also contributes to an improvement of soil health and structure, increasing resilience in the agroecosystem (Altieri, 2013).

The use of these agroecological practices is common in the farms comprising Red MAC. For instance, in a study from the municipality of Buga (See the location in Figure 8 in section 4.3), Suarez (2014) found that the majority of the farmers use their own organic fertilizer (*e.g.* compost, manure); and depending on the type of crops (annual or perennial), they establish crop rotations, intercropping (*e.g.* coffee, plantain and banana; cassava and *arracacha*), or other plant arrangements to benefit soil conservation and the control of pests and diseases. Similarly, from a study with a group of farmers from Red MAC´s Markets in Tuluá (See the location in Figure 8, section 4.3), Angel et al. (2015) argue that the farmers are aware of the value of these practices; recognizing the importance of managing leaf litter and organic matter, and the use of green manure and organic fertilizers to build a fertile soil and contribute to soil conservation.

The management techniques employed at the farms of Red MAC contrast with the general situation of the region, where less than 40% of the farms practice any soil conservation technique (see Figure 13), nearly 70% use mechanical or chemical control for pests, diseases and weeds; and more than 46% use chemical fertilization while 24% declare to use none (see Figure 14).

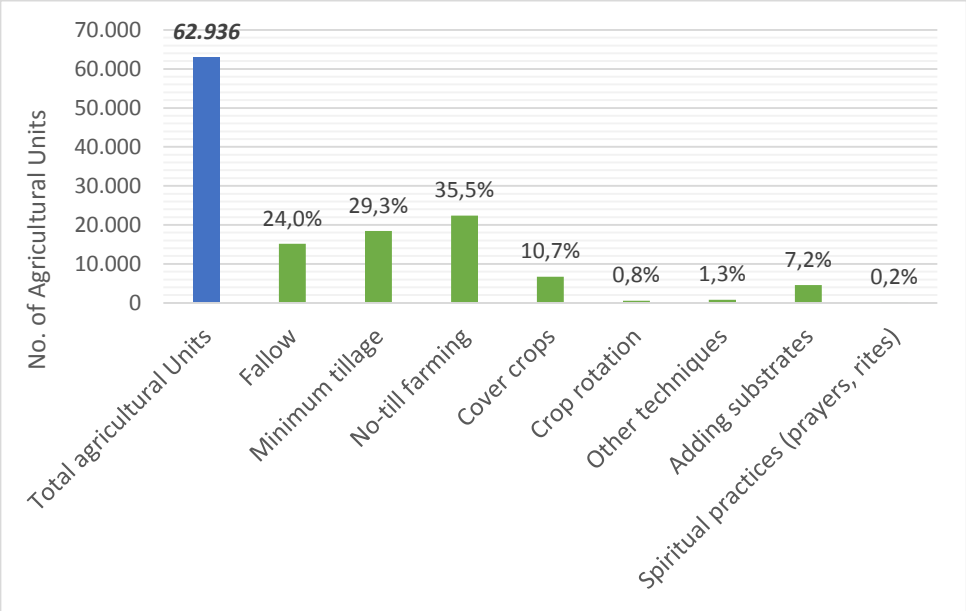

Figure 13. Soil conservation practices in Valle del Cauca
Source: Data from DANE (2014a)

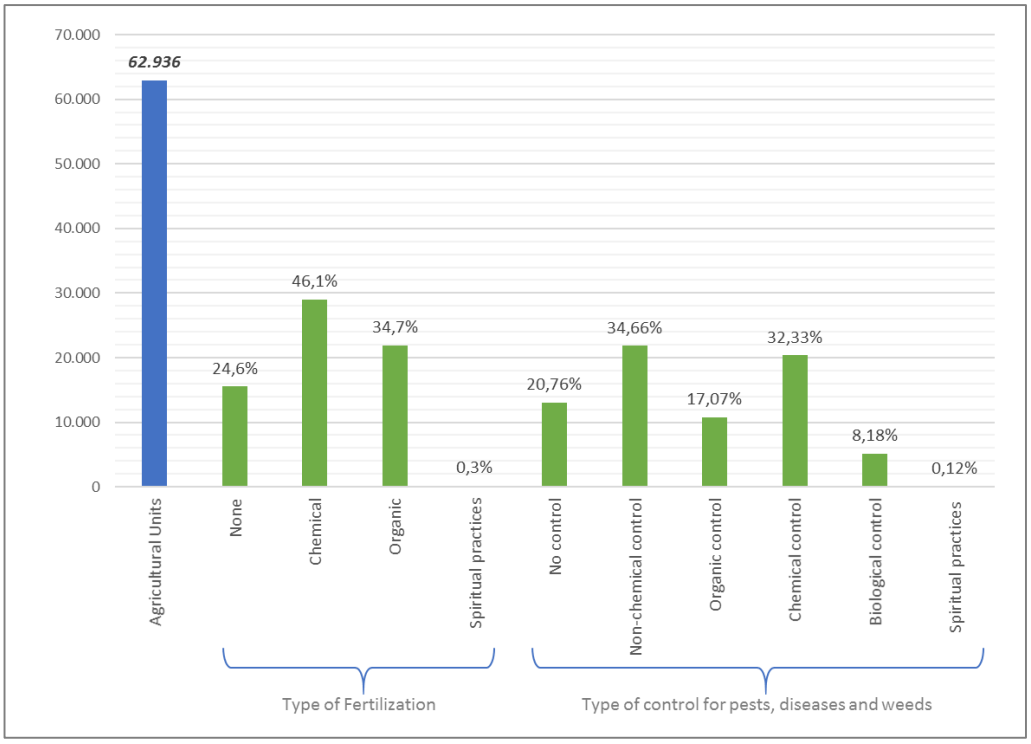

Figure 14. Agricultural practices in Valle del Cauca
Source: Data from DANE (2014a)

5.1.2. Diversity for Resilience

Diversity is one of the main elements to foster resilience. For agroecosystems, in particular, diversity contributes to both stability and sustainability (Gliessman, 2007) and has been linked to flexibility and adaptability (Darnhofer & Strauss, 2014).

All farms exhibit a high degree of both agrobiodiversity and non-cultivated biodiversity. A sample of 45 different agricultural species (9 animal and 39 plant) were found at the farms, and several races or varieties were present in cases like the maize, beans, cassava, *arracacha*, cidra, avocado, orange, tangerine, and lemon, among others (see Table 6 and photos in Appendix 2). Similarly, their homegardens exhibit a wide variety of vegetables, spices, medicinal herbs, and aromatic plants (See Table 7). In relation to non-agricultural biodiversity, all the farms exhibit patches of forest, hedgerows, and living fences, thus providing habitat for local fauna and important ecosystem services. For example, peasant from Farm #1 manifested that from an incomplete inventory of plants in the farm he identified over 200 species.

Table 6. List of agrobiodiversity found during the farm visits or reported during the interviews

Name	Scientific Name	Farm # 1	Farm # 2	Farm # 3	Farm # 4
Arracacha	Arracacia xanthorrhiza				
Avocado	---				
Banana	---				
Beans	---				
Caimito	Pouteria caimito				
Cassava	Manihot esculenta				
Chachafruto	Erythrina edulis				

Chickens	---				
Chili pepper	---				
Cidra	Sechium edule				
Coffee	---				
Maize	---				
Corozo	Bactris guineensis				
Ducks	---				
Fish	Cyprinus carpio				
Goats	---				
Granadilla	Passiflora ligularis				
Guadua	Guadua angustifolia				
Guama	Inga edulis				
Guanabana / Soursop	Annona muricata				
Pigeon pea *(guandul)*	Cajanus cajan				
Guava	Psidium guajava				
Guinea-pigs	---				
Hens (eggs)	---				
Honey	---				
Lemon	---				
Mango	---				
Mountain papaya	Vasconcellea pubescens				
Orange	---				
Papaya	Carica papaya				
Passion fruit	Passiflora edulis				
Pigs	---				
Pitaya	Hylocereus megalanthus				
Plantain	Musa paradisiaca				
Pomos	Syzygium jambos				
Potatoes	---				
Quails	---				
Rabbits	---				
Raspberry	---				
Squash	Cucurbita maxima				
Sugar cane	---				
Tangerine	---				
Tomate de árbol enano	Solanum abutiloides				
Uchuva	Physalis peruviana				
Zapote	Pouteria sapota				
	Total	**26**	**23**	**38**	**23**

Table 7. Homegardens´ agrobiodiversity

Common vegetables, herbs and spices found in the homegardens.	Tomatoes, Onions, Chives, Carrots, Spinach, Chard, Lettuce, Cabbage, Radish, Broccoli, Cauliflower, Ginger, Aloe vera, Coriander, Basil, Parsley, Celery, Spearmint, Peppermint, Marjoram, Oregano, *Mentha pulegium*, Rosemary, Lemongrass, among others.

This diversity, due to the homeostatic capacities that smoothen the effects of external changing variables (Altieri, 2013: 96) has allowed farmers to spread risks associated with harsh climate conditions. Agrobiodiversity is increasing farms´ *persistence capability* as it opens possibilities for the farmers to cope with change. For instance, intra-species diversity allows the farmers to undergo the draught without major changes in the products they are cultivating and consuming. As explained by one farmer:

> "*I have a large variety of maize and beans because I like their different taste. But also the variety is useful in times of crisis. That is why the indigenous people had them. Because a large variety helps in situations when you have to ´start over´, like after a catastrophe* […] *Now with the summer, for example, I am planting two or three varieties that don't need much water*" (Female peasant, 34 years-old).

Similarly, peasants are aware that without the diversity of trees and plants´ arrangements in their farms, the effects of the draught would be worse, as they have seen in neighboring farms that prioritize the production of monocrops (*e.g.* coffee, pineapple, *Solanum quitoense*) or that have converted diversified farms into grasslands.

In addition, the presence of homegardens contributes to the farmers´ food security and allows them to create a buffer to overcome disturbances. As shown by van der Stege et al. (2012), homegardens help building social-ecological resilience; the access to food, medicinal and ritual plants, and the profit from selling or bartering plant material offers farmers direct and important benefits.

On-farm agrobiodiversity also enhances economic aspects of resilience, as it helps farmers to avoid a one-sided dependency on the income and spread the risks involved in 'putting all eggs in one basket' (Darnhofer & Strauss, 2014: 1779-1780). This was evidenced by the flexibility that farmers have for taking a variety of seasonal products to the market. As explained by them:

> "*There is always something to take to the market. Bananas and eggs are very regular. Sometimes there are tangerines or passion fruits. Recently, I have sold a lot of Guinea-pigs*" (Female peasant, 55-60 years-old). "*Last year we were selling a lot of plantain and papaya. Now because of the plantain disease and the summer, we are taking more cassava and cidra* […] *and a handful of vegetables*" (Female peasant, 34 years-old).

A high level of agrobiodiversity is a common feature of the farms that belong to Red MAC. This was stressed during the conversations with professors from the National University of Colombia, who have carried out various research in many of Red MAC´s farms. Similarly, when comparing agroecological farms from the municipalities of Buga and Andalucia with equivalent[22] conventional farms, Suarez (2014) found that agroecological farms exceed up to three times the agrobiodiversity of the conventional ones.

Once again, these characteristics contrast with the general outlook of the Department. For example, 39.8% of the land currently used for farming is covered with sugar cane (DANE, 2014a), mainly grown under large-scale monocrops. Giraldo (2014) points out that the agro-industrial model promoted in Valle del Cauca during the XX century, but strongly during the last 50 years, has generated a degradation of the ecological landscape. This model, he argues, based on the monoculture of sugar cane and the commodification of the land, has had negative impacts in local communities, the territory and the biodiversity. Recently, this trend is accompanied by an increase in the transformation of coffee and mixed farms into pasture lands for livestock, as mentioned by the farmers during the interviews and noted earlier by UNDP (2008: Ch.8).

As a consequence of this situation, having a high biodiversity can become a burden for the farmers, since their farms act as ´biodiversity islands´ in a landscape dominated by monocrops, grasslands, and the use of agrochemicals. In words of a farmer:

> "*Our farms, as they are rich in biodiversity and clean from chemicals, have become a shelter for animals. But this is a problem in times of scarcity, because we have to share with them the few things that have survived the draught. For example, we have to share the fruits and maize with the birds and the squirrels*" (Female peasant, 35-40 years-old).

[22] Equivalent in dimensions like size, socio-economic characteristics, and geophysical features.

To sum up, agroecological practices and high levels of agrobiodiversity are distinguishing features of the agroecological farms and are mechanisms through which Red MAC´s farms are building resilience.

5.2. Persistence and Adaptability at the Market level

At the market level, resilience takes the shape of persistence, and to a lesser extend of adaptability. Farmers participating in MERCOVIDA have resist both socioeconomic and ecological changes, (see Figure 15). From the beginning of the Market, *persistence* emerged as a precondition for resilience. Soon after the market was created two organizations withdrew, which, according to the farmers,

> "*They didn´t have the patience and perseverance like the rest of us. At the beginning the sales were very low, it was more about becoming known and acquiring a reputation. Those two organizations just wanted to sell more, so they decided to quit the Market early*" (Farmer during workshop #2).

The Coffee Leaf Rust (CFL) hit the region in 2009, when its effects were worsened by longer rainy seasons. Although not directly affecting the products offered at the Market, farmers had to look for alternatives since coffee was the main income source. Several farms sought a larger diversification, some took credits from ACOC to buy and plant new coffee trees (including Farms #2 and #4), and others decided to increase plantain production (including Farms #1, #2, and #3). However, in 2011, a plague of black weevil (*Cosmopolites sordidus*) arrived to the area and affected plantain production for the next couple of years, destroying large part of their plantain trees and affecting their family economies. Some farmers are using their external social networks to access new plant material from other region of the country, and are starting all over to cultivate plantain, but in a different way: "*We have learnt the lesson. Now we are planting in smaller plots and in a staggered way. So that each plot lasts 2 or 3 harvest seasons*" (Farmer during workshop #2). Others have increased production of cassava and *arracacha*, or are planting avocadoes and citric fruit trees.

Furthermore, in 2013, just as the farmers were starting to recover from the black weevil outbreak on plantain, a donation that was covering the transportation from the rural district to the center of the municipality terminated. This forced them to self-finance the transportation of the products from the farm to the Market, thus increasing their costs. The same year, the Mayor Office finished a festival dedicated to the revalorization of peasants´ knowledge and food. MERCOVIDA was in charge of the festival, and used the opportunity to advertise the Market and to raise awareness around the benefits of clean production (agroecology). Finally, as it has been mentioned earlier, one of the strongest *El Niño* phenomenon took place in the country during the last semester of 2015, generating severe droughts and a consequent increase of food prices.

The use of their external social networks; and the diversity and flexibility of their agroecosystems have facilitate the persistence of MERCOVIDA in the face of these events. However, a large part of this persistence relies on the personal strength of their members:

> "*We have not had good things* [positive shocks], *the good thing is that we are people that resist*". "*We should have been more united for getting a communal transport for the Market. But from those things we learnt that ´unity makes strength´, without union there is nothing*".

"*The Market has persisted because we have the strength to endure* […], *we are overcoming capitalism, we are not thinking about profits all the time"* (Farmers during workshop #2).

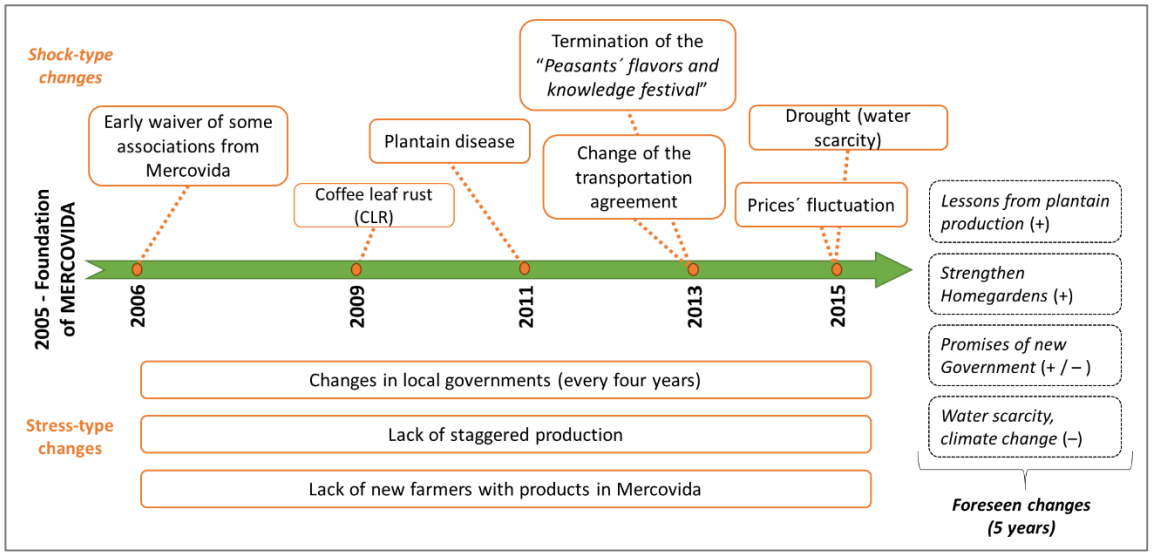

Figure 15. Timeline of MERCOVIDA´s agroecological market, constructed with the farmers during a workshop

Complementary to these individual characteristics, MERCOVIDA, as a group, exhibits elements of two of the principles for resilience building described in Chapter 2.

(i) Diversity and redundancy. As a consequence of the farms´ agrobiodiversity, there is a diversity of products for sale. "*Some farms usually bring more cassavas, others more citrus fruits, or eggs and chickens, or tubers, there is always something to offer*" (Farmers during workshop #2). Altogether, they have a relatively diverse flow of products to the market. In this sense, their collective capacity of offering products in the Market serves as response diversity (Kotschy et al., 2015); when one farmer fails to provide products to the Market, it is likely that other farmer will bring more products that day, compensating for the probable loss of credibility or reputation. As pointed out by Leslie and McCabe (2013), response diversity can play an important role, not only in promoting and shaping change but also in maintaining stability and enabling persistence of elements within a particular SES. It is important to highlight here, however, the necessity of strengthening the attributes that are bringing forth response diversity. As identified by the farmers, these responses are threatened by the lack of new farmers in the group and the lack of planned, constant and staggered production.

(ii) Knowledge and learning. MERCOVIDA market is, itself, a place of sharing and learning. Both during the market day and during the workshop, farmers talked about production, they exchanged advices on specific crops or plants, they shared recipes, and they exchanged seeds and plant materials. These actions improve the responses that farmers can have in times of change. By expanding both the knowledge and materials (seeds and plants) available to them, MERCOVIDA creates opportunities for persistence and adaptation (Folke et al., 2003; Altieri et al., 2015). For example, during the visit to Farm # 2, the farmer mentioned that her male rabbit was lent to another farmer from MERCOVIDA who needed it for breeding. Similarly, one of the MERCOVIDA´s

organizations, *NUEVO HORIZONTE*, has been organizing monthly meetings to discuss and learn the medicinal properties of specific herbs and plants. "*Between 2012-2015 we were meeting here in the vereda* [rural district] *and studying medicinal plants. We studied like 20 different* […], *we want to start doing it again soon, because it helps us being independent from the health system*" (Farmer during workshop #2). The presence of medicinal plants in homegardens and the use of social mechanisms to enhance their cultivation and use, have been identified by van der Stege et al. (2012) as a contributor to social-ecological resilience through medicinal subsistence and an increase of natural capital.

Finally, MERCOVIDA has improved the *social capital* of the farmers, positively affecting three of the features identified by Pretty and Smith (2003). First, it has strengthened trust among the participants. Farmers lend animals to each other for breeding purposes and they look out for each other, selling fellow farmers´ products on their behalf when they cannot come to the market. Second, it has enhanced processes of reciprocity and exchange, around farming knowledge, seeds and plant material. Third, it has increased the connectivity between them (with the market as the meeting point, but also through other gatherings and workshops), and with external groups (particularly through Red MAC). In this regard, farmers express: "*the Market has become a part of our family. It has become a place of integration*" (Farmers during workshop #2). By improving social capital, MERCOVIDA is enabling a potential for collective action and is establishing the basis for social resilience (Adger, 2000).

5.3. Trust, Diversity and Collective action at the Network level

Red MAC is at a crossroads of agricultural (food systems) regimes[23]; with the traditional peasant agriculture on one side, and the agro-industrial model emphasizing monocrops and agro-exports, on the other (Altieri & Toledo, 2011). Disturbances and pressures ´come from both regimes´, and thus Red MAC needs to exercise a variety of capabilities in order to navigate times of changes. Amid the economic and policy pressures of the market and the government, pushing them towards conventional farming, farmers are *adapting* their practices and relations. They are seeking to conserve the ´identity, functions, and structures´ of traditional peasant agriculture. However, some of these adaptations can take place within the same structures that generated the disturbances in the first place, and without questioning the goals and values governing the system (Darnhofer, 2014). This can be the case of organic coffee, produced by some associations under conventional certifications that can be coopted by corporations (Jaffee & Howard, 2010). Furthermore, Red MAC is also enhancing resilience through *transformability*. Farmers are disengaging from the dominant food system (Kloppenburg et al., 1996) and building alternatives based on different governance models (Lamine et al., 2012), biodiversity (Hainzelin, 2013), and values of reciprocity and solidarity; while joining social and political mechanisms to challenge and transform the larger system (Holt-Gimenez, 2013).

[23] Regimes as used in the SES literature, not as in the ´food regimes´ approach popularized by McMichael (2009).

The following sections explore the mechanisms through which Red MAC, as a Network, is exercising adaptability and transformability to foster resilience, and how it is putting into practice some of the principles discussed in Chapter 2.

5.3.1. Diversity

Diversity, is one of the most outstanding characteristics of Red MAC and a fundamental factor for resilience. It offers the seeds for new opportunities amid change and increases the options for coping with disturbances and dealing with uncertainties and surprises, making the system less vulnerable (Folke et al., 2003; Berkes, 2007; Darnhofer & Strauss, 2014; Kotschy et al., 2015). Besides the agrobiodiversity exhibited in its farms (as seen in section 5.1 and as it will be further analyzed in section 5.4), diversity in Red MAC is expressed by the variety of actors and structures of its Markets.

Red MAC is composed of a diversity of Markets, with different structures and operating mechanisms. Some of them function in the same place of conventional agricultural markets while others have a separate location in the municipalities. The origin and composition of the Markets are also diverse. Some of them originated from the exclusive initiative of farmers themselves (later supported by Red MAC); others were started by the farmers with the support of CVC or IMCA; and others were created entirely by these organizations as part of larger programs. Similarly, the Markets consist of a diversity of organizations and people. There are peasants´ associations; Farmers Field Schools; professional farmers with a background in agriculture, social, or environmental sciences; women-led groups; youth groups; and people that have migrated from other areas. This diversity gives each Market its particular identity and constitutes a strength for the regional agroecological process (Suarez, 2007). Further, there is diversity of experiences and knowledge present in Red MAC[24], contributing to social capital and collective action. As expressed by Schlüter et al. (2015: 260), "diversity of actor groups, perspectives and knowledge systems enhance learning by providing a broader knowledge base and by making the problem-solving process more inclusive, which can have positive effects on collective action".

5.3.2. Participation, Trust, and the Participatory Guarantee System (PGS)

Red MAC is generating participatory and trust building processes around food, and in doing so it is fostering resilience in the rural areas of Valle del Cauca. Participation is fundamental to initiatives aiming to build social-ecological resilience (Walker et al., 2002), as it can play a significant role in supporting transparency, the legitimacy of decisions, knowledge sharing and learning. These mechanisms, in turn, "can promote understanding of system dynamics and enhance the capacity of a management system to detect and interpret shocks and disturbances, which is central to facilitating the collective action required to respond to change in social-ecological systems" (Leitch et al., 2015: 201). Further, participation builds the trust needed to mobilize and self-organize (Lebel et al., 2006). As an essential feature of social capital, trust lubricates cooperation and reduces the transaction costs between people (Pretty & Smith, 2003), playing a significant role in the activation of collective action.

[24] During the workshop with the Coordination Board of Red MAC (Workshop #1), *diversity of people*, and *diversity of knowledge*, emerged as the fifth and sixth strongest factors for resilience of Red MAC (See Appendix 1 for the full list).

The strength of Red MAC in terms of participation and trust, was evidenced during the workshop with the Coordination Board, where these attributes received the highest valuation in the participatory scoring exercise. Regarding participation, members of Red MAC mentioned:

> "*The meetings* [of the Network] *are open to everyone. It is common that the representatives come with other members of the Markets to participate in the decision-making processes* […] *where everyone has the space to expose what is happening, to discuss it and find a group solution* […] *Decisions are taken democratically; everyone has a vote*" (Farmers during workshop #1).

About trust, they highlighted: "*We believe in the word* [sic]. *Trust building is one of the founding principles of Red MAC, and we have been working all these years for that*" (Farmers during workshop #1).

Red MAC´s participatory and trust-building processes are well illustrated by the implementation of the Seed Houses Network (that will be explored in section 5.4) and the Participatory Guarantee System (PGS) started in 2009. According to IFOAM (2013), PGSs "are locally focused quality assurance systems. They certify producers based on active participation of stakeholders and are built on a foundation of trust, social networks and knowledge exchange". Red MAC sees a double function in the PGS. On one hand, it is a tool to differentiate products and processes from agroecological peasant farming, and to value the efforts of hundreds of families to produce clean and healthy food. On the other hand, it is an exercise to promote ecological agriculture and to generate relationships based on trust, solidarity, and affection. Relations that transcend simple commercial relations and allow the sharing of knowledge and interests, and a common vision of the territory (IFOAM, 2013).

Although the adoption of PGS is at initial stages, with only one third of the producers being certified[25], the implementation of the participatory system has promising benefits for resilience. According to Mora (2014: 50-51), and shared by farmers during the small talks at the Markets´ visits, the PGS is strengthening cohesion and robustness of Red MAC. It has brought dynamism to meetings and visits between farmers, it has created spaces for exchange and for the participation of friend-consumers in the process. Further, it is broadening participation of women and youth, and favoring revalorization and conservation of traditional knowledge and biodiversity (Mora, 2014). These findings are in line with larger studies that have stressed the benefits of PGSs on livelihoods´ improvement, community development, and sustainability of community collaboration (IFOAM, 2013; 2014); as well as their role in the adoption of sustainable agricultural practices (FAO, 2016) and territorial agroecological strategies (Torremocha, 2012).

5.3.3. Networking and Collective Action for Alternative Food Systems

The *organizing* and *networking* functions of Red MAC emerge as fundamental elements for building resilience, and they are recognized as such by external, but close, actors to Red MAC. The leader of the Agroecology Research Group at the National University highlighted that:

> "*farmers who persist in the movement* [agroecology]*, are those that have learnt to organize* […] *From many years of working and studying with them* [the farmers]*, we can see how social organization is a prerequisite for social resilience. And Red MAC has understood that*".

[25] Based on information provided by the head of the Agroecology Research Group, National University of Colombia, Palmira.

Moreover, the networked and polycentric structure of Red MAC provides flexibility to respond to changes, and create spaces for social interactions. Members of the local NGO IMCA point at the horizontal structures and the organizational experimentation present in Red MAC as key factors for maintaining the process. Due to this, they argue, relations of solidarity and invisible networks that were removed by the industrial agricultural model are starting to flourish again.

Through its social and productive networks Red MAC has been able to exercise *collective agency* (Berkes & Ross, 2013), activating system´s *transformability* (Walker et al., 2004). These processes of transformation are expressed in *collective actions* at internal and external scopes (different levels of the panarchy). As representative of the Agroecological Markets, Red MAC has been able to implement important projects regarding homegardens and food security, Participatory Guarantee Systems, and Community Seed Houses (explained in the next section). Similarly, it has engaged in local discussions on agricultural and rural development policies, as well as in regional and international platforms for the transformation of food systems. In particular, Red MAC co-organized the VI Meeting on Ecological Agriculture of Latin American and the Caribbean in 2011; it is part of the Latin American Agroecological Movement (MAELA); and it co-founded the Regional Coordination of Agroecological and Fair Trade Organizations (CROAC) of Valle del Cauca, a current member of the regional committee for the promotion of family agriculture. These achievements would hardly have been realized if farmers, or even Markets, had acted individually. This is recognized by Blay-Palmer et al. (2016: 30) when stressing "the need for enhanced networking that prevents the isolation of food system innovators and facilitates the creation of spaces for collective action".

Similarly, by providing opportunities for interaction that enable extended engagement of participants (Cundill et al., 2015), the organizational structures of Red MAC have facilitated *learning.* Apart from the monthly meetings which gather representatives of the Markets, Red MAC is enabling meetings and workshops between members of the network and a diverse group of actors –*e.g.* research projects from local universities or training courses with local NGOs. This is central to resilience as "networks can provide sources of knowledge, interpretation, and resources" that are essential to respond to disturbances (Cundill et al., 2015: 192). The role of Red MAC in formation and training has been also recognized by members of IMCA as one important element contributing to the endurance of the agroecological process in the region.

Institutional arrangements characterized by horizontal and participatory structures, networking implementation, and democratic processes, have previously shown important benefits for territorial rural development in the Colombia (Ardila, 2013). However, most of these initiatives are not necessarily based on agroecological principles and can thus be contributing to environmental unsustainability or can be reinforcing structures of the globalized agro-industrial model. Red MAC, on the other hand, seems to be using networked institutional arrangements for the promotion of agroecology and the transformation of the food system. By "bringing various initiatives together through new and more solid networks*"* Red MAC is opening opportunities "to channel the complexity of interactions within and between systems towards more productive ends and to build a networked System of Sustainable Food Systems as a counter-point to the corporate food regime" (Blay-Palmer et al., 2016: 39).

5.4. Diversity from the seed to the fork

"Las semillas criollas y nativas son patrimonio de los pueblos al servicio de la humanidad"
(´Native and local seeds are people´s heritage at the service of humanity´.
Slogan of the Community Seed Houses)

As it has been echoed here, diversity is one of the most important attributes of Red MAC. This stands for people, organizations, and agricultural biodiversity, and importantly, it is expressed in the diversity (of food) from the seed to the fork; an important component of agro-biocultural diversity. The actions regarding seed conservation and multiplication, together with the rescue and promotion of traditional knowledge on medicinal plants and foods done by Red MAC, is essential for resilience. They enlarge the knowledge and materials available to respond to change and deal with uncertainty (Folke et al., 2003; Altieri et al., 2015). Moreover, the Markets and farms integrating Red MAC can be acting as small biocultural refugia; ´pockets´ of social-ecological memory where a set of carriers facilitate the renewal and reorganizational capacity of a system to produce food and generate ecosystem services (Barthel et al., 2013). The carriers include genotypes, landscape features, oral and artistic traditions, self-organized systems of rules, diverse agricultural practices, and traditional foods and recipes (Barthel et al., 2013).

Farmers and Markets at Red MAC are taking important actions for the conservation of traditional seeds and crops and their associated knowledge and practices. Throughout the fieldwork, farmers commonly exchanged seeds, and shared agricultural practices and recipes. This has positive impacts on-farm agrobiodiversity, and on the availability of traditional foods that farmers offer during markets and meetings –*e.g.* workshops, fairs, festivals (see photos in Appendix 2). For instance, high levels of agrobiodiversity were found during the farm visits at Restrepo (as seen in section 5.1). It was possible to verify the presence of 25 varieties of maize[26], 12 varieties of beans[27] (*Phaseolus vulgaris*); five varieties of cassava[28] (*Manihot esculenta*); four varieties of *arracacha*[29] (*Arracacia xanthorrhiza*); and several varieties of *cidra* (*Sechium edule*), cache beans (*Phaseolus polyanthus*) and pigeon pea (*Cajanus cajan*), among others (see photos in Appendix 2). The findings are in accordance with Salazar et al. (2014), who found, for the same area of Restrepo, the presence of 40 local varieties and 16 races of maize, as well as 25 local varieties of beans and several varieties of fruit trees. Further, Salazar argues that the recovery of traditional seeds and their related knowledge is mainly possible thanks to the collective efforts taking place directly on the field (*in situ* conservation), since it is the place where the multiple uses of seeds and crops converge.

Maize is of particular importance for food security in the area and a valuable biocultural asset. As explained by the farmers:

> "*We don´t grow maize for money, we don´t sell it. We have maize for its beauty and because it is delicious* […] *Before it was common to keep the maize in the attic. And slowly you would bring down what was needed for cooking. If you have maize, you have all the meals: You can*

[26] The maize varieties belong to the following 16 races. *Primitive races*: (1) Pollo, (2) Pira. *Races probably introduced*: (3) Clavo, (4) Güirua, (5) Maiz dulce, (6) Cariaco. *Colombian Hybrid races*: (7) Montaña, (8) Capio, (9) Común, (10) Yucatán, (11) Negrito, (12) Puya, (13) Chococeño. *Other races*: (14) Negro peruano, (15) Morado peruano, (16) Rojo. (Salazar et al., 2014)
[27] The local names for the varieties of beans are: mortiño, calima, sangre-de-toro, bola roja, uribe rosado, cargamanto blanco, cargamanto rojo, frijol arrocillo, blanquillo, habichuela rosada, habichuela negra, habichuela metro.
[28] The local names for the varieties of cassava are: siete mesino, morada, chirosa, blanca, valluna.
[29] The local names for the varieties of *arracacha* are: siete colinos, amarilla, blanca, morada.

make soup, bread, maize parcels, porridge, boiled or roasted corn-on-the-cob […], *you can feed the hens and you will guarantee eggs, you can feed the goats and you will have milk. With maize you can do everything in the farm*" (farmers during workshop #2).

The conservation of agro-biocultural diversity also has positive effects on other dimensions that are essential for resilience. On one hand, it can deliver significant ecosystem services through beneficial impacts on pest and diseases, pollination, air and water regulation, and soil nutrient cycling and biota; while at the same time provide educational, recreational, spiritual and aesthetic values (Martins, 2015; Altieri et al., 2015). On the other hand, conservation of agro-biocultural diversity has a potential to improve human health and nutrition through increasing the availability of the variety of foods and their uses (Fanzo et al., 2013; Martins, 2015), and the access and knowledge to medicinal plants (as mentioned in section 5.2).

The culmination of these actions towards agro-biocultural diversity is a project on food security and seed sovereignty that Red MAC implemented during 2015[30]. The project had three action areas: (i) build capacities for food security through the promotion and creation of homegardens; (ii) reactivate the knowledge of seeds´ guardians and promote seeds´ conservation and exchange; and (iii) a communicational strategy. Although it was intended to benefit directly 100 families with training and assets for homegardens, it reached 139 families, mainly belonging to Red MAC but including neighboring families, and thus having a territorial impact.

The second area was materialized by the creation of a network of 12 Community Seed Houses, mainly linked to the work of the Markets and benefiting over 300 families. With this project, Red MAC is conserving social-ecological memory and strengthening strategies for agro-biocultural diversity that are already happening among farmers. Seed exchange networks (formal and informal) have proved to help conserving agricultural and socio-cultural diversity and identity; and to enhance resilience against economic and environmental shocks (Velasquez-Milla et al., 2013; Helicke, 2015; Vernooy et al., 2015). Moreover, Red MAC enlarged its networks and increased the number and diversity of actors, perspectives and ideas to cope with change. As a consequence of the project, it became part of the Free Seeds´ Network of Colombia, who supported the creation of the Regional Community Seed House; and joined the campaign ´Seeds of Identity´, which claims the rights of indigenous, afro-Colombians, and peasant communities over their resources and territories.

According to Red MAC´s coordinator:

"*the seeds´ network is a learning process that can serve as an example to other regions that are implementing seed houses. The idea of a Regional Seed House is innovative, since its main role is to interact and boost the relations with the local Seed Houses, to share the seeds throughout the region and to diversify production and consumption*" (intervention during the launch event of the Seed Houses).

In this sense, by employing collective actions based on innovative coordinating mechanisms and institutional arrangements employed at the right scale (Vanni, 2014:27), Red MAC is enhancing the provision of a public good (seeds) that is fundamental for resilience (Shiva, 2008; Vernooy et al.,

[30] The project was financed by a south-south cooperation program of the ´Chile Fund Against Hunger and Poverty´, established by the Government of Chile and the United Nations Development Programme –UNDP.

2015). In words of a farmer, "*the Community Seed Houses are the places to continue exercising the right to resist, the place for the seeds to be free and continue moving freely across farms*" (Male farmer, 45-40 years-old).

Moreover, the network of Community Seed Houses can act as a platform for seed sovereignty. By saving and sharing the plant varieties that farmers consider to be essential, they advance towards the *control* and knowledge of the variety, production, and distribution of seeds; reducing farmers´ dependence on commercial seeds. The promotion and re-valorization of the diversity of seeds, crops, tastes, foods, and knowledges is a major step for bringing back 'culture' into agri-culture (Pretty, 2002) and for building more resilient food systems.

Chapter 6 – Discussion

6.1. Limitations and recommendations for further research

In order to understand how alternative food systems can enhance social-ecological resilience in Colombia, this research sought to analyze the case of Red MAC. Given its complexity, a sample of one Market was selected for more in-depth examination. However, the research would have benefited by an expansion of the case´s boundaries. Including more farms within MERCOVIDA, more Markets within Red MAC, and non-agroecological farms and markets, would have enriched the data and analysis of the regional food system. Furthermore, the systematic inclusion of consumers will provide further research with the opportunity to explore the importance of strengthening consumers´ actions and relations for the sustainability and resilience of AFN. Analysis of *food citizenship* and the ways in which people use their consumption choices as expressions of social agency or citizenship, will provide important insights for the transformation of food systems (Lockie, 2009).

The use of agroecological practices was identified in the research as one important element for resilience. These practices were reported by the farmers, and to a lesser extend verified during fieldwork. However, it was not possible to study the concrete effects that these practices are generating on the ecological components of the farms –*i.e.* on soil composition, nutrient cycling, biological activity, etc. Similarly, it would have been enriching to investigate whether the use of these practices is strengthened by the participation in the Market or in Red MAC, or it responds exclusively to farmers´ individual decisions.

Diversity was another element highlighted in this research as a feature of Red MAC that is contributing to resilience. Nevertheless, it is important to be cautious and bear in mind that it is not diversity *per se*, what contributes to resilience, but rather functional diversity. In this sense, further research on this topic may explore with more details the possible trade-offs of diversification at the farm level (Darnhofer & Strauss, 2014), as well as the possible restrictions that heterogeneous groups of actors and institutions can pose on collective action (Kotschy et al., 2015).

A possible shortcoming of the research is related with the causality between increased social capital (and collective action) and membership to MERCOVIDA or Red MAC. The effects that these organizations may have on social capital were not explored in-depth, and therefore, the claim that *they are* increasing social capital needs to be taken with caution. However, as with the analysis of any social change phenomenon, the study of causality or prediction of this type of relations requires larger research and its results can always be contested (Glynos & Howarth, 2007). Similarly, it is important to further examine the scope of trust-building and participation processes. It remains under question whether these processes are reaching the grassroots of the Network or they are staying at shallow levels, including only the representatives of the markets and the most active farmers.

Another possible limitation is the absence of analysis of justice-related issues. Although this lays beyond the scope of the research, it is necessary to analyze how the extreme poor, and in particular the land-less, are being included or not in the processes established by Alternative Food Networks.

For these initiatives to truly build resilience, social justice needs to be at the forefront (Allen, 2010). This is especially relevant for the peacebuilding process in Colombia.

The important role that Community Seed Houses are playing in the conservation and promotion of agro-biocultural diversity was identified in this research. However, the project is just starting, thus its real impact on the conservation and promotion of traditional seeds, knowledge, and foods, is still to be analyzed. Similarly, further research in this direction may include the scope of the revalorization of traditional foods and recipes, and explore whether these initiatives stay at the farm and market level, or they can reach broader spaces like schools, restaurants and other public spaces.

One important area for further research concerns the role of women in AFN, in general, and in Red MAC, in particular. Although the role of women in agriculture has been increasingly explored, further attention is needed to analyze their role in building resilience and sustainable food systems. Despite receiving only 5% of all extension services and owning around 2% of all titled land worldwide, women do 75% of the work in agriculture and produce 75% of the world's food (van Walsum, 2015). Around the globe, women are forging change in their communities with agroecological approaches (van Walsum, 2015). Most of the farmers that participated in the workshops and farm visits were women. Similarly, various actors expressed that the carriers of the knowledge regarding seeds, medicinal herbs, and traditional foods, are generally women. In this sense, it is of outmost importance to investigate women´s challenges and opportunities in the face of food system´s transformations.

Finally, this study brought to light other issues for further research, among them: the relations between agroecological markets and conventional markets; the role and importance of the herbs and vegetables´ homegarden; and the dynamics of farmer-to-farmer learning that is happening among the Markets.

6.2. Implications for public policies

The expansion of agroecological approaches around the world has been led by farmers and NGOs (De Schutter, 2010; Altieri & Nicholls, 2012). Nonetheless, some governments have also taken important steps to scale up agroecology. For example, Cuba, Bolivia, Nicaragua and Ecuador have adopted rural development policy frameworks with an agroecological approach (FAO, 2015). Similarly, Brazil has a National Policy on Agroecology and Organic Production (PNAPO) and a resulting National Plan for its implementation (PLANAPO). In Colombia, however, the rural development model continues to have an emphasis on large-scale conventional agriculture (UNDP, 2011) and the few efforts done in support of peasant and family farming still lack major ecological criteria and do not consider the ´agroecological character' of the production[31].

Initiatives like Red MAC can provide important insights for designing and implementing public policies with an agroecological approach. Three lessons in particular can be drawn from the case.

[31] This was concluded from the interviews with representatives from the Government, the FAO, the Academia, and other agroecological initiatives; as well as from the author´s experience working in rural development policies at the Colombian government.

- Agroecology is knowledge intensive, and thus, it requires a farmer-led system of agricultural research and extension services that combines science with local knowledge, and contributes to both ecological literacy and decision-making in farming communities (De Schutter, 2010; Wibbelmann et al., 2013; Parmentier, 2014). Building such system on horizontal processes and networks, like those of Red MAC, has the potential of contributing to the strengthening of social capital and the stimulation of collective action. In this sense, programs and interventions at this scale will be more efficient than those with an individual approach, as they will have a positive impact on both agricultural production and social development. As highlighted by many authors (De Schutter, 2010; McKay, 2013; Altieri & Nicholls, 2012; Parmentier, 2014), supporting these networks contributes not only to the dissemination of agroecological practices, but also to social organization, advocacy and citizenship formation.

- Scaling-up agroecological practices requires the provision of public goods associated with rural infrastructure, access to credits and insurance, extension services, storage and handling facilities, and education and sanitation, among others (De Schutter, 2010; McKay, 2013; Parmentier, 2014). By using farmers´ networks and farmer-to-farmer learning processes that are already present (*i.e.* within a Market or between them), the provision of public goods like seeds or agricultural extension services may have lower costs of provision (economies of scale) and improved coordination mechanisms (economies of scope). Further, the use of a network structure for the co-creation of these public goods, facilitates their flexibility and adaptation to local contexts.

- Recent studies (DNP, 2015) and initiatives[32] in Colombia have stressed the importance of public purchases of food and short-food supply mechanisms for family farming. By prioritizing the inclusion of agroecological farming and networks, these policies could simultaneously contribute to the viability of family farming and to biodiversity conservation. This while enhancing food security with safe, healthy, and culturally appropriate food, as is happening in Brazil´s Food Acquisition Programme (Grisa & Schmitt, 2013). One place to start such efforts in Colombia could be the Participatory Guarantee Systems, which are not recognized in the country as a ´valid´ certification for organic or ecological products, but are used by Red MAC and other agroecological initiatives.

These lessons gain particular importance if we consider the ongoing Peace Talks between the Government of Colombia and FARC-EP. Particularly regarding the agreements on ´Integral Agrarian Development´. As I have argued elsewhere (Ardila, 2015), agroecological approaches exhibit important benefits for integrating different development visions and processes of various actors; for incorporating the territorial component in the ´Action Plans for Regional Transformation´; and for implementing the ´Food Security System´.

[32] The interviewed person from FAO commented on the pilot project that FAO is developing in three Departments of Colombia regarding public purchases of food in support of family farming. The pilot is now in the finalization phase, and is going to be expanded to other departments.

Chapter 7 – Conclusions

The results indicate that Alternative Food Networks, like Red MAC, have a great potential in contributing to the transformation of the decoupled global food system. By creating alternatives based on principles of resilience and sustainability, they can produce safe, healthy and locally appropriate food, reconnect consumers with producers, conserve biodiversity, and provide important ecosystems services. The results of this research go in line with, and add to, other analysis of agroecological networks in Latin America (e.g. Radomsky et al., 2015, for a study of Ecovida in Brazil; Lacroix & Cheng, 2014, for a selection of experiences in the Andean Region).

Red MAC emerged as a collective effort between farmers, local NGOs, and to a lesser extent local governments, in an attempt to sale farm surpluses outside conventional channels. What started as a small group for the commercialization of organic food, has now transformed into a regional network for the realization and promotion of agroecology. Providing spaces for relations of trust and solidarity, and for the conservation of local biological and cultural diversity. Through a nested and networked structure (Figure 5 and Section 4.3), Red MAC is able to maintain flexibility to respond to local conditions, while exercising collective action for broader issues like seed sovereignty and policy advocacy. (**SQ1 & SQ2**)

Farms, Markets, and the Network as a whole, are employing different mechanisms for responding to change and disturbances. However, **diversity** is common to all the levels of Red MAC and is one of Red MAC´s most outstanding characteristics. Diversity is a fundamental factor for resilience as it offers the seeds for new opportunities amid change, and increases the options for coping with disturbances and dealing with uncertainties and surprises, making a system less vulnerable. At the farm level, this is expressed in high levels of agrobiodiversity, which allows farmers to spread risks associated with harsh climate conditions and to avoid income dependency on a single crop (*e.g.* sugar cane, pineapple). As a consequence of this diversity, Markets have a collective capacity of offering a relatively diverse flow of products, thus acting as a response diversity. This is essential in promoting and shaping change, as well as in maintaining stability and enabling persistence of particular elements within the system. Similarly, Red MAC is composed of a diversity of Markets, organizations, knowledge, and experiences. By broadening the knowledge base and making the problem-solving processes more inclusive, this diversity enhances learning and contributes to social capital and collective action. **(SQ3)**

At the farm level, the use of **agroecological practices** is contributing to both sustainability and resilience. Farms display agroforestry systems for growing coffee, cassava, fruits, and other crops; they use simple intercropping and crop rotations; they employ a variety of home-made compost; they weed manually or with simple tools; and they use botanical or natural pesticides for controlling pests and diseases. In doing so, they are increasing soil organic matter and soil cover; enhancing nutrient cycling, reducing soil erosion, and increasing carbon sequestration. The agrobiodiversity and management techniques employed at Red MAC´s farms contrast with the general situation of the Department of Valle del Cauca, where conventional livestock production and large-scale sugar cane monocultures dominate the agricultural landscape. **(SQ3)**

At the market level, the **use of external social networks and the diversity and flexibility of farm´s agroecosystems**, have facilitate the persistence of MERCOVIDA in the face of disturbances. Similarly, the Market is a place for **learning and exchange**, improving the responses that farmers can have in times of change. By expanding both the knowledge and materials (seeds and plants) available to them, MERCOVIDA creates opportunities for persistence and adaptation. However, it is important to bear in mind that a large part of this persistence still relies on the personal strength of their members. **(SQ3)**

At the network level, Red MAC is generating **participatory and trust building processes around food**, which are essential for resilience. Participation and trust play a significant role in supporting transparency, legitimacy of decisions, knowledge sharing and learning; and are a prerequisite for mobilization and self-organization. These processes are well illustrated by the implementation of the Participatory Guarantee System (PGS), which Red MAC sees as an exercise to promote ecological agriculture and to generate relationships based on trust, solidarity, and affection; as well as a tool to differentiate products and processes from agroecological peasant farming. Similarly, using **horizontal and networked structures** Red MAC has been able to exercise collective agency, activating system´s transformability. These processes of transformation are expressed in **collective actions** at internal and external scopes (different levels of the panarchy). Red MAC has been able to implement important projects regarding homegardens and food security, Participatory Guarantee Systems, and Community Seed Houses, and it has also engaged in local and international discussions and platforms for the transformation of food systems. **(SQ3 & SQ4)**

One promising area in which Red MAC is building resilience is the **conservation of agro-biocultural diversity**, exemplified by the creation of a network of 12 Community Seed Houses. The actions regarding seed conservation and multiplication, together with the rescue and promotion of traditional knowledge on medicinal plants and foods, are essential for the resilience and sustainability of food systems. On one hand, agro-biocultural diversity enlarges the knowledge and materials available to respond to change and deal with uncertainty. On the other hand, it can deliver significant ecosystem services and has a potential to improve human health and nutrition through increasing the availability of the variety of foods and their uses. **(SQ4)**

Similarly to Red MAC, there is an increasing number of agroecological initiatives in Colombia trying to build more sustainable, resilient and just food systems. The study and examination of the processes and challenges of these initiatives are of utmost importance for the peacebuilding process in Colombia, as they can inform how to implement the peace agreements on the basis of principles of social-ecological resilience and sustainability. (**SQ5**)

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Esta tesis está dedicada a los millones de agricultores y campesinos que están alimentando a la humanidad y enfriando el planeta, poniendo en práctica la agroecología.

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Appendices

Appendix 1. Factors for resilience that were used in the workshop with the coordination board of Red MAC

Factors that contribute to resilience	Total score (sum of the three groups)	Sources		
		Folke et al. (2003)	Biggs et al. (2015)	Berkes & Ross 2013
Diversity of people	20	2. Nurturing diversity for reorganization and renewal	1. Maintain diversity and redundancy 5. Encourage learning	
Diversity of organizations	18	2. Nurturing diversity for reorganization and renewal	1. Maintain diversity and redundancy	
Functional redundancy	12	2. Nurturing diversity for reorganization and renewal	1. Maintain diversity and redundancy	
Build social memory	17	2. Nurturing diversity for reorganization and renewal 3. Combining different types of knowledge for learning	1. Maintain diversity and redundancy 5. Encourage learning 6. Broaden participation	
Build ecological memory (eco-literacy)	16	2. Nurturing diversity for reorganization and renewal 3. Combining different types of knowledge for learning	2. Manage connectivity	
Internal connectivity	14	2. Nurturing diversity for reorganization and renewal	2. Manage connectivity	Social networks
External connectivity	17	2. Nurturing diversity for reorganization and renewal	2. Manage connectivity	Social networks
Incorporate change and uncertainty in planning	18	1. Learning to live with change and uncertainty	4. Foster complex adaptive systems thinking	
Learn from crisis	18	1. Learning to live with change and uncertainty	3. Manage slow variables and feedbacks	
Flexible organizational rules	18	1. Learning to live with change and uncertainty	3. Manage slow variables and feedbacks	
Positive attitude	20	1. Learning to live with change and uncertainty		Positive outlook
Long-term monitoring	12	1. Learning to live with change and uncertainty	5. Encourage learning 3. Manage slow variables and feedbacks	
Social environment for learning	19	3. Combining different types of knowledge for learning 1. Learning to live with change and uncertainty	5. Encourage learning	Knowledge, skills and learning
Resources for learning	15	3. Combining different types of knowledge for learning	5. Encourage learning	Knowledge, skills and learning

Diversity of knowledges	19	3. Combining different types of knowledge for learning	5. Encourage learning 1. Maintain diversity and redundancy	Knowledge, skills and learning
Enlarge internal participation	21	4. Creating opportunity for self-organization	6. Broaden participation	
Enlarge external participation	16	4. Creating opportunity for self-organization	6. Broaden participation	
Build trust	21		6. Broaden participation	
Community infrastructure	12			Community infrastructure
Diverse and innovative economy	12			Diverse and innovative economy
Sense of belonging	20			People-place relationships

Appendix 2. Pictures from the fieldwork

Photo 1. Peasant and consumers at a regional agroecological market
Author: Camilo Ardila

Photo 2. Regional agroecological market
Author: Camilo Ardila

Photo 3. Farmers (representatives of Red MAC) during workshop #1
Author: Camilo Ardila

Photo 4. With MERCOVIDA´s farmers at the end of workshop #2
Author: Camilo Ardila

Photo 5. Agroforestry system
Author: Camilo Ardila

Photo 6. Intercropping plantain, banana, maize, and coffee
Author: Camilo Ardila

Photo 7. Cassava in agroforestry system
Author: Camilo Ardila

Photo 8. Mega diverse agroforestry system
Author: Camilo Ardila

Photo 9. Launch event of the Network of Community Seed Houses
Author: Camilo Ardila

Photo 10. MERCOVIDA´s farmers and consumers
Author: Camilo Ardila

Photo 11. During a transect walk with farmers
Author: Camilo Ardila

Photo 12. Peasant with local-breed chickens
Author: Camilo Ardila

Photo 13. Beehives inside the coffee agroforestry system
Author: Camilo Ardila

Photo 14. Vegetables homegarden
Author: Camilo Ardila

Photo 15. After an interview with farmers
Author: Camilo Ardila

Photo 16. Pineapple monoculture, heavily promoted in the area
Author: Camilo Ardila

Photo 17. Urban area of Restrepo, surrounded mainly by grazing lands
Author: Camilo Ardila

Photo 18. Building for composting
Author: Camilo Ardila

Photo 19. Traditional foods offered during the launch event of the Community Seed Houses
Author: Camilo Ardila

Photo 20. *Traditional seeds during the launch event of the Community Seed Houses*
Author: Camilo Ardila

Photo 21. Diversity of seeds at one of the farmer´s house (seed guardian)
Author: Camilo Ardila

Photo 22. Diversity of fruits
Author: Camilo Ardila

Photo 23. Diversity of maize
Author: Camilo Ardila

Photo 23. Getting the lunch ready- cassava, plantain, and diversity of beans.
Author: Camilo Ardila